City of Alexandria, Virginia

Draft Phase 3 Chesapeake Bay Total Maximum Daily Load (TMDL) Action Plan for 100% Compliance

August 2024

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Infrastructure and Environmental Quality, Stormwater Management Division

For compliance with 9VAC25-890-30
General VPDES Permit for Discharges of Stormwater from Small Municipal Separate Storm Sewer Systems, Permit No. VAR040057

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Public Comment Draft Phase 3 Chesapeake Bay TMDL Action Plan for 100% Compliance

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Executive Summary

The purpose of this Phase 3 Chesapeake Bay Total Maximum Daily Load (TMDL) Action Plan (Phase 3 Action Plan) is to comply with the Registration Statement requirements in the 2023 – 2028 General Virginia Pollution Discharge Elimination System (VPDES) Permit for Discharges of Stormwater from Small Municipal Separate Storm Sewer Systems (MS4), No. VAR040057.

The City's Phase 1 Chesapeake Bay TMDL Action Plan documenting the City's proposed strategies to achieve 5% of the overall goals for total nitrogen, total phosphorus, and total suspended solids (sediment) goals, respectively, by June 30, 2018, was approved by Virginia Department of Environmental Quality (DEQ) on January 12, 2016. The City's Phase 2 Chesapeake Bay TMDL Action Plan documenting the City's proposed strategies to achieve 40% of the overall goal for total nitrogen, total phosphorus, and total suspended solids (sediment) goals, respectively, by June 30, 2018, was approved by DEQ September 24, 2019.

Total suspended solids was removed as a pollutant of concern from the MS4 general permit by DEQ and is no longer includes a required pollution targets for Phase 3. EPA evaluated Virginia's Phase III Watershed Implementation Plan December 19, 2019, and noted that the "sediment targets will not affect the BMPs called for in the WIP [Watershed Implementation Plan] and are not intended to be the driver for implementation moving forward…". This was incorporated into the updated 2023-2028 MS4 general permit through the removal of sediment as a pollution target under Part II TMDL Special Conditions A. Chesapeake Bay TMDL special condition.

This Phase 3 Action Plan has been developed to document preliminary sufficient measures to be implemented to meet the 100% compliance targets identified in the 2023-2028 MS4 general permit. The focus of this 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 100% cumulative Chesapeake Bay TMDL reduction targets in the MS4 permit for phosphorus and nitrogen developed by the United States Environmental Protection Agency (EPA) in December 2010.

During the Phase 1 Action Plan, the following tasks were completed and/or documented:

- Delineation of the MS4 service area including the breakdown of pervious and impervious area;
- Calculation of the pollutant baseline loads for MS4 service area;

- Calculation of the increased pollutant loads from redevelopment projects during July 1, 2009 to June 30, 2014 where an average land cover condition greater than 16% impervious cover was used;
- Calculation of pollutant loads from Grandfathered projects that are required to be offset prior to project completion;
- Mean and methods to meet the Phase 1 target pollutant load reductions;
- Calculation of the total pollutant reductions required for Phase 1; and
- Calculation of the pollutant reductions associated with the proposed strategies and corresponding costs.

The Phase 2 Action Plan addressed pollutant reductions to meet or exceed 40% of the L2 scoping run in addition to the offsets required from July 1, 2009 to June 30, 2019 redevelopment projects and grandfathered projects. Table E1 provides a summary of the required pollutant load reductions during Phase 2.

Table E1 – Summary of Required Reductions for Existing Sources

Pollutant	40% Cumulative L2 Reduction (lbs/yr)	2009-2019 New Sources Offsets	Grandfathered Offsets (lbs/yr)	Total Phase 2 Reductions[1]
TN	3,038.8	13.0	-30.6	**3,021.3**
TP	401.8	2.3	-8.7	**395.4**
TSS	344,775	1,911	-3,676	**343,010**

[1] *Total reductions to be addressed by the end of the second permit cycle.*

The City has an "all of the above" strategy, which 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 the reduction goals required in the third MS4 permit cycle.

Means and methods to meet the target pollutant load reduction are described in Section 9 and include the following:

- Credits for January 1, 2006 to July 1, 2009 stormwater BMPs
- Credit for post July 1, 2009 stormwater BMPs
- Projected Redevelopment
- New Regional Facilities and Retrofits
- Retrofits on City Properties
- Retrofits of City Rights-of-Way
- Tree Planting
- Urban Stream Restoration
- Public-Private Partnerships (P3s)
- Urban Nutrient Management
- Land Use Change
- Forest Buffers

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- Nutrient Trading
- Bi-Lateral Trading with AlexRenew

In addition to the strategies listed above, two specific projects have been identified to meet the required reductions for the Phase 2 permit cycle. The Lake Cook Retrofit project was substantially complete in September 2018; therefore, it was moved from the end of the Phase 1 permit cycle to the Phase 2 cycle. The Ben Brenman Pond Retrofit also was completed during the Phase 2 cycle and includes modifying an existing wet pond to meet the Virginia BMP Clearinghouse guidance for a Level 2 wet pond and increasing the acreage draining to the pond. This allowed the City to take credit for the variation in the pollutant removal.

Phase 2 reductions were met through the projects listed in Table E2, which includes associated pollutant reductions and estimated costs. Due to the progress made during Phase 1, the reductions in Phase 2 exceeded the required reductions as indicated in Table E3. In addition to the projects and BMPs that helped to achieve pollution reductions, three BMPs had to be removed from the City's inventory because they were found to be removed or in major disrepair during Phase 2. These are: 1) Vegetated Roof; 2) 2010 developer-lead stream restoration on the lower portion of Strawberry Run; and 3) a StormFilterTM Stormwater Treatment System that was no longer in operation and not able to be repaired. The Credits received for these facilities were removed from BMP Warehouse; the Bay TMDL calculations; and reflected in this Phase 3 Bay TMDL Action Plan.

Table E2 – Phase 2 Permit Cycle Pollutant Reductions and Costs

Project or BMPs	TN Removed (lbs/yr)	TP Removed (lbs/yr)	TSS Removed (lbs/yr)	Approximate City Cost[1]
FY2019-FY2023 BMPs[1]	131	60	28,161	$0
BMP Removal (2010 Strawberry Run Restoration (2004-0038 01))[2]	-45	-40.8	-26,928	$0
BMP Removal (Vegetated Green Roof, Windsor Ave. (2007-0102 01))[2]	-0.06	-0.01	-5	$0
BMP Removal (StormFilter™ Stormwater Treatment System (2008-0012 04))[2]	-0.42	-2.85	-532	$0
2009-2019 New Sources Offsets[2]	-13	-2.3	-1,911	$0
Grandfathered Offsets	30.6	8.7	3,676	$0
Lake Cook Retrofit	1,587	163.3	131,334	$4.5M
Ben Brenman Pond Retrofit	946	151	87,734	$3.75M
TOTAL PHASE 2	**2,575**	**320**	**214,177**	**$8.25M**

[1]*Developer bears installation and long-term operation and maintenance costs for private facilities.*
[2]*Negative values indicate net pollutant reductions described further in Section 11.1.*

Table E3 summarizes the progress achieved at the end of the Phase 2 permit cycle. Based on progress made in the first and second permit cycles, the City far exceeded the 40% pollutant reduction requirement and made substantial progress towards meeting the 100% reduction goal. This is consistent with the City's internal goal to exceed the mandated targets to smooth the ascent of the ramp up towards the third permit cycle's 100% cumulative reductions.

Table E3 summarizes the final progress at the end of the Phase 2 permit cycle:

Table E3 – Phase 1 and 2 Progress

Pollutant of Concern	City Phase 1 & 2 Actual Reductions (lbs./yr)	L2 Total Required Reductions (lbs./yr)	Percent of L2 Total Required Reductions Met
TN	5,264.72	7,597.03	69.30%
TP	722.04	1,004.40	71.89%
TSS	576,167	861,937	66.85%

The City anticipates meeting the required reduction goals by the end of the permit cycle per the strategies provided herein. This Phase 3 Action Plan details how the City will meet these goals through credits obtained from redevelopment along with the "all of the above" strategy, an iterative, adaptive approach that considers a range of potential strategies based on extant conditions. The main strategy to meet the reminder of the nitrogen and phosphorus targets are through the anticipated availability of pollution reduction credits generated from the Alexandria Renew Enterprises – the City's wastewater treatment authority – River Renew Combined Sewer Overflow (CSO) mitigation project (River Renew) through the use of bi-lateral trading consistent with the executed agreement between the City and Alexandria Renew. This project will capture and store combined stormwater runoff and sanitary flows during wet weather and send the captured flow to the advanced wastewater treatment plant to be treated prior to discharge.

Though there are no direct City costs associated with the Project or BMPs indicated in Table E4 for the Phase 3 pollution reduction activities, there are still associated costs. For example, the Bi-Lateral Trading project cost $615 million and the majority will be paid for by rate payers in the City over time, in addition to funds secured at the state-level. The City is also sharing in the funding of the Landmark Redevelopment and the North Potomac Yard Redevelopment through land leases, tax incentives, Metro funding, transportation upgrades, and other means. So while there is no cost listed in the table due to the lack of direct funding, the City does provide funding and proffers to fund these projects for the pollution reduction credits.

It should also be noted that the City has identified strategies to reach 98% and 80% of the phosphorus and nitrogen goals, respectively, through the Phase 2 requirements, with this Phase 3 Action Plan including strategies to achieve 100% of the total requirements ahead of the 2028 deadline. While credits available through bi-lateral trading will be used on annual basis as needed to fill the gap, the City continues to explore opportunities through the strategies to meet the requirements of the 2028 deadline through redevelopment and retrofits.

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Table E4 – Phase 3 Permit Cycle Anticipated Pollutant Reductions

Project or BMPs	TN Removed (lbs/yr)	TP Removed (lbs/yr)	Approximate City Cost
Lucky Run Stream Restoration	658	257	$1.8M
Bi-Lateral Trading	1,500	500	$0
Anticipated Annual Redevelopment through FY2028	1,036	320	$0
TOTAL PHASE 3	3,194	1,077	$1.8M

[1]*Numbers are estimated and dependent on the performance of the tunnel and storage system.*

As mentioned above, the 2023 – 2028 MS4 permit removed total suspended solids/sediment from the Chesapeake Bay TMDL special conditions. Table E5 summarizes the Phase 3 expected reductions, which account for 100% of the TN and TP goal.

Table E5 – Phase 3 Anticipated Reductions

Pollutant of Concern	Total Phase 1 & Phase 2 Reductions (lbs/yr)	Anticipated Phase 3 Reductions (lbs/yr)	Total Phase 1 through 3 Reductions (lbs/yr)	Total Required Reductions (lbs/yr)	Percent of Total
TN	5,265	3,194	8,459	7,597.03	111%
TP	722	1,077	1,799	1,004.40	179%

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Introduction

The purpose of this Phase 3 Chesapeake Bay Total Maximum Daily Load (TMDL) Action Plan is to comply with Part II A "Chesapeake Bay TMDL special condition" of the 2023 – 2028 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 November 1, 2023. Virginia Department of Environmental Quality (DEQ) also requested a draft of Action Plan be submitted with the MS4 Permit Registration Statement that has been revised into this current version.

Effective June 31, 2024, the City achieved 98% of the 100% pollution reduction target through stormwater best management practices based on tracking phosphorus pollution (TP). This Phase 3 Action Plan provides an outline of the City's path to achieve 100% pollution reduction goals. This action plan process began with the issuance of the 2013 – 2018 MS4 permit which required the submission and approval of a Phase 1 Chesapeake Bay TMDL Action Plan (approved by DEQ in 2016) to meet at least 5% of the targeted pollutant reductions and the subsequent issuance of the 2018 – 2023 MS4 permit requiring the submission and approval of a Phase 2 Action Plan (approved by DEQ in 2019) to meet at least a cumulative 40% of the targeted pollutant reductions.

The Phase 3 Action Plan is developed to document that sufficient measures will be implemented to meet the compliance targets identified in the 2023 – 2028 MS4 permit to demonstrate compliance with the required final 60% reductions (for a total of 100%) from existing sources as of June 30, 2009, increased loads from 20092019 New Sources, and increased loads from Grandfathered projects (9VAC25-870-48). The Phase 3 Action Plan includes the requisite planning items found in the 2023-2028 Permit Part II A and is developed according to the procedures provided in Virginia DEQ Guidance Memo No. 15-2005 dated May 18, 2015 (Phase 1 Guidance). In a letter dated May 2, 2018, regarding the reissuance of VPDES General Permit No. VAR040057, it was stated that while the Action Plan guidance is currently being updated, the most current guidance document is still Guidance Memo No. 15-2005.

The focus of the Phase 3 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 final 60% Chesapeake Bay TMDL reduction targets in the current MS4 general permit for phosphorus and nitrogen developed by the United States Environmental Protection Agency (EPA) in December 2010. Due to the City's approach to front load achievement through an aggressive water quality program, 98% and 80% of the TMDL targets for phosphorus and nitrogen, respectively, have been accounted for during Phase 1 and 2. While DEQ removed the requirement to continue to report on sediment removal in the 2023-2028 MS4 general permit, based on the guidance from EPA, it is of note that one hundred and twenty-four percent (124%) of the sediment target was achieved through the Phase 2 Action Plan. This Phase 3 Action Plan focuses on the remaining pollution reduction requirements for phosphorus and nitrogen.

The TMDL contains aggregate wasteload allocations (WLAs) for regulated stormwater with no specific WLAs for the City's MS4 service area. The Virginia Chesapeake Bay TMDL Phase I Watershed Implementation Plan (WIP I) submitted by the Commonwealth to EPA on November 29, 2010, contains general requirements for permittees. The Phase II Watershed Implementation Plan (WIP II) submitted to EPA on March 20, 2012, builds on the WIP I as the state's primary planning tool to establish strategies,

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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 Draft Phase III Watershed Implementation Plan (WIP III) submitted April 5, 2019, includes new state initiatives as well as existing federal, state and local programs, and local area planning goals for unregulated areas provided by the planning district commissions and soil and water conservation districts and augmented by DEQ. The WIPs identify the use of state-issued stormwater permits – such as MS4 permits – as the tool for compliance by requiring target reductions for the TMDL.

The MS4 general permit reissued by DEQ, effective July 1, 2013, contained special conditions which required 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. This 5% goal (Phase I) was to be implemented no later than June 30, 2018. The 2018-2023 MS4 general permit, effective November 1, 2018, requires implementation of strategies to meet an additional 35% of the L2 scoping run for a total reduction at the end of the permit term of 40% of L2. The 2023-2028 MS4 general permit, effective November 1, 2023, requires the implementation of strategies to meet the final 60% of the L2 scoping run for the final reduction at the end of 2028 of 100% of L2. Of note is the requirement to reduce total suspended solids has been removed from the permit.

According to the WIP II, WIP III, and MS4 general permit, the City would get three full MS4 general permit cycles to implement the required L2 scoping reductions (Phase 1: 2013-2018; Phase 2: 2018-2023; and Phase 3: 2023-2028). During the first cycle (Phase 1), the City was required to implement practices sufficient to achieve 5% of the reduction targets. During the second cycle (Phase 2), the City was required 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 3). Pursuant to the permit, this Phase 3 Action Plan is required to address the final 60%, or Phase 3, reductions required during the permit term. While the WIP II and WIP III contain a range of strategies applicable to urban land uses, the City can only be required to implement strategies that are enforceable through the MS4 general permit based on the City's regulated land contained in the MS4 service area as defined.

The technical and fiscal challenges of meeting the Chesapeake Bay TMDL as required in the MS4 general permit are 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). This Phase 3 Action Plan builds on the previous technical and planning-level work, to include the previous action plans, 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 to meet the MS4 general permit target reductions.

The "means and methods" or reduction strategies discussed require significant resources. This report focuses on strategies to meet the total 100% reduction goals that must be implemented by October 31, 2028. To get ahead of this large final push, the City set an internal goal to go beyond the permit requirements for the first and second permit cycles to achieve the escalating total reductions in the required timeframe towards meeting the overall total. Concrete strategies to achieve the final 60% are presented, with the

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flexibility to choose from a menu of options as contingency measures. 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 the reduction goals required in the third MS4 permit cycle.

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 BMPs, towards meeting the target pollutant reductions. The first official planning-level exercise in development of the Phase 1 Action Plan 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. The City's Phase 1 Action Plan – approved by DEQ on January 12, 2016 – outlined means and methods to not only meet the required 5% reduction targets but to make substantial progress in meeting the Phase 2 reduction targets. The City's Phase 2 Action Plan (approved 2019) focused on meeting the 40% requirements in the 2018-2023 MS4 general permit. The Phase 3 Action Plan focuses on meeting 100% of the total pollution reduction goals.

The Phase 3 Action Plan:

1. Documents the progress made during the first and second permit cycles including updated calculations based on final project data;
2. Provides general information regarding the City's process for the L2 required reductions; and
3. Outlines potential strategies that may be implemented in the 2023 – 2028 permit cycle.

This Phase 3 Action Plan includes the following sections:

- Current Program and Legal Authority
- Delineation of the MS4 Service Area
- Existing Source Loads and Calculating Target Reductions
- Increased Loads from 2009 – 2019 New Sources
- Increased Loads from Grandfathered Projects
- Estimated Future Grandfathered Projects
- Phase 1 Action Plan and Progress
- Phase 2 Action Plan and Progress
- Means and Methods to Meet Target Reductions
- Estimated Cost of Implementation

1. 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

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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-foot Resource Protection Area (RPA) requirements in the City, and designating all other non-RPA land acreage as Resource Management Areas (RMAs). The City exceeded the Bay Act requirements by implementing a 50-foot buffer requirement for natural intermittent streams and isolated wetlands. In addition to meeting the minimum water quality requirements for development and redevelopment, the City adopted a more stringent requirement to provide stormwater treatment for the first one-half-inch of runoff from all onsite impervious surfaces, known as the "water quality volume default", which provides reductions beyond those mandated. The City adopted amendments to the Environmental Management Ordinance that incorporate the Virginia Stormwater Management Program (VSMP) regulations, while retaining the more stringent water quality volume default requirements and 50-foot buffer application, and currently operates the VSMP locally.

The City was initially issued an MS4 general permit in 2003 to regulate stormwater discharges. Successive five-year permits have been reissued, with the City currently regulated under the 2018-2023 MS4 general permit and the 2023-2028 MS4 general permit effective November 1, 2023. Since the Phase 2 Action Plan, there have not been any new or modified legal authorities that have been implemented to meet the City's Chesapeake Bay required pollutant reductions.

2. Delineation of the MS4 Service Area

The City's MS4 general permit is the regulatory mechanism used to require implementation of stormwater quality BMPs or other strategies necessary to meet the Chesapeake Bay TMDL. The permit requires the City to define the size and extent of the MS4 service area, to include the existing impervious and pervious area within the service area – the regulated 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 – the unregulated 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.

As part of the Phase 1 Action Plan, areas were distinguished 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

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(DCR) during their previous administration of the MS4 program. Additional confirmation of this approach is provided in the Phase 1 Guidance and current 2013-2018 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
National Park Service: George Washington Parkway & Jones Point Park	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
NS Thoroughbred Bulk Terminal Alexandria	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. A map of the MS4 service area is also available online via the "Sewer Viewer".

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	576.60
Non-Alexandria MS4 (unregulated)	452.17	1387.68	1839.85

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

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

3. Existing Loads and Compliance Reductions

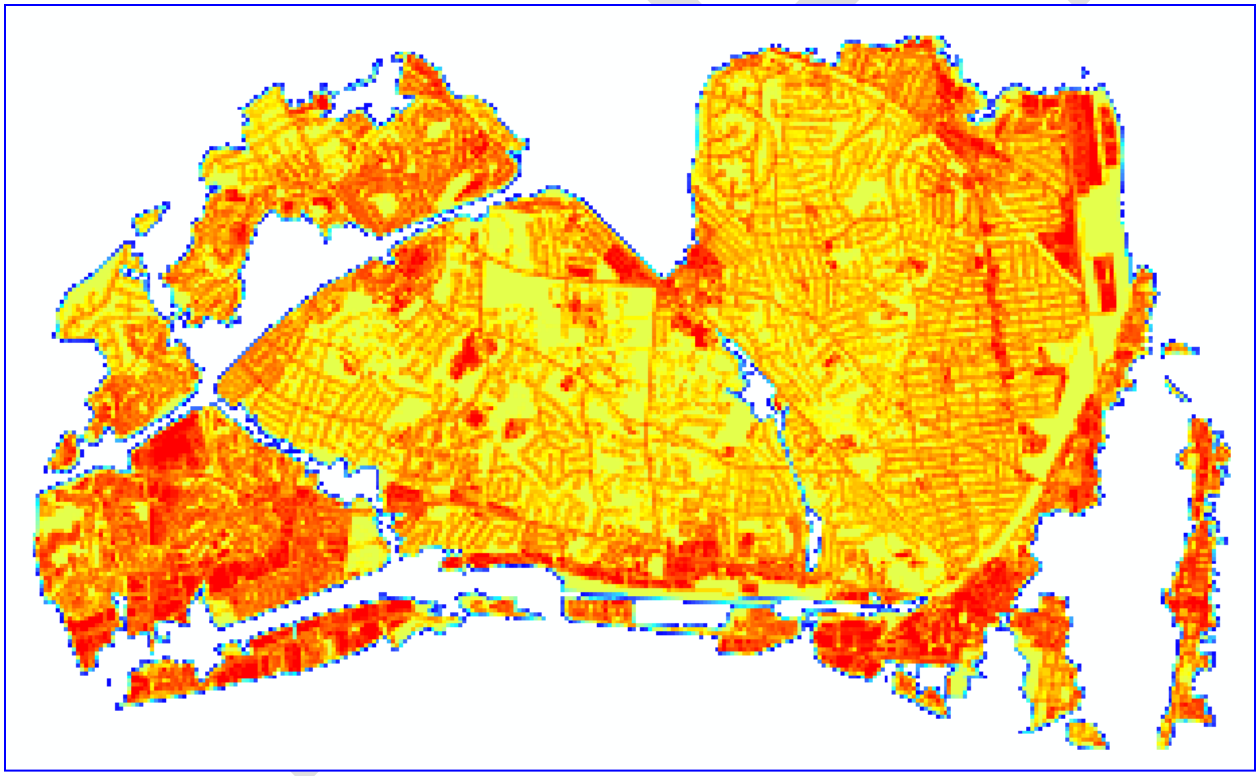
Baseline loads for nitrogen, phosphorus, and sediment were established using the City's impervious surface GIS data that represent the best available data for total existing acres served by the MS4 as of June 30, 2009, along with loading rate data for each pollutant of concern found in Table 2b (Potomac River Basin) of the 2013-2018 MS4 general permit. In working with the City's 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 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 Existing 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 general permit cycle (2013-2018), the L2 reduction requirements were 5% while during the second cycle, 35% reductions are required, for a total of 40%. This report focuses on the final 60%, or Phase III, reductions. 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 all three permit cycles. The total loads were calculated using 2018-2023 MS4 general permit Table 3b 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.

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	97,809.78	**7,597.03**
Regulated Pervious			
Regulated Impervious	TP	7,172.47	**1,004.40**
Regulated Pervious			
Regulated Impervious	TSS	4,704,399.56	**861,936.64**
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	TN (lbs/yr)	TP (lbs/yr)	TSS (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[2]
TOTAL REDUCTION (100%)	**7,597.03**	**1,004.40**	**861,936.64**

[1]*These estimates are based on percentages of the L2 requirements.*
[2]*The 2023-2028 MS4 general permit removed the TSS requirement from the Third MS4 Cycle Target.*

The 2018-2018 MS4 general permit requires the City to use permit Table 3b for the Potomac River Basin to determine the reductions required by the end of the permit cycle. For reference purposes, the 5% reduction requirements associated with the first permit cycle were TN = 379.9 lbs/ac; TP = 50.2 lbs/ac; and TSS = 43,097 lbs/ac. The second permit cycle 40% reductions can be seen in Table 6b. It should be

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noted that for the City, the 2010 Census urbanized area did not change from the 2000 nor the 2020 Census urban area.

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

Permit Table 3b Calculation Sheet for Estimating Existing Source Loads and Reduction Requirement for the Potomac River Basin								
		A	B	C	D	E	F	G
Pollutant	**Subsource**	**Loading rate (lbs/ac/yr)[1]**	**Existing developed lands as of 6/30/09 served by the MS4 within the 2010 CUA (acres)[2]**	**Load (lbs/yr)[3]**	**Percentage of MS4 required Chesapeake Bay total L2 loading reduction**	**Percentage of L2 required reduction by 3/30/2023**	**40% cumulative reduction required by 6/30/2023 (lbs/yr)[4]**	**Sum of 40% cumulative reduction (lbs/yr)[5]**
Nitrogen	Regulated urban impervious	16.86	3417.24	57,614.7	9%	40%	2,074.1	3,038.8
	Regulated urban pervious	10.07	3991.57	40,195.1	6%	40%	964.7	
Phosphorus	Regulated urban impervious	1.62	3417.24	5,535.9	16%	40%	354.3	401.8
	Regulated urban pervious	0.41	3991.57	1,636.5	7%	40%	47.5	
Total suspended solids	Regulated urban impervious	1171.32	3417.24	4,002,682	20%	40%	320,215	344,775
	Regulated urban pervious	175.8	3991.57	701,718	9%	40%	24,560	

[1]Edge of stream loading rate based on Chesapeake Bay Watershed Model Progress Run 5.3.2
[2]To determine the exiting developed acres required in Column B, permittees should first determine the extent of their regulated service area based on the 2010 Census Urbanized Area (CUA). Next permittees will need to delineate the lands within the 2010 CUA served by the MS4 as pervious or impervious as of the baseline date of June 30, 2009.
[3]Column C = Column A x Column B
[4]Column F = Column C x (Column D /100) x (Column E /100)
[5]Column G = The sum of the subsource cumulative reduction required by 6/30/23 (lbs/yr) as calculated in Column F.

The 2023-2028 MS4 general permit requires the City to use permit Table 3b for the Potomac River Basin to determine the final 100% reductions required by the end of the permit cycle (see Table 6c). It should be noted that the Census urbanized area did not change for the City. Further, total suspended solids was removed from the MS4 general permit as a pollutant of concern and is no longer includes a required pollution target. EPA evaluated Virginia's Phase III Watershed Implementation Plan December 19, 2019[1] and notes that the "sediment targets will not affect the BMPs called for in the WIP [Watershed Implementation Plan] and are not intended to be the driver for implementation moving forward…".

[1] EPA Letter to DEQ, December 19, 2019. Available at https://www.epa.gov/sites/default/files/2019-12/documents/va.pdf

Table 6c – Third Permit Cycle Pollutant Reductions Calculated per the MS4 Permit[1]

		A	B	C	D	F	G
Pollutant	**Subsource**	**Loading rate (lbs/ac/yr)[1]**	**Existing developed lands as of 6/30/09 served by the MS4 within the 2010 CUA (acres)[2]**	**Load (lbs/yr)[3]**	**Percentage of MS4 required Chesapeake Bay total L2 loading reduction**	**100% cumulative reduction required by 10/31/2028 (lbs/yr)[4]**	**Sum of 100% cumulative reduction (lbs/yr)[5]**
Nitrogen	Regulated urban impervious	16.86	3417.24	57,614.7	9%	5185.32	7,597
	Regulated urban pervious	10.07	3991.57	40,195.1	6%	2411.71	
Phosphorus	Regulated urban impervious	1.62	3417.24	5,535.9	16%	885.74	1,004
	Regulated urban pervious	0.41	3991.57	1,636.5	7.25%	118.65	

[1]Edge of stream loading rate based on Chesapeake Bay Watershed Model Progress Run 5.3.2
[2]The exiting developed acres are lands served by the MS4 (pervious or impervious) as of June 30, 2009.
[3]Column C = Column A x Column B
[4]Column E = Column C x Column D

4. Increased Loads from 2009 – 2019 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 Alexandria. Requiring development to go back to 16% impervious cover would be overly burdensome 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 these criteria. This represented the existing condition, so that new development and redevelopment projects could not increase the pollutant load above this average. However, in addition to meeting the Bay Act stormwater requirements the City went a step further and adopted the more stringent "water quality volume default" requirements for development and redevelopment projects to also treat the first one-half inch depth of stormwater runoff over the site's entire impervious surface – "first flush" – for post-construction stormwater design. This more stringent requirement reduced pollution beyond the 41% impervious land cover condition. The City 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

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(formerly 9VAC25-870, revised to 9VAC25-875). The 2018-2023 MS4 general permit Part II.A.4 requires the City to offset increased loads from new sources initiating construction between July 1, 2009 and June 30, 2019 that disturb one acre or greater and result in a total phosphorous load greater than 0.45 lbs./ac/yr. With the implementation of the July 1, 2014, stormwater regulations and the Virginia Runoff Reduction Method, the target total phosphorous loading after construction is 0.41 lbs./ac/yr or less, which is more conservative than the 0.45 lbs./ac/yr requirement. Therefore, there have been no increased loads from new sources initiating construction between July 1, 2014, to June 30, 2019. Please note that the majority of land-disturbing activities in the City do not reach the one acre or greater threshold.

The increased loads from projects that initiated construction between July 1, 2009, to June 30, 2014, were calculated for the Phase 1 Action Plan. The City used the aggregate approach discussed in the Phase 1 Guidance to determine the increased loads from projects disturbing greater than one acre. Loading rates in permit Table 3b 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 loadings. Since 40% reductions need to be addressed during Phase 2, the required offsets were calculated as 40% of the total. Table 7 provides net change in pollutant load, required reduction for this permit cycle, and total required offset. Detailed supporting calculations for the net load change was submitted with the Phase 1 Action Plan. It should be noted that credits from BMPs installed as part of the July 1, 2009, to June 30, 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 2009-2019 New Sources

Pollutant	Net Load Change (lbs/yr)*	Required Reduction during second permit cycle	Additional Red. Reqd. by the end of second permit cycle (lbs/yr)
Nitrogen	32.6	40%	13.0
Phosphorus	5.8	40%	2.3
Total Suspended Solids	4,778	40%	1,911

**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.*

5. Increased Loads from Grandfathered Projects

The Virginia Stormwater Management Regulations (9VAC25-870-48) provides 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, 2013-2018 MS4 general permit Section I.C.2.a.(8) required 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 one-half inch of runoff associated with impervious surfaces – the water quality volume default. The permit requires that the City

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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 certain to initiate construction during this MS4 general 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 Phase 1 Guidance do not provide details regarding 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 Phase 1 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 (lbs./ac/yr) was subtracted from the post site loading rate (lbs./ac/yr), and the difference was multiplied by the post site area (ac) to yield the increased load (lbs./yr). As instructed in the 2018-2023 MS4 general permit, Table 4 was used to develop the equivalent pollutant loads for nitrogen and total suspended solids. These are the loads 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 Phase 1 Guidance using the Chesapeake Bay Program BMP efficiencies in Table V.C.1.

These Grandfathered projects generate minimal offsets, due in large part to the existing impervious cover of the site and the City's more stringent requirements to treat the water quality volume default. Considering the most aggressive scenario that all the projects are completed before October 31, 2023, 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 10. For the Phase 1 Action Plan, the City identified 14 projects implementing 25 BMPs to meet the old water quality technical criteria and the more stringent Alexandria water quality volume default. For the Phase 2 update, the City reviewed the list of these grandfathered projects and potential grandfathered projects and updated and refined the project list and corresponding pollutant calculations. There have only between two grandfathered projects been constructed thus far. As often seen with development projects, many were not built due to funding issues or other complications and others lost grandfathering status. 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	20.4	3.0	1,390
Loads Removed by BMPs[1]	51.0	11.6	5,066
Total Load Remaining[2]	**-30.6**	**-8.7**	**-3,676**

[1]*These BMP reductions are not included in Post-2009 BMP credits.*
[2]*Negative values indicate net pollutant credit.*

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6. 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, 2019. It is uncertain if or when these projects may initiate construction as they all have been delayed or on hold for a significant period. The City documents six projects associated with 47 acres are considered as grandfathered and have yet to begin construction. It is likely that many of these projects will never be constructed, but the City will maintain a list of these projects until the grandfathering status expires in 2024. The list of future grandfathered projects is provided in Appendix A.

7. Summary of Required Phase 2 Reductions

The 2018-2023 MS4 general permit contains special conditions requiring the implementation of strategies to meet 40% reductions of the overall L2 scoping for nitrogen, phosphorus and sediment, along with offsets for new sources and grandfathered projects. This 40% goal (Phase 2) was to be implemented no later than the end of the permit cycle. Appendix B includes the BMP calculations.

Table 9 presents a summary of the required total reductions for each pollutant of concern (POC), 2009-2019 offsets, grandfathered projects, and 40% required reductions.

Table 9 – Summary of Required Reductions for Existing Sources

Pollutant	40% cumulative L2 reduction (lbs/yr)	2009-2019 New Sources Offsets	Grandfathered Offsets (lbs/yr)	Total Phase 2 Reductions[1]
TN	3,038.8	13.0	-30.6	**3,021.3**
TP	401.8	2.3	-8.7	**395.4**
TSS	344,775	1911	-3,676	**343,010**

[1] *Total reductions to be addressed by the end of the second permit cycle.*

8. Summary of Required Phase 3 Reductions

The 2023-2028 MS4 general permit contains special conditions requiring the implementation of strategies to meet 100% reductions of the overall L2 scoping for nitrogen and phosphorus. This 100% goal (Phase 3) is to be implemented no later than the end of the permit cycle.

Table 10 presents a summary of the required total reductions for each pollutant of concern (POC) in the permit. TSS pollution reduction requirements were removed from the 2023-2028 MS4 general permit.

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Table 10 – Summary of Required Phase 3 Reductions

Pollutant	100% cumulative L2 reduction (lbs./yr)
TN	7,597
TP	1,004

9. Means and Methods to Meet Target Reductions

The BMP strategies discussed in this Action Plan are part of the City's "means and methods" to meet target pollutant reductions. While the WIP II and WIP III contain a range of strategies applicable to urban land uses, the City can only be required to implement strategies that are enforceable through the MS4 general permit based on the City's regulated land contained in the MS4 service area. This Action Plan focuses specifically on means and methods to meet the 100% reduction goals that must be implemented by the end of the permit cycle.

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. In addition to this Action Plan, this includes the following documents:

1. Chesapeake Bay TMDL Analysis and Options - Final Draft August 2012
2. The City's February 1, 2012, response to the Virginia Department of Conservation and Recreation (DCR) "local letter" - November 9, 2011
3. Draft Chesapeake Bay TMDL Phase 1 (5%) Action Plan - June 26, 2014
4. Feasibility Study for Retrofit of Existing Ponds and Construction of New Stormwater Management Ponds" – Final December 2014
5. Final Chesapeake Bay TMDL Phase 1 (5%) Action Plan with updated attachments – February 2016
6. Draft Chesapeake Bay TMDL Phase 2 (40%) Action Plan
7. Final Chesapeake Bay TMDL Phase 2 (40%) Action Plan with updated attachments – September 2019

The City will employ a wide variety of means and methods to meet the required target pollutant for reductions total nitrogen, total phosphorus, and total suspended solids. This includes reductions to meet pollution related to:

1. Existing Sources
2. New Sources
3. Increased Loads from 2009 – 2019 New Sources
4. Increased Loads from Grandfathered Projects.

The Phase 1 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

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candidate projects for implementation. This approach puts the greatest number of strategies on the table and allows the City to consider all of the strategies based on conditions present at the time.

The means and methods in this Action Plan represent the synthesis of analysis and options reports, planning-level exercises, feasibility studies, and historical staff knowledge regarding project needs. 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 numerous potential strategies to reach target reduction goals. A mix of the following strategies will be implemented, where practicable, to address the reductions due by the end of the final permit cycle.

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.

Focus on Green Infrastructure

The City recognizes that Green Infrastructure (GI) can reduce stormwater runoff volumes, peak flow, and pollutant loads. As such, GI practices is the first option in selecting BMPs to retrofit existing impervious areas. Retrofits of City properties or rights-of-way will be considered using GI approaches, including but limited to, urban bioretention, bio-swales, permeable pavers, and vegetated green roofs. The City also requires development and redevelopment projects to implement GI practices through small area planning (Old Town North Small Area Plan, Eisenhower West Small Area Plan, etc.) and through the January 2018 release of a Memorandum to Industry requiring all new development and redevelopment to use non-proprietary surface BMPs approved by the Virginia Stormwater BMP Clearinghouse (Clearinghouse) to treat a minimum of 65% of the TP removal required by the VSMP regulations incorporated into the City's zoning ordinance. The memo also prohibits MTDs from being used on single-family detached residential projects. The City continues to look for targets of opportunity to incorporate additional GI into City projects. 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 not listed below may also be implemented.

- ***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 and treat at least 65% of the TP removal requirement through non-proprietary surface BMPs.
- ***New Regional Facilities and Retrofits.*** Installing new facilities to treat stormwater and retrofitting existing facilities originally installed with the primary purpose of addressing stormwater quantity to enhance their ability to improve water quality.
- ***Retrofits on City Properties.*** Retrofitting City-owned properties that are currently undertreated or not treated by stormwater quality BMPs and overtreating redevelopment.
- ***Right-of-Way Retrofits.*** Retrofitting public streets, especially in coordination with Capital Improvement Program (CIP) road projects where implementation is deemed feasible.

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- ***Tree Planting.*** Planting trees on developed land to increase tree canopy but not to mimic forest-like conditions or to plant trees within a contiguous area.
- ***Urban Stream Restoration.*** Restoration using natural channel design methods for urban streams.
- ***Public Private Partnerships (P3).*** May consist of (1) an 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; or (2) an agreement between the City and a private owner to construct a BMP on private property.
- ***Bi-Lateral Trading.*** Applying credits generated through the implementation of combined sewer overflow and wet-weather treatment controls implemented by Alexandria Renew Enterprises – the River Renew project mandated through Virginia's 2017 CSO Law – to address the VPDES Combined Sewer System (CSS) permit requiring bacteria reductions that will also generate total nitrogen and total phosphorus credits that can be applied towards addressing MS4 general permit requirements.

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 anticipated for Phase 3 but may be investigated during this phase.

- ***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.
- ***Nutrient Trading.*** Purchasing pollutant credits through the expanded nutrient credit exchange.

Acknowledging the significantly higher reduction requirements for the 2018-2023 and 2023-2028 permit cycles, the City set an internal planning goal for the first permit cycle that extended beyond the 5% target to approximately 15-20% of the anticipated total reductions. Similarly, the City set an internal goal for the second permit cycle that extended beyond the required 40% target. The City's adaptive management approach allows the City to realize efficiencies through maximization of benefits and minimize of cost and external impacts. Due to the higher internal goals, the City is on track to reach the required 100% target reductions prior to the deadline of 2028. The mix of potential strategies presented above are discussed in further detail in the following sections.

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9.1 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 and redevelopment that is subject to these stormwater management regulations have to meet nitrogen and phosphorus loading rates associated with pervious area, or a 0.41 lbs./ac/yr TP loading rate. The City has adopted the updated Virginia Erosion and Stormwater Management Regulations into the local ordinance effective July 1, 2024 has updated this loading rate. However, this updated loading rate continues to equate to no net pollution 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 one-half inch 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.

9.2 New Regional Facilities and Retrofits

Several 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. In the Phase 1 Action Plan, potential regional facilities were identified for retrofits. Five projects were completed during Phase 1 and 2 and described in Section 10 and 11. These are Four Mile Run wetland, Windmill Hill living shoreline, Lake Cook, Eisenhower Block 19 Pond, and Ben Brenman Pond (previously referred to as Cameron Station Pond). The Lucky Run stream restoration was completed during the first year of Phase 3.

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9.3 Retrofits on City Property

This strategy involves retrofits on City properties to treat existing impervious areas that are not currently treated by stormwater quality BMPs and overtreating when redevelopment occurs. 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) Greater than one-acre of untreated impervious area; and
2) No planned redevelopment for the property 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 is currently evaluating conducting a green infrastructure on City properties projects that would build on the analyses already completed. The study would assess, evaluate, and rank potential project sites for implementation of green infrastructure. Section 10 includes a list of completed retrofits on City properties and corresponding pollutant removals.

9.4 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, many 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.

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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.

Pursuant to the City's memo to industry No. 04-2014 issued on June 1, 2014, entitled 'Treatment of Roadway Runoff Associated with Development Projects', projects are required to install BMPs to treat runoff from any new public roadways created as a consequence of development or redevelopment. This requirement serves to treat new roadways. For existing roadways within a project limit or adjacent to a project are often treated by the developer to comply with the City's more stringent water quality requirement in Sec. 13-110 of the Alexandria zoning ordinance that development and redevelopment projects must treat the first one-half inch of runoff from all impervious surfaces within the project by installing BMPs. If drainage patterns make this impractical, the project may treat adjacent existing roadways to meet this local more stringent requirement. Because of these requirements, new roadways associated with development and adjacent roadways are often treated during development and redevelopment. Additionally, based on input provided by a convened stakeholder group comprised of staff and the development community, the City's memo to industry No. 01-18 requires that at least 65% of the state's phosphorus reduction requirements be met through implementation of green infrastructure practices.

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.

9.5 Tree Planting

The "Final Recommendation of the Expert Panel to Define BMP Effectiveness for Urban Tree Canopy Expansion" was approved in September 2016. This report includes two different implementation options for determining pollutant credits.

- Urban Tree Canopy Expansion BMP – Tree plantings on developed land (impervious or turfgrass) that result in an increase in tree canopy but are not intended to result in forest-like conditions. The pollutant reduction associated with the tree is dependent on the underlying land use.
- Urban Forest Planting BMP – Trees planted in a contiguous area with the intent of establishing a forest or similar ecosystem processes and function.

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The City currently has a tree planting program and property owner can receive a tree planting credit or a tree preservation credit as part of the Stormwater Utility. The City anticipates using the expert panel guidance for the Urban Tree Canopy Expansion BMPs for pollution reductions.

9.6 Urban Stream Restoration

The *Recommendations of the Expert Panel to Define Removal Rates for Individual Stream Restoration Projects* (Expert Panel Report) contains the pollutant removal computation methodologies accepted by the Chesapeake Program to address Bay TMDL reductions enforced through the City's MS4 general permit

The Four Mile Run Stream Restoration project was substantially completed in the summer of 2016 and brought online in the Phase 2 PY4 reporting period. Additional details can be found in Section 10.6 and a memorandum documenting the associated pollutant removal credits was submitted with the Phase 1 Action Plan.

Lucky Run Stream Restoration

The City received a FY2017 SLAF grant for the Lucky Run Stream Restoration project which involved restoring 950 linear feet of stream. The project is bounded by residential developments to the north and east, West Braddock Road to the west, and by Interstate 395 to the south. Lucky Run eventually outfalls to Four Mile Run, which ultimately outfalls to the Potomac River, and then the Chesapeake Bay. Approximately 224 acres of highly urban land drains to Lucky Run. The restoration reestablished a stable pattern and profile in the stream and addressed areas of severe erosion near a sanitary line and nature trail. The project was considered substantially complete in December 2023 and the pollution removals are included in Phase 3.

Strawberry Run and Taylor Run Stream Restoration

In 2018, the City completed a study to assess, evaluate, and rank five potential stream restoration projects using a decision matrix with a comprehensive list of criteria to prioritize the projects. The two top ranking projects were segments along Strawberry Run (900 feet) and Taylor Run (1,800 feet). These projects would mitigate channel and bank erosion, preventing sediment and phosphorous associated with that erosion from being delivered downstream from an actively incising urban stream. The City applied for and was awarded FY2019 SLAF grants for these two projects.

It was anticipated that the Taylor Run and Strawberry Run stream restorations would be part of the strategies to meet the 100% target reductions in the 2023 – 2028 MS4 general permit. However, in response to community pushback, the City Council 'paused' the projects in April 2021 to perform extended public engagement based on the community's concerns. The City brought in a neutral third-party to lead extended public engagement to build a consensus on the design approach for these two stream restoration projects. Each stream had a tailored list of consensus derived recommendations that went before City Council in June 2023. City Council decided to adopt the consensus approach to stabilize the exposed sanitary sewer infrastructure using a minimal approach that did not comport to the Expert Panel stream restoration approach and therefore would not earn credits towards the Bay goals. Additionally, at the June 2023 meeting, City Council decided to 'table' the Strawberry Run stream restoration project with no further action. These actions removed the projects from the planned reductions.

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9.7 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 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. This program is complicated, and processes are still being defined; however, these P3 and CBP3 strategies are being considered to help achieve reductions required in Phases II and III. 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 suitability of a P3 or CBP3 approach, the City has taken a less formal collaborative approach. Negotiations between the City and developers 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

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return on investment for parcels with smaller untreated areas. Projects which had a significant possibility of being developed between 2015 and 2028 were identified. The City may enter into discussions with these properties to determine if over treatment of the site is a possibility.

9.8 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 has developed all necessary NMPs according to the MS4 general permit and continues to update and implement them. Following the Phase 1 Guidance and the Expert Panel report, the City is considering the feasibility for the implementation of NMPs on unregulated lands, private lands, and City lands receiving nutrients that are less than one contiguous acre. The option for residential condominiums to develop NMPs has been included as a method to receive stormwater utility fee credit. The City can receive pollution reduction credit for these non-MS4 general permit required NMPs. If additional NMPs are developed, they will be included in the City's annual report.

9.9 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 Phase 1 Guidance to calculate the reductions. Pollutant reductions credited will be reported in the annual report for the appropriate period.

9.10 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 existing RPAs. Focus will be placed on identifying areas on City properties. Credits will be calculated using the efficiencies found in Table V.H.1 of the Phase 1 Guidance and will be reported with the appropriate annual report.

9.11 Nutrient Trading

The Commonwealth of Virginia allows 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

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credits annually. This annual trading can also be a valuable tool to assist localities in complying with their MS4 general permits while working to implement the required reductions.

Likewise, urban stormwater pollutant reduction practices functioning beyond the pollutant reductions required in each MS4 general 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 40% pollutant reduction requirements for 2023, these credits should be available for the City to trade in 2023 to other permittees that may need more time to reach the required June 30, 2023 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.

9.12 Bi-Lateral Trading

A Combined Sewer System (CSS) exists in the older historic district of the City and includes four combined sewer outfalls. The Bay TMDL assigns a wasteload allocation (WLA) to these four combined sewer overflow (CSO) outfalls (CSO 001 at Oronoco Bay, CSO 002 at Hunting Creek, and CSOs 003 and CSO 004 at Hooffs Run) for nutrients and sediment. Additionally, the Hunting Creek Bacteria TMDL assigns a WLA to three (CSO 002, CSO 003, and CSO 004) of the four CSO outfalls and requires substantial reductions that are enforced through CSO legislation enacted in 2017 (2017 CSO Law). The Virginia General Assembly enacted the 2017 CSO Law on April 26, 2017, which requires the implementation of CSO controls to address the Hunting Creek Bacteria TMDL and reduction of overflows at CSO 001 to meet the EPA CSO Control Policy Presumption Approach by July 1, 2025. In 2024, the General Assembly extended the deadline to July 1, 2026.

In response to the 2017 CSO Law, the City and AlexRenew developed a revised long term control plan update (LTCPU) to comply with the CSO reduction requirements and compliance deadline. AlexRenew owns and operates the Water Resource Recovery Facility (WRRF) which provides sanitary and combined sewage treatment services to the Cityand parts of Fairfax County. The LTCPU, currently known as the RiverRenew project, is constructing new sewer infrastructure to meet CSO control requirements, which includes storage and conveyance tunnels strategically coupled with AlexRenew's WRRF, to maximize the volume of CSO flow receiving treatment. The LTCPU was approved by City Council in April 2018 and subsequently by DEQ in June 2018. The controls implemented as the result of the LTCPU will achieve substantial nitrogen, phosphorus and sediment reductions and are on schedule to be constructed by July 1, 2026.

AlexRenew and the City are working together to leverage the WRRF to achieve CSO control requirements by the extended legislative deadline and have made significant progress towards meeting this overall water quality goal. On June 6, 2018, City Council approved the Outfall Transfer Agreement between the City of Alexandria, Virginia and the City of Alexandria Sanitation Authority Concerning Wet Weather Wastewater Storage and Conveyance Facilities (Outfall Transfer Agreement). The Outfall Transfer Agreement makes AlexRenew responsible for the financing, design, construction, operation and maintenance of the RiverRenew project. (However, note that the City's rate payers are

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funding the project through increased fees.) Additionally, the Outfall Transfer Agreement outlined "Secondary Benefits" following the implementation of CSO controls with respect to the Chesapeake Bay TMDL.

On July 1 2018, the City transferred ownership of these outfalls to AlexRenew, who is now the VPDES permit holder for the outfalls. Section 15 of the Outfall Transfer Agreement states that AlexRenew will apply the Bay TMDL CSO WLAs that are in effect for nitrogen, phosphorus and sediment to any CSO overflows and to combined sewer flows that are measured, captured, and treated through AlexRenew's WRRF once the RiverRenew project is complete. If after this analysis, allocation of nitrogen, phosphorus, and sediment remains unapplied, such credits will be calculated using AlexRenew's actual previous year annual reported nitrogen, phosphorus and sediment performance and traded to the City for its use. As such, the City may use these credits towards meeting the Bay TMDL pollutant reductions in the MS4 general permit.

The cost of the RiverRenew project is currently $615M, while infrastructure investments for compliance with the MS4 general permit are estimated at $100 - $200M. Note that the same ratepayers in the City fund the RiverRenew project as well as the MS4 capital costs to mitigate stormwater discharges. By integrating these two water quality 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 to the City ratepayers as well as funding for the Stormwater Utility fee that was adopted to fund costly stormwater infrastructure retrofits to meet MS4 general permit requirements and the Bay TMDL. Therefore, this bi-lateral trading approach will provide water quality benefits to the City's local streams, the Potomac River and the Chesapeake Bay through maximizing the economic benefits to the City's rate payers through the most cost-effective approach (EPA Memo, June 2012).

10. Phase 1 Permit Cycle Progress

The following sections discuss the progress that the City has made in meeting the L2 Scoping Target Reductions. Each project or group of BMPs below was initially presented in the City's Phase 1 Action Plan and is complete or is expected to be substantially completed by the end of the 2017-2018 permit year. Section 10.9 summaries the pollutant reductions for the Phase 1 permit cycle. BMP calculations are found in Appendix A.

10.1 Credits for 2006 – 2009 Historical Stormwater BMPs

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. The credits for structural BMPs implemented on or after January 1, 2006, and prior to July 1, 2009, were approved by DEQ in the Phase 1 Chesapeake Bay Action Plan. These historical BMPs were submitted by September 1, 2015, as part of the "Historical Data Clean-up" and so that they could be incorporated into the Phase 6 Chesapeake Bay Model. The Phase 1 Guidance stated that if the data submitted prior to September 1, 2015, the permittee would receive credit toward target pollutant 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

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Potomac River Basin loading rates from 2013-2018 Table 2b. 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 was submitted with the Phase 1 Action Plan and can be found in AppendixB . The summary of the 2006 – 2009 BMP reductions for nitrogen, phosphorus and sediment are presented in Table 11.

Table 11 – 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. City Cost[1]
40	62	1,305.1	158.0	150,452	$0

[1]*Developer bears installation and long-term operation and maintenance costs for private facilities.*

10.2 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 (Credit for BMPs installed on or after January 1, 2006, and before July 1, 2009 are discussed in Section 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. Specific BMP types and associated pollutant removal efficiencies were based on the Chesapeake Bay Program Efficiencies and Retrofit Curves data, as applicable.

Two separate calculation tables were developed:

- Table 12 with pollutant reductions associated with BMPs installed between 2009 and June 30, 2014; and
- Table 13 with pollutant reductions associated with BMPs installed between July 1, 2014, and June 30, 2018.

The differentiation was made due to the implementation of the updated VSMP regulations on July 1, 2014 and the need to compare these reductions to the increased loads from the 2009 to June 30, 2014 redevelopment projects (Section 4). The full calculation tables with the pollutant removals for the BMPs installed during these time periods can be found in the Appendix B.

Please note that there was a summation error in the pollutant reduction table for the July 1, 2009, to June 30, 2014 BMPs (Attachment 1B) which was submitted to DEQ on December 14, 2015 and the values found in Table 12 have been updated.

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Table 12 – Reductions Achieved for July 1, 2009 – June 30, 2014 BMPs

Total Acres Treated	Impervious Acres Treated	TN Removed (lbs/yr)	TP Removed (lbs/yr)	TSS Removed (lbs/yr)	Approx. City Cost[1]
230.7	165.2	610.9	117.9	125,640	$0

[1]*Developer bears the cost of installation and long-term operation and maintenance for private facilities.*

Table 13 – Reductions Achieved for July 1, 2014 – June 30, 2018 BMPs

Total Acres Treated	Impervious Acres Treated	TN Removed (lbs/yr)	TP Removed (lbs/yr)	TSS Removed (lbs/yr)	Approx. City Cost[1]
130.28	102.78	263.4	36.7	34,583	$0

[1]*Developer bears the cost of installation and long-term operation and maintenance for private facilities.*

10.3 Lake Cook, Regional Facility

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 is being 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.

A Technical Memorandum providing the approach of the planned retrofit, the calculated pollutant removal efficiencies, and the associated pollutant removal credits was submitted and approved with the Phase 1 Action Plan and included as Appendix B.

Note that the project wasn't substantially complete until September 2018, so the associated reductions are not included in Phase 1 but with the Phase 2 pollutant reductions. Table 14 provides a summary of acres treated, pollutant reductions, and costs for this retrofit project. The total cost of the project was $4.5M.

Table 14 – Lake Cook Retrofit - Pollutant Reductions

Total Acres Treated	Impervious Acres Treated	TN Removed (lbs/yr)	TP Removed (lbs/yr)	TSS Removed (lbs/yr)	Approx. City Cost[1]
390.3	127.5	1587.0	163.3	131,334	$4.5M

[1]*Value includes funds from a SLAF grant. Operation and maintenance is projected at $103,000 annually beginning in FY 2019 with a three percent annual inflation factor included each year thereafter.*

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10.4 Eisenhower Pond 19, Regional Facility

This regional facility was 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 the stormwater retrofit curves/equations and the runoff depth treated per impervious acre. The efficiency values of 35.0% TP; 22.2% for TN and 44.5% for TSS were subsequently derived. Table 15 presents the pollutant removal data for this regional facility. The Eisenhower Block 19 Pond was brought online in June 2015.

Table 15 – Eisenhower Block 19 Pond – Pollutant Reductions

Total Acres Treated	Impervious Acres Treated	TN Removed (lbs/yr)	TP Removed (lbs/yr)	TSS Removed (lbs/yr)	Approx. City Cost[1]
67.1	53.7	166.8	39.2	23,644	$0

[1]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.

10.5 Retrofits on City Properties

The City has completed several BMP retrofit projects on City properties. Table 16 presents the retrofits that have been implemented on City properties after June 30, 2009 and the related pollutant reductions.

Table 16 – Retrofits on City Property – Pollutant Reductions

Project	Total Treated (ac)	Impervious Treated (ac)	TN Removed (lbs/yr)	TP Removed (lbs/yr)	TSS Removed (lbs/yr)	Approximate Total City Cost[2]
Fire Station #206	0.55	0.55	2.66	0.40	515.38	$252,240
Burke Library BMP#1	0.53	0.51	2.52	0.38	480.71	$71,686[1]
Burke Library BMP#2	0.78	0.41	2.66	0.37	299.91	$71,686[1]
Charles Barrett Elementary BMP#1	0.73	0.62	3.31	0.47	596.45	$252,240[1]
Charles Barrett Elementary BMP#2	1.62	1.38	6.42	1.05	912.24	$252,240[1]
		Totals	**17.6**	**2.7**	**2,805**	**$900,092**

[1]The total cost was evenly divided, however actual costs varied for each.
[2]Average operational costs based on published studies of such facilities with enhanced amenities and visibility are estimated at $25,000 annually beginning in FY 2019, with a three percent annual inflation factor included each year thereafter.

10.6 Four Mile Run, Urban Stream Restoration

Following years of design, public outreach and inter-jurisdictional collaboration, the Four Mile Run Stream Restoration began construction in May 2015 and substantial completion in the Summer of 2016. The project involved 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 main Four Mile Run stream channel to the floodplain over a wide range of storm events. The approach and the determination of pollutant removal credits is discussed in the Technical Memorandum submitted with the Phase 1 Action Plan and included in Appendix B. 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. Table 17 presents the reductions for each pollutant of concern and the approximate project cost. This project was brought online in July 2016.

Table 17 – Four Mile Run Stream Restoration – Pollutant Reductions

TN (lbs./yr)	TP (lbs./yr)	TSS (lbs./yr)	Approximate City Cost[1]
194.8	40.0	14,914	$1.8M

[1]*Estimate from the total costs of multiple projects in one package; construction only.*

10.7 Windmill Hill Living Shoreline

Construction of the living shoreline at Windmill Hill Park was substantially complete in June 2018. This project was not documented during the Phase 1 Action Plan because it was not known at the time that the scope of the project would include the installation of a natural living shoreline, and the Expert Panel Report for Shoreline Management Projects had not obtained final approval. The project was initiated because of a failing bulkhead along the Potomac River at Windmill Hill Park. Several options for replacement were studied with the most cost effective and beneficial being the installation of a living shoreline. Pollutant removal calculations can be found in Table 18.

Table 18 – Windmill Hill Living Shoreline Pollutant Reductions

TN (lbs/yr)	TP (lbs/yr)	TSS (lbs/yr)	Approximate City Cost[1]
131.3	8.0	9,951	$3.6M

[1]*Total cost of project; construction only.*

10.8 Phase 1 Action Plan

The Phase 1 Action Plan was approved by DEQ on January 12, 2016. Correspondence between the City and DEQ along with the Action Plan approval letter can be found in Appendix D. The following list documents the updates and additions to the anticipated Phase 1 reductions documented in the Phase 1 Action Plan:

1. The as-built conditions for Pond 19 produces pollutant reductions slightly less than the values submitted (differences of TN = -2.1 lb/yr; TP = -3.5 lb/yr; TSS = -275.3 lb/yr).
2. A summation error was discovered in the pollutant reduction table for the July 1, 2009 to June 30, 2014 BMP table. The updated values are significantly higher than what was submitted (differences of TN = 500.6 lb/yr; TP = 103.0 lb/yr; TSS = 108,589 lb/yr).
3. The inclusion of the reductions associated with the BMPs installed from July 1, 2014 to June 30, 2018 (differences of TN = 263.4 lb/yr; TP = 36.7 lb/yr; TSS = 34,583 lb/yr).

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4. The list of grandfathered projects which began construction was updated and refined. There were several projects that did not move forward or were updated to use the Virginia Runoff Reduction methodology (differences of TN = -722.6 lb/yr; TP = -85.2 lb/yr; TSS = -25,798 lb/yr).
5. The pollutant reductions associated with Windmill Hill Shoreline Restoration were added (TN = 131.3 lb/yr; TP = 8.0 lb/yr; TSS = 9,951 lb/yr).
6. The pollutant reduction associated with Lake Cook Retrofit were removed and are included with the Phase 2 pollutant reductions since the project was substantially complete in September 2018. (TN = 1,587 lb/yr; TP = 163.3 lb/yr; TSS = 131,344 lb/yr).

10.9 Phase 1 Reductions

The following table summarizes the pollutant reductions related to the projects which have been completed, fully or substantially, by the end of the 2017-2018 permit year.

Table 19 – Phase 1 Permit Cycle Pollutant Reductions

Project or BMPs	TN Removed (lbs/yr)	TP Removed (lbs/yr)	TSS Removed (lbs/yr)	Approximate City Cost[1]
2006-2009 BMPs	1305.1	158.0	150,452	$0
2009-2014 BMPs[2]	610.9	117.9	125,640	$0
2014-2018 BMPs[3]	263.4	36.7	34,583	$0
Eisenhower Pond 19[4]	166.8	39.2	23,644	$0
Retrofits on City Properties	17.6	2.7	2,805	$900,000
Four Mile Run Restoration	194.8	40.0	14,914	$1.8M
Windmill Hill Living Shoreline[3]	131.3	8.0	9,951	$3.6M
TOTAL PHASE 1	**2,689.8**	**402.4**	**361,990**	**$6.3M**

[1]Developer bears installation and long-term operation and maintenance costs for private facilities.
[2]Calculation error discovered in Phase 1 Action Plan (values have been increased by TN = 500.6 lb/yr; TP = 103.0 lb/yr; TSS = 108,589 lb/yr as compared to the Phase 1 Action Plan)
[3]Was not included in Phase 1 Action Plan
[4]Values have changed from the Phase 1 Action Plan based on the as-built survey

11. Phase 2 Permit Cycle Progress

The following sections discuss the progress that the City has made in meeting the L2 Scoping Target Reductions. Each project or group of BMPs below was initially presented in the City's Phase 2 Action Plan and is complete.

11.1 Lake Cook Retrofit

Construction of the Lake Cook Retrofit project was substantially complete in September 2018 or during the beginning of permit year 2018-2019. The project was awarded Stormwater Local Assistance Fund (SLAF) grant funding from DEQ.

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Table 20 – Lake Cook Retrofit – Pollution Reductions

Total Acres Treated	Impervious Acres Treated	TN Removed (lbs/yr)	TP Removed (lbs/yr)	TSS Removed (lbs/yr)	Approx. City Cost[1]
390.3	127.5	1587.0	163.3	131,334	$4.5M

[1]*Value includes funds from a SLAF grant. Operation and maintenance is projected at $103,000 annually beginning in FY 2019 with a three percent annual inflation factor included each year thereafter.*

11.2 Ben Brenman Pond Retrofit

The Ben Brenman Pond retrofit was substantially complete in June 2020. This City-owned and maintained facility drains approximately 290 acres of urban land with an impervious percentage of 62%. The pond is in Ben Brenman Park and is in the Backlick Run watershed. Design plans improving the pond to meet the Level 2 Wet Pond criteria were finalized in November 2017. Improvements include increased pond and forebay volume, multiple cells, aquatic benches, wetland areas, aerators, and diversion of an additional 35 acres that was previously untreated. uThe project received a SLAF 50% matching grant in December 2014. The pollutant removals have been refined since they were reported for reference purposes in the Phase 1 Action Plan. The Pollution Calculations for Ben Brenman Pond is included in Appendix B.

Table 21 – Ben Brenman Pond Retrofit – Pollutant Reductions[1]

Total Acres Treated	Impervious Acres Treated	TN Removed (lbs/yr)	TP Removed (lbs/yr)	TSS Removed (lbs/yr)	Approx. Cost[1]
290.1	179.1	946.4	151.3	87,734	$3.75M

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

11.3 Development SWM Facilities

In accordance with the Phase 1 and Phase 2 Action Plans, BMPs installed as part of redevelopment projects have been certified, documented, and uploaded to the DEQ BMP Warehouse. The BMP calculations for these BMPs are found in Appendix B.

Table 22 – Development SWM Facilities – Pollution Reductions

Total Acres Treated	Impervious Acres Treated	TN Removed (lbs/yr)	TP Removed (lbs/yr)	TSS Removed (lbs/yr)	Approx. City Cost[1]
67	50	131	60	28,161	$0

11.1 Update to BMPs

During PY4, two BMPs were found to be removed or in major disrepair. BMP ID 2007-0102 is a Vegetated Roof and was found to be completely removed from the facility. BMP ID 2004-0038 01 is a stream restoration completed in 2010 and was found to have "failed" based on a forensic analysis that was completed. The stream project restored approximately 600 linear feet of the downstream portion of Strawberry Run and the City calculated 40.80 lbs/yr of TP reductions using the linear foot method from this project. However, the published *Strawberry Run Downstream*

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Forensic Investigation (June 2022) found that the restoration no longer functions as designed. During PY5, one BMP was found to be removed. BMP ID 2008-0012 04 was a StormFilter™ Stormwater Treatment System that was no longer in operation. The Credits received for these three SMFs are shown in Table 24 and will be removed from the BMP Warehouse; the Bay TMDL calculations; and reflected in this Phase 3 Action Plan.

Table 23 – Credits Received from BMPs Removed from Inventory

Project	TN Reductions (lbs/yr)	TP Reductions (lbs/yr)	TSS Reductions (lbs/yr)
2010 Strawberry Run Restoration (2004-0038 01)	45	40.80	26,928
Vegetated Green Roof, Windsor Ave. (2007-0102 01)	0.06	0.01	5
StormFilter™ Stormwater Treatment System (2008-0012 04)	0.42	2.85	532

11.2 Phase 2 Summary of Progress

Table 26 presents a summary of the progress at the end of the Phase 2 permit cycle. Based on progress made in the first cycle and strategies to be implanted in the second permit cycle, the City will far exceed the 40% pollutant reduction requirement and has made substantial progress in achieving 100% reduction goals.

Table 24 – Phase 2 Permit Cycle Pollutant Reductions

Project or BMPs	TN Removed (lbs/yr)	TP Removed (lbs/yr)	TSS Removed (lbs/yr)	Approximate City Cost
FY2019-FY2024 BMPs[1]	131	60	28,161	$0
BMP Removal (2010 Strawberry Run Restoration (2004-0038 01))[2]	-45	-40.8	-26,928	$0
BMP Removal (Vegetated Green Roof, Windsor Ave. (2007-0102 01))[2]	-0.06	-0.01	-5	$0
BMP Removal (StormFilter™ Stormwater Treatment System (2008-0012 04))[2]	-0.42	-2.85	-532	$0
2009-2019 New Sources Offsets[2]	-13	-2.3	-1,911	$0
Grandfathered Offsets[2]	30.6	8.7	3,676	$0
Lake Cook Retrofit	1,587	163.3	131,334	$4.5M
Ben Brenman Pond Retrofit	946.4	151.3	87,734	$3.75M
TOTAL PHASE 2	**2,575**	**320**	**214,177**	**$8.25M**

[1]*Developer bears installation and long-term operation and maintenance costs for private facilities.*
[2]*Negative values indicate net pollutant reductions.*

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Table 25 – Phase 1 and 2 Progress

Pollutant of Concern	City Phase 1 & 2 Actual Reductions (lbs./yr)	L2 Total Required Reductions (lbs./yr)	Percent of L2 Total Required Reductions Met
TN	5,264.72	7,597.03	69.30%
TP	722.04	1,004.40	71.89%
TSS	576,167.00	861,937	66.85%

12. Phase 3 Permit Cycle Anticipated Reductions and Final TMDL Compliance

In addition to redevelopment credits, the City completed the Lucky Run stream restoration project during FY 2024, and will use redevelopment and new BMP retrofits, along with credits obtained through the bi-lateral trading program with River Renew to achieve over 100% TMDL compliance by FY2028 as required through the 2023-2028 MS4 general permit. As noted above, DEQ removed the TSS requirement from the 2023-2028 MS4 general permit and that update is reflected in the tables below. Please note that the City has achieved over 100% of the previously required sediment reduction requirements. An overview of the reductions and credits are included in Table 26 and described herein.

The new 2023-2028 MS4 general permit removed total suspended solids/sediment from the Chesapeake Bay TMDL special conditions. Table 30 summarizes the completed expected reductions, which account for over 100% of the TN and TP goal.

Table 26 – Phase 3 Anticipated Reductions

Pollutant of Concern	Total Phase 1 & Phase 2 Reductions (lbs/yr)	Anticipated Phase 3 Reductions (lbs/yr)	Total Phase 1 through 3 Reductions (lbs/yr)	Total Required Reductions (lbs/yr)	Percent of Total
TN	5,265	3,194	8,459	7,597.03	111%
TP	722	1,077	1,799	1,004.40	179%

12.1 Stream Restoration

The City will complete the Lucky Run Stream Restoration project during Phase 3 (December 2023). The City received an FY2019 SLAF grant for the project, which involves restoring 950 linear feet of stream. The project is bounded by residential developments to the north and east, West Braddock Road to the west, and by Interstate 395 to the south. Lucky Run eventually outfalls to Four Mile Run, which ultimately outfalls to the Potomac River, and then the Chesapeake Bay. Approximately, 224 acres of highly urban land drain to Lucky Run. The restoration has reestablished a stable pattern and profile in the stream as well as addressing areas of severe erosion near a sanitary line and nature trail. Construction was completed during the Phase 3 permit cycle. The pollutant removals for the project are based on the 2014 Stream Restoration Expert Panel Report using protocols 1 and 2.

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Table 27 – Phase 3 Progress: Lucky Run

Project	TN Removed (lbs/yr)	TP Removed (lbs/yr)	Approx. Cost to City[1]
Lucky Run Stream Restoration	658	257	$1.8M

[1]*The cost of the Lucky Run project has been updated from the Phase 2 Action Plan and is based on more current information. This cost includes SLAF funding.*

12.2 Bi-Lateral Trading

During Phase 3, the City will engage in bi-lateral trading with Alexandria Renew Enterprises (AlexRenew) for the pollution reduction credits generated from the River Renew project funded by the City's rate payers. Section 15 of the Outfall Transfer Agreement states that AlexRenew will apply the Bay TMDL Combined Sewer Overflow (CSO) WLAs that are in effect for nitrogen, phosphorus, and sediment to any CSO overflows and to combined sewer flows that are measured, captured, and treated through AlexRenew's Water Resource Recovery Facility (WRRF) once the RiverRenew project is complete. If after this analysis, allocation of nitrogen, phosphorus, and sediment remains unapplied, such credits will be calculated using AlexRenew's actual previous year annual reported nitrogen, phosphorus and sediment performance and traded to the City for its use. As such, the City may use these credits towards meeting the Bay TMDL pollutant reductions in the MS4 general permit. The funding for the RiverRenew project is being born by the City's ratepayers. These are the same ratepayers that pay the City's Stormwater Utility Fee. The anticipated annual trading credits are provided in Table 28.

Table 28 – Phase 3 Progress: Anticipated Bi-Lateral Trading Credits

Project	TN Removed (lbs/yr)	TP Removed (lbs/yr)	Approx. Cost to City[1]
Bi-Lateral Trading[2]	1,500	500	$0

[1]*The cost of the RiverRenew Project is $615 million that is funded by rate payers in the City as described above.*
[2]*Numbers are estimated and dependent on the performance of the tunnel system.*

12.3 Redevelopment SWM Credits

During Phase 3, two large redevelopment projects are anticipated to be completed as well as routine redevelopment. Stormwater quality BMPs implemented to meet the VSMP regulations, as adopted into the City's Environmental Management Ordinance effective July 1, 2014, and the City's more stringent requirements to treat the first one-half inch of runoff – the first flush – from all impervious surfaces. Note that development also must comply with the City's memo to industry that requires at least 65% of the TP removal requirement be accomplished through non-proprietary surface BMPs, i.e. Green Infrastructure.

- ***Landmark.*** The Landmark Redevelopment Project was approved on July 6, 2021 by City Council. This project will result in up to approximately four million square feet of new development. The project will be anchored by the relocation and expansion of Inova's new state-of-the-art Alexandria Hospital bringing more than 2,000 health care workers to the medical campus. This transformational project—led by developer Foulger-Pratt—was named by the Washington Business Journal as the 2020 Real Estate Deal of the Year.

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- ***North Potomac Yard.*** The 2010 North Potomac Yard Small Area Plan established the vision and guiding principles for the redevelopment of the approximately 70-acre site as a sustainable, mixed-use, walkable community oriented around the construction of the Potomac Yard Metrorail station and established the framework to determine funding sources for the Metrorail Station and potential phasing options for redevelopment of the Plan area.

Table 29 – Phase 3 Progress: Anticipated Redevelopment Credits

Project	TN Removed (lbs/yr)	TP Removed (lbs/yr)	Approx. Cost to City[1]
Anticipated Annual Redevelopment through FY2028	1,036	320	$0

[1]Developer bears installation and long-term operation and maintenance costs for private facilities.
[2]The City anticipates additional projects to come through from FY2025-FY2028 and will report these in the Annual Report beyond the 100% required reductions.

12.4 Summary of Projected Credits for Phase 3 (2023 – 2028)

Table 30 provides a summary of anticipated pollution credits and estimated costs anticipated during Phase 3.

Table 30 – Phase 3 Permit Cycle Anticipated Pollutant Reductions

Project or BMPs	TN Removed (lbs/yr)	TP Removed (lbs/yr)	Approximate City Cost
Lucky Run Stream Restoration	658	257	$1.8M
Bi-Lateral Trading	1,500	500	$0
Anticipated Annual Redevelopment through FY2028	1,036	320	$0
TOTAL PHASE 3	3,160	905	$1.8M

13. Costs of Implementation

The cost for credits for BMPs implemented during development and redevelopment are borne by the developer. But much of the cost to implement the strategies outlined herein 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 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. Regarding 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.

To meet increased costs, the City adopted a Stormwater Utility Fee on May 4, 2017, with the Fiscal Year 2018 budget to provide a dedicated source to fund the City's Stormwater Management Program, to be billed starting May 2018. The fee funds stormwater management, to include federal and state mandates to clean up the Chesapeake Bay, more equitably than through real estate taxes by shifting stormwater management costs to residential and nonresidential property owners with greater impact on stormwater runoff. The fee was effective January 1, 2018, and the first bill was mailed on in May 2018. The fee is billed twice a year with the City's real estate billing.

14. Public Comment

Public comments will be solicited and addressed during PY2 of the 2023-2028 MS4 general permit for this Phase 3 Action Plan and the comment and response table will be included below in the Final Phase 3 Action Plan for submission to DEQ.

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15. References

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

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

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

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

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

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

7. Recommendation of the Expert Panel to Define Removal Rates for Shoreline Management Projects, July 2015

8. Recommendations of the Expert Panel to Define Removal Rates for Street and Storm Drain Cleaning Practices, May 2016

9. Recommendations of the Expert Panel to Define BMP Effectiveness for Urban Tree Canopy Expansion, September 2016

10. 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

11. Strawberry Run Downstream Forensic Investigation, Part 1 Final Report - Forensic Analysis, June 22 2022

12. December 19, 2019 Memo form EPA Regional Administrator to DEQ on Phase III WIP

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Appendix A

Future Grandfathered Projects

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Future Grandfathered Projects		
Project Name	**Address**	**Approx. Project Site Area (ac)**
Carlyle Plaza Two (Amendments)	DSP2013-00025	6.92
Hoffman Properties Blocks 11 and 12	DSP2016-00012 (DSUP2013-00008)	4.27
Carlyle Plaza One	DSP2006-00003	1.39
Mark Center Plaza 1A Building 5	DSP2007-00027	7.24
	Total	**19.82**

Potomac Yard Landbay G - Block D (Institute for Defense Analyses at Potomac Yard) (DSP2012-00008) was removed from the list of future grandfathered projects during the Phase 3 Action Plan update. The calculations for this BMP are included in the Phase 2 calculations and reflected herein. Eisenhower Block 20 (DSP2015-00008 (DSUP2007-00017)) also was removed and will be go back through the planning process.

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Appendix B: BMP Calculation Tables

July 1, 2009 to June 30, 2014 BMP Calculation Table
July 1, 2014 to June 30, 2018 BMP Calculation Table
July 1, 2018 to June 30, 2024 BMP Calculation Table

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July 1, 2009 to June 30, 2014 BMP Calculation Table

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

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
1995-0021 01	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	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 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	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	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	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	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 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 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 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 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 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 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 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 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	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	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	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	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	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	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 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	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

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

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
2002-0044 08	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 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	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	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
2003-0013 02	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	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	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 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 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 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	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 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	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	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	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	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	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 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 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	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	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	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	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	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	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

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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
2005-0013 03	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	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	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	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	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	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	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	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
2005-0038 05	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	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	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	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	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	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	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	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	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 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 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	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	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	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	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	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	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

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2006-0031 03	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	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	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 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	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	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	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	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	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	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	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	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
2007-0024 PLT 01	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	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	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	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	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		Oil / Grit Separator	12/28/2009	0.1	0.1	0.16	1.69	117							Chesapeake Bay Program
2007-0030 01	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	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 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 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 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 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

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2007-0037 05	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 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	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	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	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	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	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	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	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	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	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 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 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 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/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
2008-0035 PLT 02	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	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	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	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	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	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 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	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

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2009-0008 02	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	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	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 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 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 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 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 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 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 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 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 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	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	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	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	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	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	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	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	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	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
2010-0005 09	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 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 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	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	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

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

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
2010-0009 03	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	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	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	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	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	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	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	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	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	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	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	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	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 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	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	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	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	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 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 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 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 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 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 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	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 06	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

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
2011-0015 07	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	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	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	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 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	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	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	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 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	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	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	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 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	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	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	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	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	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	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	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 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	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	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	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 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

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

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
2012-0383 PRJ 02	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	**230.73**	**165.19**	**294.48**	**3,445**	**205,012**			**Totals**	**117.86**	**610.86**	**125,640.17**	

July 1, 2014 to June 30, 2018 BMP Calculation Table

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City of Alexandria July 1, 2014 - June 30, 2018 BMPs

BMP ID	Reporting PY	Chesapeake Bay Program BMP Type	BMP Name (Full)	Efficiency Method	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]
2012-0011 01	2014/2015	Infiltration Practices w/o Sand, Veg.	Infiltration System	Chesapeake Bay Program	9/1/2015	2.84	2.25	3.89	43.88	2,739	85%	80%	95%	3.30	35.10	2602.23
2012-0011 02	2014/2015	Infiltration Practices w/o Sand, Veg.	Infiltration System	Chesapeake Bay Program	9/1/2015	0.83	0.66	1.14	12.84	803	85%	80%	95%	0.97	10.27	762.81
2012-0011 03	2014/2015	Bioretention C/D soils, underdrain	Bioretention Filter	Chesapeake Bay Program	9/1/2015	0.85	0.48	0.93	11.82	627	45%	25%	55%	0.42	2.95	345.00
2012-0011 04	2014/2015	Already included in aggregate method for determining increase in impervious areas	Cistern		9/1/2015	2.1	1.73	2.95	32.89	2,091						
2012-0011 05	2014/2015	Dry Detention Ponds and Hydrodynamic Structures	CDS® Stormwater Treatment System	VA BMP Clearinghouse - MTD	9/1/2015	2.1	1.73	2.95	32.89	2,091	20%	13%	50%	0.59	4.19	1045.71
2012-0011 06	2014/2015	Dry Detention Ponds and Hydrodynamic Structures	CDS® Stormwater Treatment System	VA BMP Clearinghouse - MTD	9/1/2015	0.38	0.32	0.54	6.00	385	20%	13%	50%	0.11	0.76	192.69
2010-0023 01	2014/2015	Filtering Practices	StormFilter™ Stormwater Treatment System	VA BMP Clearinghouse - MTD	1/2/2015	0.8539	0.8539	1.38	14.40	1,000	45%	29%	80%	0.62	4.12	800.15
2004-0005 01	2014/2015	Dry Detention Ponds and Hydrodynamic Structures	Aqua-Swirl® Stormwater Hydrodynamic Separator	VA BMP Clearinghouse - MTD	1/21/2015	2.13	0.9	1.96	27.56	1,270	20%	13%	50%	0.39	3.51	635.21
2004-0005 02	2014/2015	Dry Detention Ponds and Hydrodynamic Structures	Aqua-Swirl® Stormwater Hydrodynamic Separator	VA BMP Clearinghouse - MTD	1/21/2015	1.4	0.56	1.25	17.90	804	20%	13%	50%	0.25	2.28	401.81
2010-0028 01	2014/2015	Filtering Practices	Dry Vault Sand Filter	Chesapeake Bay Program	1/28/2015	2.23	2.2	3.58	37.39	2,582	60%	40%	80%	2.15	14.96	2065.74
2014-0101 01	2014/2015	Bioretention C/D soils, underdrain	Tree Box Filter	Chesapeake Bay Program	7/7/2014	0.17	0.11	0.20	2.46	139	45%	25%	55%	0.09	0.61	76.67
2014-0101 02	2014/2015	Bioretention C/D soils, underdrain	Tree Box Filter	Chesapeake Bay Program	7/7/2014	0.16	0.12	0.21	2.43	148	45%	25%	55%	0.09	0.61	81.17
2014-0101 03	2014/2015	Bioretention C/D soils, underdrain	Tree Box Filter	Chesapeake Bay Program	7/7/2014	0.16	0.08	0.16	2.15	108	45%	25%	55%	0.07	0.54	59.27
2014-0101 04	2014/2015	Bioretention C/D soils, underdrain	Tree Box Filter	Chesapeake Bay Program	7/7/2014	0.18	0.12	0.22	2.63	151	45%	25%	55%	0.10	0.66	83.11
2014-0101 05	2014/2015	Bioretention C/D soils, underdrain	Tree Box Filter	Chesapeake Bay Program	7/7/2014	0.19	0.11	0.21	2.66	143	45%	25%	55%	0.09	0.67	78.60
2014-0101 06	2014/2015	Bioretention C/D soils, underdrain	Tree Box Filter	Chesapeake Bay Program	7/7/2014	0.15	0.13	0.22	2.39	156	45%	25%	55%	0.10	0.60	85.68
2014-0101 07	2014/2015	Bioretention C/D soils, underdrain	Tree Box Filter	Chesapeake Bay Program	7/7/2014	0.18	0.14	0.24	2.76	171	45%	25%	55%	0.11	0.69	94.06
2012-0001 01	2014/2015	Filtering Practices	StormFilter™ Stormwater Treatment System	VA BMP Clearinghouse - MTD	9/19/2014	1.555	1.269	2.17	24.28	1,537	45%	29%	80%	0.98	6.95	1229.35
2011-0022 01	2014/2015	Filtering Practices	StormFilter™ Stormwater Treatment System	VA BMP Clearinghouse - MTD	9/19/2014	1.868	1.548	2.64	29.32	1,869	45%	29%	80%	1.19	8.40	1495.57
2003-0007 01	2014/2015	Dry Detention Ponds and Hydrodynamic Structures	CDS® Stormwater Treatment System	VA BMP Clearinghouse - MTD	2/19/2015	1.6	0.4	1.14	18.83	679	20%	13%	50%	0.23	2.40	339.74
2010-0012	2015/2016	Wet Ponds and Wetlands	Wet Pond	Chesapeake Bay Program	6/30/2015	18.84	15.1	26.00	292.25	18,344	45%	20%	60%	11.70	58.45	11006.65
2011-0030 01	2015/2016	Filtering Practices	StormFilter™ Stormwater Treatment System	VA BMP Clearinghouse - MTD	8/3/2015	3.94	3.58	5.95	63.98	4,257	45%	29%	80%	2.68	18.33	3405.29
2012-0010	2015/2016	Dry Detention Ponds & Hydrodynamic Structures	CDS® Stormwater Treatment System	VA BMP Clearinghouse - MTD	2/24/2016	1.56	1.56	2.53	26.30	1,827	20%	13%	50%	0.51	3.35	913.63
2012-0022 01	2015/2016	Filtering Practices	StormFilter™ Stormwater Treatment System	VA BMP Clearinghouse - MTD	7/27/2015	1.48	0.79	1.56	20.27	1,047	45%	29%	80%	0.70	5.81	837.32
2012-0028	2015/2016	Wet Pond	Wet Pond	Chesapeake Bay Program	6/30/2015	67.1	53.68	92.46	1040.18	65,236						
2013-0005 01	2015/2016	Filtering Practices	StormFilter™ Stormwater Treatment System	VA BMP Clearinghouse - MTD	8/3/2015	0.83	0.73	1.22	13.31	873	45%	29%	80%	0.55	3.81	698.11
2013-0010 01	2015/2016	Dry Detention Ponds & Hydrodynamic Structures	CDS® Stormwater Treatment System	VA BMP Clearinghouse - MTD	6/14/2016	0.2	0.16	0.28	3.10	194	20%	13%	50%	0.06	0.39	97.22

City of Alexandria July 1, 2014 - June 30, 2018 BMPs

BMP ID	Reporting PY	Chesapeake Bay Program BMP Type	BMP Name (Full)	Efficiency Method	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]
2011-0014 01	2016/2017	Dry Detention Ponds & Hydrodynamic Structures	StormChamber Stormwater Treatment System	VA BMP Clearinghouse - MTD	8/8/2016											
2011-0014 02	2016/2017	Filtering Practices	Flow Thru Planter Box	Chesapeake Bay Program	8/8/2016	0.0091	0.0091	0.01	0.15	11	60%	40%	80%	0.01	0.06	8.53
2011-0014 03	2016/2017	Filtering Practices	Flow Thru Planter Box	Chesapeake Bay Program	8/8/2016	0.0091	0.0091	0.01	0.15	11	60%	40%	80%	0.01	0.06	8.53
2011-0014 04	2016/2017	Filtering Practices	Flow Thru Planter Box	Chesapeake Bay Program	8/8/2016	0.0091	0.0091	0.01	0.15	11	60%	40%	80%	0.01	0.06	8.53
2011-0014 05	2016/2017	Filtering Practices	Flow Thru Planter Box	Chesapeake Bay Program	8/8/2016	0.0091	0.0091	0.01	0.15	11	60%	40%	80%	0.01	0.06	8.53
2011-0014 06	2016/2017	Filtering Practices	Flow Thru Planter Box	Chesapeake Bay Program	8/8/2016	0.0091	0.0091	0.01	0.15	11	60%	40%	80%	0.01	0.06	8.53
2011-0014 07	2016/2017	Permeable Pavement w/o Sand, Veg. C/D soils, underdrain	Permeable Pavement	Chesapeake Bay Program	8/8/2016	0.012	0.012	0.02	0.20	14	20%	10%	55%	0.00	0.02	7.73
2011-0014 08	2016/2017	Permeable Pavement w/o Sand, Veg. C/D soils, underdrain	Permeable Pavement	Chesapeake Bay Program	8/8/2016	0.01	0.01	0.02	0.17	12	20%	10%	55%	0.00	0.02	6.44
2011-0028 01	2016/2017	Filtering Practices	StormFilter™ Stormwater Treatment System	VA BMP Clearinghouse - MTD	10/24/2016	0.55	0.44	0.76	8.53	535	45%	29%	80%	0.34	2.44	427.78
2012-0030 01	2016/2017	Dry Detention Ponds & Hydrodynamic Structures	CDS® Stormwater Treatment System	VA BMP Clearinghouse - MTD	11/8/2016	0.56	0.5	0.83	9.03	596	20%	13%	50%	0.17	1.15	298.10
2013-0019 02	2016/2017	Filtering Practices	StormFilter™ Stormwater Treatment System	VA BMP Clearinghouse - MTD	10/20/2016	1.09	0.58	1.15	14.91	769	45%	29%	80%	0.52	4.27	615.22
2016-0102 01 DPI	2016/2017	Bioretention C/D soils, underdrain	Bioretention Filter	Chesapeake Bay Program	12/2/2016	0.63	0.46	0.81	9.47	569	45%	25%	55%	0.37	2.37	312.78
2016-0103 01 DPI	2016/2017	Stream Restoration Urban	Stream Restoration FP Reconnection	NA	7/2/2016											
2017-0101 01 DPI	2016/2017	Bioretention C/D soils, underdrain	Bioretention Filter	Chesapeake Bay Program	4/18/2017	0.5	0.1	0.33	5.71	187	45%	25%	55%	0.15	1.43	103.10
2017-0102 01 DPI	2016/2017	Permeable Pavement w/o Sand, Veg. C/D soils, underdrain	Permeable Pavement	Chesapeake Bay Program	8/12/2016	0.05	0.05	0.08	0.84	59	20%	10%	55%	0.02	0.08	32.21
2014-0004 02	2017/2018		CDS® Stormwater Treatment System	VA BMP Clearinghouse - MTD	4/20/2018	2.08	1.78	3.01	33.03	2,138	20%	13%	50%	0.60	4.20	1068.84
2014-0011 01	2017/2018		Bioretention 2	VA BMP Clearinghouse	3/7/2018	0.11	0.06	0.12	1.52	79	90%	90%	0%	0.11	1.36	0.00
2014-0011 02	2017/2018		Bioretention 2	VA BMP Clearinghouse	3/7/2018	0.44	0.10	0.30	5.11	177	90%	90%	0%	0.27	4.60	0.00
2014-0011 03	2017/2018		Bioretention 1	VA BMP Clearinghouse	3/7/2018	0.04	0.04	0.07	0.71	49	55%	64%	0%	0.04	0.45	0.00
2014-0011 04	2017/2018		Bioretention 1	VA BMP Clearinghouse	3/7/2018	0.04	0.04	0.07	0.71	49	55%	64%	0%	0.04	0.45	0.00
2014-0011 05	2017/2018		Bioretention 1	VA BMP Clearinghouse	3/7/2018	0.04	0.04	0.07	0.71	49	55%	64%	0%	0.04	0.45	0.00
2014-0011 06	2017/2018		Bioretention 1	VA BMP Clearinghouse	3/7/2018	0.04	0.04	0.07	0.71	49	55%	64%	0%	0.04	0.45	0.00
2014-0011 07	2017/2018		Bioretention 1	VA BMP Clearinghouse	3/7/2018	0.04	0.04	0.07	0.71	49	55%	64%	0%	0.04	0.45	0.00
2014-0011 08	2017/2018		Bioretention 1	VA BMP Clearinghouse	3/7/2018	0.04	0.04	0.07	0.71	49	55%	64%	0%	0.04	0.45	0.00
2014-0011 09	2017/2018		Bioretention 1	VA BMP Clearinghouse	3/7/2018	0.04	0.04	0.07	0.71	49	55%	64%	0%	0.04	0.45	0.00
2014-0011 10	2017/2018		Bioretention 1	VA BMP Clearinghouse	3/7/2018	0.04	0.04	0.07	0.71	49	55%	64%	0%	0.04	0.45	0.00

City of Alexandria July 1, 2014 - June 30, 2018 BMPs

BMP ID	Reporting PY	Chesapeake Bay Program BMP Type	BMP Name (Full)	Efficiency Method	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]
2014-0011 11	2017/2018		Bioretention 1	VA BMP Clearinghouse	3/7/2018	0.04	0.04	0.07	0.71	49	55%	64%	0%	0.04	0.45	0.00
2014-0011 12	2017/2018		Permeable Pavement 1	VA BMP Clearinghouse	3/7/2018	0.01	0.01	0.02	0.17	12	59%	59%	0%	0.01	0.10	0.00
2014-0011 13	2017/2018		Permeable Pavement 1	VA BMP Clearinghouse	3/7/2018	0.01	0.01	0.02	0.17	12	59%	59%	0%	0.01	0.10	0.00
2014-0011 14	2017/2018		Permeable Pavement 1	VA BMP Clearinghouse	3/7/2018	0.01	0.01	0.02	0.17	12	59%	59%	0%	0.01	0.10	0.00
2014-0011 15	2017/2018		Permeable Pavement 1	VA BMP Clearinghouse	3/7/2018	0.05	0.05	0.07	0.76	53	59%	59%	0%	0.04	0.45	0.00
2014-0011 16	2017/2018		Permeable Pavement 1	VA BMP Clearinghouse	3/7/2018	0.05	0.05	0.07	0.76	53	59%	59%	0%	0.04	0.45	0.00
2014-0011 17	2017/2018		Permeable Pavement 1	VA BMP Clearinghouse	3/7/2018	0.05	0.05	0.08	0.84	59	59%	59%	0%	0.05	0.50	0.00
2014-0011 18	2017/2018		Permeable Pavement 1	VA BMP Clearinghouse	3/7/2018	0.05	0.05	0.08	0.84	59	59%	59%	0%	0.05	0.50	0.00
2014-0011 19	2017/2018		Permeable Pavement 1	VA BMP Clearinghouse	3/7/2018	0.05	0.05	0.08	0.84	59	59%	59%	0%	0.05	0.50	0.00
2014-0011 20	2017/2018		Bioretention 1	VA BMP Clearinghouse	3/7/2018	0.04	0.04	0.07	0.71	49	55%	64%	0%	0.04	0.45	0.00
2014-0011 21	2017/2018		Bioretention 1	VA BMP Clearinghouse	3/7/2018	0.04	0.04	0.07	0.71	49	55%	64%	0%	0.04	0.45	0.00
2014-0011 22	2017/2018		Bioretention 1	VA BMP Clearinghouse	3/7/2018	0.04	0.04	0.07	0.71	49	55%	64%	0%	0.04	0.45	0.00
2014-0026 02	2017/2018		Urban Bioretention	VA BMP Clearinghouse	5/11/2018	0.08	0.08	0.13	1.35	94	55%	64%	0%	0.07	0.86	0.00
2014-0046 01	2017/2018		Bioretention 2	VA BMP Clearinghouse	1/24/2018	0.27	0.22	0.38	4.21	266	90%	90%	0%	0.34	3.79	0.00
2014-0046 02	2017/2018		Bioretention 2	VA BMP Clearinghouse	1/24/2018	0.35	0.30	0.51	5.56	360	90%	90%	0%	0.46	5.01	0.00
2014-0046 03	2017/2018		JellyFish Filter	VA BMP Clearinghouse - MTD	1/24/2018	0.22	0.19	0.32	3.51	228	50%	32%	0%	0.16	1.12	0.00
2014-0046 04	2017/2018		JellyFish Filter	VA BMP Clearinghouse - MTD	1/24/2018	0.43	0.43	0.70	7.25	504	50%	32%	0%	0.35	2.31	0.00
2015-0002 02	2017/2018		CDS® Stormwater Treatment System	VA BMP Clearinghouse - MTD	5/10/2018	1.29	1.10	1.86	20.46	1,322	20%	13%	50%	0.37	2.60	660.93
2015-0005 02	2017/2018		JellyFish Filter	VA BMP Clearinghouse - MTD	9/18/2017	0.42	0.42	0.68	7.08	492	50%	32%	0%	0.34	2.25	0.00
2015-0020 01	2017/2018		StormFilter™ Stormwater Treatment System, Phosphosorb	VA BMP Clearinghouse - MTD	9/25/2017	2.34	1.85	3.20	36.13	2,253	50%	32%	0%	1.60	11.50	0.00
2015-0020 02	2017/2018		Urban Bioretention	VA BMP Clearinghouse	9/25/2017	0.41	0.30	0.53	6.17	371	55%	64%	0%	0.29	3.95	0.00
2016-0023 01	2017/2018		BayFilter™ Stormwater Filtration System	VA BMP Clearinghouse - MTD	10/17/2017	1.74	1.67	2.73	28.86	1,968	50%	32%	80%	1.37	9.19	1574.73
2018-0101 01 DPI	2017/2018	Already broken out an included in Phase 1 BMPs	Urban Shoreline Vegetated	Chesapeake Bay Program	6/30/2018											
				Totals		**130.28**	**102.78**	**177.78**	**2,009.80**	**125,224.88**				**36.68**	**263.36**	**34,583.31**

July 1, 2018 to June 30, 2024 BMP Calculation Table

DRAFT

BMP ID	Reporting PY	Chesapeake Bay Program BMP Type	BMP Name (Full)	Date Installed	Acres Treated	Impervious Acres Treated	TP Load (lbs/yr)	TN Load (lbs/yr)	TSS (lbs/yr)	TP BMP Efficiency	TN Efficiency	TSS Efficiency	TP Removed (lbs/yr)	TN Removed (lbs/yr)	TSS Removed (lbs/yr)	Efficency Method
2008-0005 01	2018/2019	Bioretention C/D Soils, underdrain	Bioretention Filter	10/16/2018	0.94	0.10	0.51	10.14	264.80	45%	25%	55%	0.38	3.18	178.30	Chesapeake Bay Program
2008-0022 01	2018/2019	Filtering Practices	BayFilter™ Stormwater Filtration System	5/6/2016	3.72	3.50	5.76	61.23	4138.30	50%	32%	80%	1.54	0.00	722.57	VA BMP Clearinghouse-MTD
2017-0002 PRK 01	2018/2019	Permeable Pavement w/o Sand, Veg. -C/D soils	Permeable Pavement	2/4/2019	0.13	0.13	0.20	2.11	146.42	20%	10%	55%	0.16	1.14	75.07	Chesapeake Bay Program
2011-0002 01	2018/2019	Dry Detention Ponds and Hydrodynamic Structures	CDS® Stormwater Treatment System	2/13/2019	0.91	0.72	1.24	14.01	873.41	20%	13%	50%	0.02	0.00	9.38	VA BMP Clearinghouse-MTD
2011-0002 02	2018/2019	Green Roof	Green Roof	2/13/2019	0.15	0.15	0.24	2.51	174.53	85%	80%	90%	0.15	1.04	70.38	Chesapeake Bay Program
2012-0015 01	2018/2019	Filtering Practices	JellyFish Filter	6/27/2018	0.61	0.06	0.32	6.55	166.97	50%	32%	0%	0.67	0.00	314.36	VA BMP Clearinghouse-MTD
2012-0019 01	2018/2019	Filtering Practices	StormFilter™ Stormwater Treatment System	5/15/2019	0.46	0.46	0.75	7.77	539.98	50%	32%	0%	0.45	0.00	211.14	VA BMP Clearinghouse-MTD
2013-0002 02	2018/2019	Dry Detention Ponds and Hydrodynamic Structures	CDS® Stormwater Treatment System	8/1/2018	0.31	0.30	0.49	5.16	353.15	20%	13%	50%	0.13	0.00	61.00	VA BMP Clearinghouse-MTD
2013-0007 01	2018/2019	Filtering Practices	BayFilter™ Stormwater Filtration System	11/13/2018	1.13	1.02	1.70	18.30	1214.08	50%	32%	80%	2.43	0.00	1140.16	VA BMP Clearinghouse-MTD
2013-0007 02	2018/2019	Filtering Practices	BayFilter™ Stormwater Filtration System	11/13/2018	1.32	1.21	2.01	21.51	1436.64	50%	32%	80%	2.72	0.00	1276.22	VA BMP Clearinghouse-MTD
2013-0007 03	2018/2019	Filtering Practices	BayFilter™ Stormwater Filtration System	11/13/2018	1.32	1.22	2.02	21.58	1446.59	50%	32%	80%	2.72	0.00	1276.22	VA BMP Clearinghouse-MTD
2014-0008 01	2018/2019	Dry Detention Ponds and Hydrodynamic Structures	Stormceptor® Stormwater Treatment System	5/4/2018	0.69	0.64	1.06	11.29	758.43	20%	13%	50%	0.29	0.00	136.07	VA BMP Clearinghouse-MTD
2014-0041 01	2018/2019	Bioretention C/D Soils, underdrain	Bioretention Filter	7/25/2018	0.06	0.03	0.06	0.81	40.41	45%	25%	55%	0.05	0.38	23.46	Chesapeake Bay Program
2014-0041 02	2018/2019	Bioretention C/D Soils, underdrain	Bioretention Filter	7/25/2018	0.15	0.09	0.17	2.12	115.97	45%	25%	55%	0.13	1.05	61.00	Chesapeake Bay Program
2017-0021 01	2019/2020	Bioretention C/D Soils, underdrain	Bioretention Filter	1/8/2020	0.87	0.27	0.68	10.59	421.74	45%	25%	55%	0.27	1.98	126.68	Chesapeake Bay Program
2017-0021 02	2019/2020	Bioretention C/D Soils, underdrain	Bioretention Filter	1/8/2020	1.14	0.50	1.07	14.87	698.17	45%	25%	55%	0.18	1.47	84.46	Chesapeake Bay Program
2014-0003 01	2019/2020	Filtering Practices	BayFilter™ Stormwater Filtration System	11/8/2019	1.13	0.90	1.55	17.49	1094.62	50%	32%	80%	3.69	0.00	1731.35	VA BMP Clearinghouse-MTD
2014-0003 02	2019/2020	Filtering Practices	BayFilter™ Stormwater Filtration System	11/8/2019	0.50	0.12	0.35	5.85	207.36	50%	32%	80%	0.60	0.00	281.52	VA BMP Clearinghouse-MTD
2013-0027 03	2019/2020	Dry Detention Ponds and Hydrodynamic Structures	CDS® Stormwater Treatment System	8/22/2019	0.14	0.10	0.18	2.09	124.16	20%	13%	50%	0.24	1.57	112.61	VA BMP Clearinghouse-MTD
2019-00010	2019/2020	Bioretention C/D Soils, underdrain	Bioretention Filter	12/30/2019	0.07	0.05	0.09	1.04	62.08	45%	25%	55%	0.11	0.05	51.61	VA BMP Clearinghouse-MTD
2017-0015 01	2019/2020	Dry Detention Ponds and Hydrodynamic Structures	CDS® Stormwater Treatment System	6/2/2020	0.78	0.59	1.03	11.86	724.48	20%	13%	50%	0.02	0.00	9.38	VA BMP Clearinghouse-MTD
2016-0027 01	2019/2020	Dry Detention Ponds and Hydrodynamic Structures	Vortechs® Stormwater Treatment System	1/21/2020	0.91	0.83	1.38	14.80	986.26	20%	13%	50%	0.66	0.00	309.67	VA BMP Clearinghouse-MTD
2015-0019 01	2019/2020	Green Roof	Green Roof	12/4/2019	0.15	0.15	0.24	2.53	175.70	85%	80%	90%	0.19	1.39	89.15	Chesapeake Bay Program
2015-0019 03	2019/2020	Filtering Practices	JellyFish Filter	12/4/2019	0.43	0.43	0.70	7.25	503.67	50%	32%	0%	0.14	1.02	65.69	VA BMP Clearinghouse-MTD
2014-0019 01	2019/2020	Dry Detention Ponds and Hydrodynamic Structures	CDS® Stormwater Treatment System	10/21/2019	0.49	0.46	0.76	8.06	544.08	20%	13%	50%	0.20	0.00	93.84	VA BMP Clearinghouse-MTD
2014-0017 01	2019/2020	Dry Detention Ponds and Hydrodynamic Structures	Stormceptor® Stormwater Treatment System	8/22/2019	0.65	0.51	0.88	10.01	621.99	20%	13%	50%	0.24	0.00	112.61	VA BMP Clearinghouse-MTD
2014-0012 01	2019/2020	Green Roof	Green Roof	1/15/2020	0.14	0.14	0.23	2.36	163.98	85%	80%	90%	0.14	0.98	65.69	Chesapeake Bay Program
2014-0012 02	2019/2020	Bioretention C/D Soils, underdrain	Bioretention Filter	1/15/2020	0.11	0.11	0.18	1.85	128.85	45%	25%	55%	0.26	2.18	121.99	Chesapeake Bay Program
2014-0012 03	2019/2020	Bioretention C/D Soils, underdrain	Bioretention Filter	1/15/2020	0.11	0.11	0.18	1.85	128.85	45%	25%	55%	0.26	2.18	121.99	Chesapeake Bay Program

BMP ID	Reporting PY	Chesapeake Bay Program BMP Type	BMP Name (Full)	Date Installed	Acres Treated	Impervious Acres Treated	TP Load (lbs/yr)	TN Load (lbs/yr)	TSS (lbs/yr)	TP BMP Efficiency	TN Efficiency	TSS Efficiency	TP Removed (lbs/yr)	TN Removed (lbs/yr)	TSS Removed (lbs/yr)	Efficency Method
2014-0012 04	2019/2020	Filtering Practices	BayFilter™ Stormwater Filtration System	1/15/2020	1.37	0.89	1.64	19.84	1126.86	20%	13%	50%	0.44	0.00	206.45	VA BMP Clearinghouse-MTD
2014-0003 01	2019/2020	Filtering Practices	BayFilter™ Stormwater Filtration System	11/8/2019	1.13	0.90	1.55	17.49	1094.62	20%	13%	50%	3.69	0.00	1731.35	VA BMP Clearinghouse-MTD
2014-0003 02	2019/2020	Filtering Practices	BayFilter™ Stormwater Filtration System	11/8/2019	0.50	0.12	0.35	5.85	207.36	20%	13%	50%	0.60	0.00	281.52	VA BMP Clearinghouse-MTD
2013-0003 02 (2016-0036 B)	2020/2021	Filtering Practices	StormFilter™ Stormwater Treatment System	7/1/2020	3.16	3.15	5.11	53.21	3691.42	20%	13%	50%	3.41	0.00	1599.97	VA BMP Clearinghouse-MTD
2013-0003 03 (2014-0040 03)	2020/2021	Filtering Practices	StormFilter™ Stormwater Treatment System	5/27/2020	0.38	0.36	0.59	6.27	425.19	20%	13%	50%	0.40	0.00	187.68	VA BMP Clearinghouse-MTD
2013-0003 04 (2014-0040 04)	2020/2021	Filtering Practices	StormFilter™ Stormwater Treatment System	7/1/2020	1.79	1.69	2.78	29.50	1997.11	20%	13%	50%	1.86	0.00	872.71	VA BMP Clearinghouse-MTD
2013-0003 05 (2014-0040 05)	2020/2021	Filtering Practices	StormFilter™ Stormwater Treatment System	5/27/2020	0.75	0.70	1.15	12.31	828.71	20%	13%	50%	0.77	0.00	361.28	VA BMP Clearinghouse-MTD
2013-0003 06 (2014-0040 02)	2020/2021	Filtering Practices	StormFilter™ Stormwater Treatment System	10/15/2020	0.46	0.44	0.72	7.62	518.90	20%	13%	50%	0.48	0.00	225.22	VA BMP Clearinghouse-MTD
2013-0023 02	2020/2021	Filtering Practices	StormFilter™ Stormwater Treatment System	1/24/2019	0.14	0.10	0.18	2.09	124.16	20%	13%	50%	0.11	0.00	51.61	VA BMP Clearinghouse-MTD
2014-0019 01	2020/2021	Dry Detention Ponds and Hydrodynamic Structures	CDS® Stormwater Treatment System	10/21/2019	0.49	0.46	0.76	8.06	544.08	20%	13%	50%	0.20	0.00	93.84	VA BMP Clearinghouse-MTD
2014-0029 01	2020/2021	Vegetated Open Channels C/D soils, no underdrain	Grass Swale	7/9/2020	0.57	0.49	0.83	9.07	588.01	10%	10%	50%	0.58	4.35	272.14	Chesapeake Bay Program
2014-0029 02	2020/2021	Filtering Practices	BayFilter™ Stormwater Filtration System	7/9/2020	1.12	1.02	1.69	18.20	1212.33	20%	13%	50%	0.85	0.00	398.82	VA BMP Clearinghouse-MTD
2015-0001 01	2020/2021	Filtering Practices	BayFilter™ Stormwater Filtration System	12/9/2021	2.12	1.68	2.90	32.76	2045.17	20%	13%	50%	1.70	0.00	797.64	VA BMP Clearinghouse-MTD
2015-0001 02	2020/2021	Filtering Practices	BayFilter™ Stormwater Filtration System	12/9/2021	1.61	1.56	2.55	26.81	1836.05	20%	13%	50%	1.85	0.00	868.02	VA BMP Clearinghouse-MTD
2015-0001 03	2020/2021	Filtering Practices	BayFilter™ Stormwater Filtration System	12/9/2021	2.02	1.60	2.76	31.21	1947.95	20%	13%	50%	1.94	0.00	910.25	VA BMP Clearinghouse-MTD
2015-0001 04	2020/2021	Bioretention C/D Soils, underdrain	Bioretention Filter	12/9/2021	0.55	0.15	0.41	6.56	246.02	45%	25%	55%	0.50	3.64	234.60	Chesapeake Bay Program
2015-0001 05	2020/2021	Bioretention C/D Soils, underdrain	Bioretention Filter	12/9/2021	1.36	1.36	2.20	22.93	1593.00	45%	25%	55%	1.62	11.84	760.10	Chesapeake Bay Program
2016-0003 01	2020/2021	Green Roof	Green Roof	11/17/2020	0.14	0.14	0.23	2.36	163.98	80%	85%	90%	0.14	0.98	65.69	Chesapeake Bay Program
2016-0003 02	2020/2021	Bioretention C/D Soils, underdrain	Tree Box Filter	11/17/2020	0.03	0.03	0.05	0.51	35.14	45%	25%	55%	0.13	1.09	61.00	Chesapeake Bay Program
2016-0003 03	2020/2021	Bioretention C/D Soils, underdrain	Tree Box Filter	11/17/2020	0.08	0.08	0.13	1.35	93.71	45%	25%	55%	0.10	0.79	46.92	Chesapeake Bay Program
2016-0008 01	2020/2021	Green Roof	Green Roof	6/22/2021	0.07	0.07	0.11	1.18	81.99	80%	85%	90%	0.11	0.77	51.61	Chesapeake Bay Program
2016-0008 02	2020/2021	Green Roof	Green Roof	6/22/2021	0.09	0.09	0.15	1.52	105.42	80%	85%	90%	0.14	1.02	65.69	Chesapeake Bay Program
2016-0008 03	2020/2021	Filtering Practices	StormFilter™ Stormwater Treatment System	6/22/2021	0.62	0.54	0.91	9.91	646.58	20%	13%	50%	0.69	0.00	323.75	VA BMP Clearinghouse-MTD
2016-0024 01	2020/2021	Green Roof	Green Roof	10/9/2020	0.18	0.18	0.29	3.03	210.84	80%	85%	90%	0.18	1.25	84.46	Chesapeake Bay Program
2016-0024 02	2020/2021	Bioretention C/D Soils, underdrain	Tree Box Filter	10/9/2020	0.07	0.07	0.11	1.18	81.99	45%	25%	55%	0.08	0.69	37.54	Chesapeake Bay Program
2016-0024 03	2020/2021	Bioretention C/D Soils, underdrain	Tree Box Filter	10/9/2020	0.07	0.07	0.11	1.18	81.99	45%	25%	55%	0.08	0.69	37.54	Chesapeake Bay Program
2016-0024 04	2020/2021	Bioretention C/D Soils, underdrain	Tree Box Filter	10/9/2020	0.10	0.10	0.16	1.69	117.13	45%	25%	55%	0.12	0.99	56.30	Chesapeake Bay Program
2017-0017 01	2020/2021	Bioretention C/D Soils, underdrain	Tree Box Filter	10/23/2020	.22	.22	0.36	3.71	257.69	45%	25%	55%	0.26	2.18	121.99	Chesapeake Bay Program
2017-0017 02	2020/2021	Bioretention C/D Soils, underdrain	Tree Box Filter	10/23/2020	.22	.22	0.36	3.71	257.69	45%	25%	55%	0.26	2.18	121.99	Chesapeake Bay Program

BMP ID	Reporting PY	Chesapeake Bay Program BMP Type	BMP Name (Full)	Date Installed	Acres Treated	Impervious Acres Treated	TP Load (lbs/yr)	TN Load (lbs/yr)	TSS (lbs/yr)	TP BMP Efficiency	TN Efficiency	TSS Efficiency	TP Removed (lbs/yr)	TN Removed (lbs/yr)	TSS Removed (lbs/yr)	Efficency Method
2017-0017 03	2020/2021	Bioretention C/D Soils, underdrain	Tree Box Filter	10/23/2020	.01	.01	0.02	0.17	11.71	45%	25%	55%	0.10	0.10	4.69	Chesapeake Bay Program
2018-0019 01	2020/2021	Bioretention C/D Soils, underdrain	Bioretention Filter	1/5/2021	1.21	0.57	1.19	16.06	780.16	45%	25%	55%	0.88	7.32	412.90	Chesapeake Bay Program
2018-0019 02	2020/2021	Bioretention C/D Soils, underdrain	Bioretention Filter	1/5/2021	1.53	0.62	1.38	19.62	886.20	45%	25%	55%	1.02	8.52	478.58	Chesapeake Bay Program
2018-0019 03	2020/2021	Bioretention C/D Soils, underdrain	Bioretention Filter	1/5/2021	1.30	0.46	1.09	16.21	686.48	45%	25%	55%	0.81	6.75	380.05	Chesapeake Bay Program
2018-0019 04	2020/2021	Bioretention C/D Soils, underdrain	Bioretention Filter	1/5/2021	1.87	0.37	1.21	21.34	697.09	45%	25%	55%	0.91	7.58	426.97	Chesapeake Bay Program
2018-0019 05	2020/2021	Bioretention C/D Soils, underdrain	Bioretention Filter	1/5/2021	2.62	0.46	1.63	29.51	918.54	45%	25%	55%	2.00	14.65	938.40	Chesapeake Bay Program
2019-0017 GRD 01	2020/2021	Filtering Practices	Flow Thru Planter Box	7/16/2020	.33	.21	0.39	4.75	267.07	60%	40%	80%	0.28	2.37	131.38	Chesapeake Bay Program
2019-0017 GRD 02	2020/2021	Filtering Practices	Flow Thru Planter Box	7/16/2020	.33	.21	0.39	4.75	267.07	60%	40%	80%	0.28	2.37	131.38	Chesapeake Bay Program
2016-0021 01 (2014-0003 02)	2021/2022	Filtering Practices	BayFilter™ Stormwater Filtration System	5/12/2021	0.50	0.12	0.35	5.85	207.36	50%	32%	80%	0.60	0.00	281.52	VA BMP Clearinghouse-MTD
2016-0021 02	2021/2022	Filtering Practices	Isoilater™ Stormwater Treatment System	5/12/2021	0.22	0.16	0.28	3.30	197.96	50%	32%	80%	0.08	0.00	37.54	VA BMP Clearinghouse-MTD
2016-0021 03	2021/2022	Filtering Practices	BayFilter™ Stormwater Filtration System	5/12/2021	0.40	0.36	0.60	6.47	428.71	50%	32%	80%	0.16	0.00	75.07	VA BMP Clearinghouse-MTD
2016-0021 04	2021/2022	Filtering Practices	Isoilater™ Stormwater Treatment System	5/12/2021	0.40	0.36	0.60	6.47	428.71	50%	32%	80%	0.16	0.00	75.07	VA BMP Clearinghouse-MTD
2016-0021 05	2021/2022	Filtering Practices	Isoilater™ Stormwater Treatment System	5/12/2021	0.24	0.06	0.17	2.82	101.92	50%	32%	80%	0.05	0.00	23.46	VA BMP Clearinghouse-MTD
2016-0021 06	2021/2022	Dry Detention Ponds and Hydrodynamic Structures	First Defense Hydrodynamic	5/12/2021	0.25	0.24	0.39	4.15	282.87	20%	13%	50%	0.11	0.00	51.61	VA BMP Clearinghouse-MTD
2012-0019 01	2021/2022	Filtering Practices	StormFilter™ Stormwater Treatment System	5/15/2019	0.46	0.46	0.75	7.77	539.98	50%	32%	80%	0.45	0.00	211.14	VA BMP Clearinghouse-MTD
2014-0006 01	2021/2022	Bioretention C/D Soils, underdrain	Bioretention Filter	9/2/2021	0.02	0.01	0.02	0.25	16.57	45%	25%	55%	0.02	0.13	7.51	Chesapeake Bay Program
2014-0006 02	2021/2022	Bioretention C/D Soils, underdrain	Bioretention Filter	9/2/2021	0.02	0.01	0.02	0.25	16.57	45%	25%	55%	0.02	0.13	7.51	Chesapeake Bay Program
2014-0006 03	2021/2022	Bioretention C/D Soils, underdrain	Bioretention Filter	9/2/2021	0.02	0.01	0.02	0.25	16.57	45%	25%	55%	0.02	0.13	7.51	Chesapeake Bay Program
2014-0006 04	2021/2022	Bioretention C/D Soils, underdrain	Bioretention Filter	9/2/2021	0.02	0.01	0.02	0.25	16.57	45%	25%	55%	0.02	0.13	7.51	Chesapeake Bay Program
2014-0006 05	2021/2022	Bioretention C/D Soils, underdrain	Bioretention Filter	9/2/2021	0.02	0.01	0.02	0.25	16.57	45%	25%	55%	0.02	0.13	7.51	Chesapeake Bay Program
2014-0006 06	2021/2022	Bioretention C/D Soils, underdrain	Bioretention Filter	9/2/2021	0.02	0.01	0.02	0.25	16.57	45%	25%	55%	0.02	0.13	7.51	Chesapeake Bay Program
2014-0006 07	2021/2022	Bioretention C/D Soils, underdrain	Bioretention Filter	9/2/2021	0.02	0.01	0.02	0.25	16.57	45%	25%	55%	0.02	0.13	7.51	Chesapeake Bay Program
2014-0006 08	2021/2022	Bioretention C/D Soils, underdrain	Bioretention Filter	9/2/2021	0.02	0.01	0.02	0.25	16.57	45%	25%	55%	0.02	0.13	7.51	Chesapeake Bay Program
2014-0006 09	2021/2022	Bioretention C/D Soils, underdrain	Bioretention Filter	9/2/2021	0.02	0.01	0.02	0.25	16.57	45%	25%	55%	0.02	0.13	7.51	Chesapeake Bay Program
2014-0006 10	2021/2022	Bioretention C/D Soils, underdrain	Bioretention Filter	9/2/2021	0.02	0.01	0.02	0.25	16.57	45%	25%	55%	0.02	0.13	7.51	Chesapeake Bay Program
2014-0006 11	2021/2022	Filtering Practices	JellyFish Filter	9/2/2021	0.53	0.53	0.86	8.94	620.80	50%	32%	0%	0.60	0.00	281.52	VA BMP Clearinghouse-MTD
2016-0010 01	2021/2022	Filtering Practices	Sand filter	6/30/2022	.27	.2	0.35	4.08	246.57	60%	40%	80%	0.28	1.01	131.38	Chesapeake Bay Program
2016-0010 02	2021/2022	Bioretention C/D Soils, underdrain	Bioretention Filter	6/30/2022	.42	.33	0.57	6.47	402.36	45%	25%	55%	0.42	3.50	197.06	Chesapeake Bay Program
2016-0010 03	2021/2022	Filtering Practices	Flow Thru Planter Box	6/30/2022	.02	0	0.01	0.20	3.52	60%	40%	80%	0.02	0.20	9.38	Chesapeake Bay Program

BMP ID	Reporting PY	Chesapeake Bay Program BMP Type	BMP Name (Full)	Date Installed	Acres Treated	Impervious Acres Treated	TP Load (lbs/yr)	TN Load (lbs/yr)	TSS (lbs/yr)	TP BMP Efficiency	TN Efficiency	TSS Efficiency	TP Removed (lbs/yr)	TN Removed (lbs/yr)	TSS Removed (lbs/yr)	Efficency Method
2016-0041 01	2021/2022	Green Roof	Green Roof	8/27/2021	0.16	0.16	0.26	2.70	187.41	80%	85%	90%	0.16	1.11	75.07	Chesapeake Bay Program
2016-0041 02	2021/2022	Dry Detention Ponds and Hydrodynamic Structures	BaySeparator™ Stormwater Treatment System	8/27/2021	0.48	0.43	0.72	7.75	512.46	20%	13%	50%	0.19	0.00	89.15	VA BMP Clearinghouse-MTD
2016-0044 01	2021/2022	Permeable Pavement w/o Sand, Veg. C/D soils, underdrain	Permeable Pavement	3/31/2021	0.02	0.02	0.03	0.34	23.43	20%	10%	55%	0.03	0.00	14.08	Chesapeake Bay Program
2016-0044 02	2021/2022	Dry Detention Ponds and Hydrodynamic Structures	BaySeparator™ Stormwater Treatment System	3/31/2021	0.585	0.485	0.83	9.18	585.67	20%	13%	50%	0.03	0.00	14.08	VA BMP Clearinghouse-MTD
2016-0044 03	2021/2022	Filtering Practices	StormTech® Isolator™ Row Stormwater Management System	3/31/2021	0.585	0.485	0.83	9.18	585.67	50%	32%	80%	0.70	0.00	328.44	VA BMP Clearinghouse-MTD
2016-0044 04	2021/2022	Permeable Pavement w/o Sand, Veg. C/D soils, underdrain	Permeable Pavement	3/31/2021	0.04	0.04	0.06	0.67	46.85	20%	10%	55%	0.05	0.00	23.46	Chesapeake Bay Program
2016-0044 05	2021/2022	Filtering Practices	StormTech® Isolator™ Row Stormwater Management System	3/31/2021	0.37	0.26	0.47	5.49	323.88	20%	13%	50%	0.26	0.00	121.99	VA BMP Clearinghouse-MTD
2017-0006 01	2022/2023	Filtering Practices	Isoilater™ Stormwater Treatment System	5/30/2023	1.69	1.44	2.43	26.78	1726.38	50%	32%	80%	0.65	0.00	304.98	VA BMP Clearinghouse-MTD
2017-0006 02	2022/2023	Dry Detention Ponds and Hydrodynamic Structures	BaySeparator™ Stormwater Treatment System	5/30/2023	1.69	1.44	2.43	26.78	1726.38	20%	13%	50%	0.65	0.00	304.98	VA BMP Clearinghouse-MTD
2017-0006 03	2022/2023	Dry Detention Ponds and Hydrodynamic Structures	BaySeparator™ Stormwater Treatment System	5/30/2023	0.46	0.41	0.68	7.35	484.86	20%	13%	50%	0.18	0.00	84.46	VA BMP Clearinghouse-MTD
2017-0006 04	2022/2023	Permeable Pavement w/o Sand, Veg. C/D soils, underdrain	Permeable Pavement	5/30/2023	0.22	0.22	0.35	3.67	254.88	20%	10%	55%	0.28	1.98	131.38	Chesapeake Bay Program
2017-0025 01	2022/2023	Filtering Practices	Tree Box Filter	7/28/2022	0.04	0.04	0.07	0.69	47.20	45%	25%	55%	0.05	0.40	23.46	Chesapeake Bay Program
2017-0025 02	2022/2023	Filtering Practices	Tree Box Filter	7/28/2022	0.02	0.02	0.03	0.34	23.43	45%	25%	55%	0.02	0.20	9.38	Chesapeake Bay Program
2017-0025 03	2022/2023	Filtering Practices	Tree Box Filter	7/28/2022	0.02	0.02	0.04	0.39	26.12	45%	25%	55%	0.03	0.22	14.08	Chesapeake Bay Program
2017-0025 04	2022/2023	Filtering Practices	Tree Box Filter	7/28/2022	0.03	0.02	0.04	0.42	28.46	45%	25%	55%	0.03	0.24	14.08	Chesapeake Bay Program
2017-0025 05	2022/2023	Filtering Practices	Tree Box Filter	7/28/2022	0.03	0.02	0.04	0.47	29.17	45%	25%	55%	0.03	0.24	14.08	Chesapeake Bay Program
2017-0025 06	2022/2023	Filtering Practices	Tree Box Filter	7/28/2022	0.03	0.02	0.04	0.46	28.17	45%	25%	55%	0.03	0.24	14.08	Chesapeake Bay Program
2017-0025 07	2022/2023	Filtering Practices	Tree Box Filter	7/28/2022	0.04	0.03	0.06	0.63	40.88	45%	25%	55%	0.04	0.24	18.77	Chesapeake Bay Program
2017-0025 08	2022/2023	Filtering Practices	Tree Box Filter	7/28/2022	0.02	0.02	0.04	0.39	26.12	45%	25%	55%	0.03	0.34	14.08	Chesapeake Bay Program
2017-0025 09	2022/2023	Filtering Practices	Tree Box Filter	7/28/2022	0.02	0.02	0.03	0.34	24.42	45%	25%	55%	0.03	0.24	14.08	Chesapeake Bay Program
2017-0025 10	2022/2023	Filtering Practices	Tree Box Filter	7/28/2022	0.02	0.02	0.03	0.35	25.42	45%	25%	55%	0.03	0.23	14.08	Chesapeake Bay Program
2017-0025 11	2022/2023	Filtering Practices	Tree Box Filter	7/28/2022	0.03	0.02	0.04	0.44	25.18	45%	25%	55%	0.02	0.24	9.38	Chesapeake Bay Program
2017-0025 12	2022/2023	Filtering Practices	Tree Box Filter	7/28/2022	0.03	0.03	0.05	0.50	34.14	45%	25%	55%	0.04	0.21	18.77	Chesapeake Bay Program
2017-0025 13	2022/2023	Filtering Practices	Tree Box Filter	7/28/2022	0.60	0.02	0.27	6.17	124.39	45%	25%	55%	0.02	0.30	9.38	Chesapeake Bay Program
2017-0025 14	2022/2023	Dry Detention Ponds and Hydrodynamic Structures	CDS® Stormwater Treatment System	7/28/2022	0.58	0.58	0.94	9.78	679.37	20%	13%	50%	0.25	0.00	117.30	VA BMP Clearinghouse-MTD
2017-0025 15	2022/2023	Green Roof	Green Roof	7/28/2022	0.07	0.07	0.11	1.15	77.01	80%	85%	90%	0.06	0.45	28.15	Chesapeake Bay Program
2017-0025 16	2022/2023	Green Roof	Green Roof	7/28/2022	0.05	0.05	0.08	0.84	58.57	80%	85%	90%	0.06	0.46	28.15	Chesapeake Bay Program
2018-0014 01	2022/2023	Filtering Practices	Tree Box Filter	5/26/2022	0.12	0.10	0.17	1.89	120.65	45%	25%	55%	0.13	1.04	61.00	Chesapeake Bay Program
2018-0014 02	2022/2023	Filtering Practices	Tree Box Filter	5/26/2022	0.21	0.17	0.29	3.27	206.16	45%	25%	55%	0.21	1.79	98.53	Chesapeake Bay Program

BMP ID	Reporting PY	Chesapeake Bay Program BMP Type	BMP Name (Full)	Date Installed	Acres Treated	Impervious Acres Treated	TP Load (lbs/yr)	TN Load (lbs/yr)	TSS (lbs/yr)	TP BMP Efficiency	TN Efficiency	TSS Efficiency	TP Removed (lbs/yr)	TN Removed (lbs/yr)	TSS Removed (lbs/yr)	Efficency Method
2018-0014 03	2022/2023	Filtering Practices	Tree Box Filter	5/26/2022	0.15	0.12	0.21	2.33	145.83	45%	25%	55%	0.15	1.27	70.38	Chesapeake Bay Program
2018-0014 04	2022/2023	Filtering Practices	Tree Box Filter	5/26/2022	0.12	0.10	0.17	1.89	120.65	45%	25%	55%	0.13	1.04	61.00	Chesapeake Bay Program
2018-0014 05	2022/2023	Filtering Practices	Tree Box Filter	5/26/2022	0.15	0.14	0.23	2.46	165.74	45%	25%	55%	0.17	1.41	79.76	Chesapeake Bay Program
2018-0014 06	2022/2023	Filtering Practices	Tree Box Filter	5/26/2022	0.17	0.15	0.25	2.73	179.21	45%	25%	55%	0.18	1.54	84.46	Chesapeake Bay Program
2018-0014 07	2022/2023	Filtering Practices	Tree Box Filter	5/26/2022	0.16	0.14	0.24	2.56	167.50	45%	25%	55%	0.17	1.44	79.76	Chesapeake Bay Program
2018-0014 08	2022/2023	Filtering Practices	Tree Box Filter	5/26/2022	0.10	0.09	0.15	1.62	107.18	45%	25%	55%	0.11	0.92	51.61	Chesapeake Bay Program
2018-0014 09	2022/2023	Filtering Practices	Tree Box Filter	5/26/2022	0.23	0.23	0.37	3.88	269.40	45%	25%	55%	0.27	2.28	126.68	Chesapeake Bay Program
2018-0014 10	2022/2023	Green Roof	Green Roof	5/26/2022	0.08	0.08	0.13	1.35	93.71	80%	85%	90%	0.08	0.56	37.54	Chesapeake Bay Program
2018-0014 11	2022/2023	Dry Detention Ponds and Hydrodynamic Structures	BaySeparator™ Stormwater Treatment System	5/26/2022	1.84	1.82	2.96	30.89	2135.32	20%	13%	50%	0.81	0.00	380.05	VA BMP Clearinghouse-MTD
2018-0021 01	2022/2023	Bioretention C/D Soils, underdrain	Bioretention Filter	12/15/2022	1.5384	1.101	1.96	22.97	1366.52	45%	25%	55%	1.45	0.00	680.34	Chesapeake Bay Program
2018-0021 02	2022/2023	Dry Detention Ponds and Hydrodynamic Structures	CDS® Stormwater Treatment System	12/15/2022	1.5384	1.101	1.96	22.97	1366.52	20%	13%	50%	0.24	0.00	112.61	VA BMP Clearinghouse-MTD
2018-0021 03	2022/2023	Permeable Pavement w/o Sand, Veg. C/D soils, underdrain	Permeable Pavement	12/15/2022	0.0944	0.0944	0.15	1.59	110.57	20%	10%	55%	0.17	1.13	79.76	Chesapeake Bay Program
2021-0006 01	2022/2023	Bioretention C/D Soils, underdrain	Bioretention Filter	6/13/2023	0.015	0.01	0.02	0.22	12.59	45%	25%	55%	0.03	0.11	11.73	Chesapeake Bay Program
2021-0006 02	2022/2023	Bioretention C/D Soils, underdrain	Bioretention Filter	6/13/2023	0.015	0.01	0.02	0.22	12.59	45%	25%	55%	0.03	0.11	11.73	Chesapeake Bay Program
2021-0006 03	2022/2023	Bioretention C/D Soils, underdrain	Bioretention Filter	6/13/2023	0.015	0.01	0.02	0.22	12.59	45%	25%	55%	0.03	0.11	11.73	Chesapeake Bay Program
2021-0006 04	2022/2023	Bioretention C/D Soils, underdrain	Bioretention Filter	6/13/2023	0.015	0.01	0.02	0.22	12.59	45%	25%	55%	0.03	0.11	11.73	Chesapeake Bay Program
2021-0006 05	2022/2023	Permeable Pavement w/o Sand, Veg. C/D soils, underdrain	Permeable Pavement	6/13/2023	0.0781	0.065	0.11	1.23	78.44	20%	10%	55%	0.09	0.59	42.23	Chesapeake Bay Program
				Totals	**66.73**	**49.77**	**90.03**	**1,037.82**	**62,997.27**	---	---	---	**60.17**	**130.52**	**28,161.38**	

BMP ID	Reporting PY	Chesapeake Bay Program BMP Type	BMP Name (Full)	Date Installed	Acres Treated	Impervious Acres Treated	TP Load (lbs/yr)	TN Load (lbs/yr)	TSS (lbs/yr)	TP BMP Efficiency	TN Efficiency	TSS Efficiency	TP Removed (lbs/yr)	TN Removed (lbs/yr)	TSS Removed (lbs/yr)	Efficency Method
2013-0001 01	2023/2024	Green Roof	Green Roof	2/7/2024	0.26	0.26	0.42	4.38	304.54	80%	85%	90%	0.34	2.42	159.53	Chesapeake Bay Program
2013-0001 02	2023/2024	Green Roof	Green Roof	2/7/2024	0.45	0.45	0.73	7.59	527.09	80%	85%	90%	0.58	4.18	272.14	Chesapeake Bay Program
2013-0001 03	2023/2024	Filtering Practices	JellyFish Filter	2/7/2024	1.87	1.59	2.69	29.63	1911.62	50%	32%	0%	0.77	0.00	361.28	VA BMP Clearinghouse-MTD
2013-0001 04	2023/2024	Filtering Practices	JellyFish Filter	2/7/2024	1.26	1.16	1.92	20.56	1376.31	50%	32%	0%	1.26	0.00	591.19	VA BMP Clearinghouse-MTD
2013-0001 05	2023/2024	Dry Detention Ponds and Hydrodynamic Structures	CDS® Stormwater Treatment System	2/7/2024	2.07	2.04	3.32	34.70	2394.77	20%	13%	50%	1.55	0.00	727.26	VA BMP Clearinghouse-MTD
2015-0025	2023/2024	Permeable Pavement w/o Sand, Veg. C/D soils, underdrain	Permeable Pavement	2/24/2023	0.33	0.33	0.53	5.56	386.54	20%	10%	55%	0.42	3.00	197.06	Chesapeake Bay Program
2017-0014 01	2023/2024	Bioretention C/D Soils, underdrain	Bioretention Filter	10/14/2022	0.06	0.06	0.10	1.01	70.28	45%	25%	55%	0.06	0.55	28.15	Chesapeake Bay Program
2017-0014 02	2023/2024	Dry Detention Ponds and Hydrodynamic Structures	BaySeparator™ Stormwater Treatment System	10/14/2022	0.03	0.02	0.04	0.44	25.18	20%	13%	50%	0.03	0.30	14.08	VA BMP Clearinghouse-MTD
2017-0014 03	2023/2024	Filtering Practices	Tree Box Filter	10/14/2022	0.53	0.53	0.86	8.94	620.80	45%	25%	55%	0.23	0.00	107.92	Chesapeake Bay Program
2017-0014 04	2023/2024	Filtering Practices	Tree Box Filter	10/14/2022	0.06	0.05	0.09	0.94	60.32	45%	25%	55%	0.06	0.06	28.15	Chesapeake Bay Program
2017-0014 05	2023/2024	Dry Detention Ponds and Hydrodynamic Structures	CDS® Stormwater Treatment System	10/14/2022	0.06	0.05	0.09	0.94	60.32	20%	13%	50%	0.06	0.06	28.15	VA BMP Clearinghouse-MTD
2017-0023 01	2023/2024	Green Roof	Green Roof	7/3/2023	1.72	1.72	2.79	29.00	2014.67	80%	85%	90%	1.88	15.98	882.10	Chesapeake Bay Program
2017-0023 02	2023/2024	Dry Detention Ponds and Hydrodynamic Structures	Manufactured Treatment Device - Hydrodynamic	7/3/2023	2.09	2.08	3.37	35.17	2438.10	20%	13%	50%	1.10	0.00	516.12	VA BMP Clearinghouse-MTD
2017-0023 03	2023/2024	Filtering Practices	Tree Box Filter	7/3/2023	0.017	0.017	0.03	0.29	19.91	45%	25%	55%	0.02	0.17	9.38	Chesapeake Bay Program
2017-0023 04	2023/2024	Filtering Practices	Tree Box Filter	7/3/2023	0.017	0.017	0.03	0.29	19.91	45%	25%	55%	0.02	0.17	9.38	Chesapeake Bay Program
2017-0023 05	2023/2024	Filtering Practices	Tree Box Filter	7/3/2023	0.017	0.017	0.03	0.29	19.91	45%	25%	55%	0.02	0.17	9.38	Chesapeake Bay Program
2017-0023 06	2023/2024	Filtering Practices	Tree Box Filter	7/3/2023	0.017	0.017	0.03	0.29	19.91	45%	25%	55%	0.02	0.17	9.38	Chesapeake Bay Program
2018-0028 01	2023/2024	Green Roof	Green Roof	8/23/2023	0.48	0.48	0.78	8.09	562.23	80%	85%	90%	0.62	3.34	290.90	Chesapeake Bay Program
2018-0028 02	2023/2024	Filtering Practices	JellyFish Filter	8/23/2023	0.086	0.086	0.14	1.45	100.73	50%	32%	0%	0.09	0.00	42.23	VA BMP Clearinghouse-MTD
2018-0028 03	2023/2024	Filtering Practices	JellyFish Filter	8/23/2023	0.198	0.198	0.32	3.34	231.92	50%	32%	0%	0.21	0.00	98.53	VA BMP Clearinghouse-MTD
2019-0001 01	2023/2024	Green Roof	Green Roof	8/8/2023	0.06	0.06	0.10	1.01	70.28	80%	85%	90%	0.08	0.56	37.54	Chesapeake Bay Program
2019-0001 02	2023/2024	Dry Detention Ponds and Hydrodynamic Structures	CDS® Stormwater Treatment System	8/8/2023	0.32	0.32	0.52	5.40	374.82	20%	13%	50%	0.14	0.00	65.69	VA BMP Clearinghouse-MTD
2019-0026 01	2023/2024	Bioretention C/D Soils, underdrain	Bioretention Filter	4/5/2023	1.72	0.57	1.39	21.19	869.82	45%	25%	55%	1.70	12.43	797.64	Chesapeake Bay Program
2019-0026 02	2023/2024	Bioretention C/D Soils, underdrain	Bioretention Filter	4/5/2023	0.57	0.38	0.69	8.32	478.50	45%	25%	55%	0.51	4.26	239.29	Chesapeake Bay Program
2019-0026 03	2023/2024	Dry Detention Ponds and Hydrodynamic Structures	Barracuda BaySaver	4/5/2023	3.48	1.13	2.79	42.72	1736.72	20%	13%	50%	0.84	0.00	394.13	VA BMP Clearinghouse-MTD
2020-0001 01	2023/2024	Dry Detention Ponds and Hydrodynamic Structures	CDS® Stormwater Treatment System	1/9/2024	0.6	0.6	0.97	10.12	702.79	45%	25%	55%	0.05	0.42	23.46	Chesapeake Bay Program
2020-00001 02	2023/2024	Filtering Practices	Tree Box Filter	1/9/2024	0.04	0.04	0.07	0.71	49.08	45%	25%	55%	0.05	0.42	23.46	Chesapeake Bay Program
2020-00001 03	2023/2024	Filtering Practices	Tree Box Filter	1/9/2024	0.04	0.04	0.07	0.71	49.08	45%	25%	55%	0.05	0.42	23.46	Chesapeake Bay Program
2020-00001 04	2023/2024	Filtering Practices	Tree Box Filter	1/9/2024	0.04	0.04	0.07	0.71	49.08	45%	25%	55%	0.05	0.42	23.46	Chesapeake Bay Program
2020-00001 05	2023/2024	Filtering Practices	Tree Box Filter	1/9/2024	0.04	0.04	0.07	0.71	49.08	45%	25%	55%	0.05	0.42	23.46	Chesapeake Bay Program
2020-00001 06	2023/2024	Filtering Practices	Tree Box Filter	1/9/2024	0.04	0.04	0.07	0.71	49.08	45%	25%	55%	0.05	0.42	23.46	Chesapeake Bay Program
2020-00001 07	2023/2024	Filtering Practices	Tree Box Filter	1/9/2024	0.04	0.04	0.07	0.71	49.08	45%	25%	55%	0.05	0.42	23.46	Chesapeake Bay Program

BMP ID	Reporting PY	Chesapeake Bay Program BMP Type	BMP Name (Full)	Date Installed	Acres Treated	Impervious Acres Treated	TP Load (lbs/yr)	TN Load (lbs/yr)	TSS (lbs/yr)	TP BMP Efficiency	TN Efficiency	TSS Efficiency	TP Removed (lbs/yr)	TN Removed (lbs/yr)	TSS Removed (lbs/yr)	Efficency Method
2020-00001 08	2023/2024	Filtering Practices	Tree Box Filter	1/9/2024	0.04	0.04	0.07	0.71	49.08	45%	25%	55%	0.05	0.42	23.46	Chesapeake Bay Program
2020-00001 09	2023/2024	Filtering Practices	Tree Box Filter	1/9/2024	0.04	0.04	0.07	0.71	49.08	45%	25%	55%	0.05	0.42	23.46	Chesapeake Bay Program
2020-0015 01	2023/2024	Green Roof	Green Roof	5/13/2024	0.115	0.115	0.19	1.94	134.70	80%	85%	90%	0.11	0.80	51.61	Chesapeake Bay Program
2020-0015 02	2023/2024	Dry Detention Ponds and Hydrodynamic Structures	CDS® Stormwater Treatment System	5/13/2024	0.249	0.249	0.40	4.20	291.66	45%	25%	55%	0.14	0.00	65.69	VA BMP Clearinghouse-MTD
2018-0006 01	2023/2024	Filtering Practices	Tree Box Filter	6/27/2024	0.07	0.07	0.11	1.18	81.99	45%	25%	55%	0.07	1.31	32.84	Chesapeake Bay Program
2018-0006 02	2023/2024	Filtering Practices	Tree Box Filter	6/27/2024	0.07	0.06	0.10	1.11	72.04	45%	25%	55%	0.07	1.31	32.84	Chesapeake Bay Program
2018-0006 03	2023/2024	Filtering Practices	Tree Box Filter	6/27/2024	0.07	0.06	0.10	1.11	72.04	45%	25%	55%	0.07	1.31	32.84	Chesapeake Bay Program
2018-0006 04	2023/2024	Filtering Practices	Tree Box Filter	6/27/2024	0.07	0.06	0.10	1.11	72.04	45%	25%	55%	0.07	1.31	32.84	Chesapeake Bay Program
2018-0006 05	2023/2024	Filtering Practices	Tree Box Filter	6/27/2024	0.07	0.06	0.10	1.11	72.04	45%	25%	55%	0.07	1.31	32.84	Chesapeake Bay Program
2018-0006 06	2023/2024	Filtering Practices	Tree Box Filter	6/27/2024	0.07	0.06	0.10	1.11	72.04	45%	25%	55%	0.04	0.99	18.77	Chesapeake Bay Program
2018-0006 07	2023/2024	Filtering Practices	Tree Box Filter	6/27/2024	0.03	0.06	0.08	0.71	65.01	45%	25%	55%	0.06	1.22	28.15	Chesapeake Bay Program
2018-0006 08	2023/2024	Filtering Practices	Tree Box Filter	6/27/2024	0.06	0.03	0.06	0.81	40.41	45%	25%	55%	0.05	1.09	23.46	Chesapeake Bay Program
2018-0006 09	2023/2024	Filtering Practices	Tree Box Filter	6/27/2024	0.04	0.05	0.08	0.74	56.81	45%	25%	55%	0.08	1.34	37.54	Chesapeake Bay Program
2018-0006 10	2023/2024	Filtering Practices	Tree Box Filter	6/27/2024	0.08	0.04	0.08	1.08	53.88	45%	25%	55%	0.07	1.24	32.84	Chesapeake Bay Program
2018-0006 11	2023/2024	Filtering Practices	Tree Box Filter	6/27/2024	0.07	0.05	0.09	1.04	62.08	45%	25%	55%	0.05	1.12	23.46	Chesapeake Bay Program
2019-0003 01	2023/2024	Filtering Practices	Tree Box Filter	6/29/2024	2.2	2.1	3.44	36.41	2477.35	45%	25%	55%	0.92	0.00	431.66	Chesapeake Bay Program
2019-0003 02	2023/2024	Filtering Practices	Tree Box Filter	6/29/2024	0.057	0.057	0.09	0.96	66.77	45%	25%	55%	0.07	0.56	32.84	Chesapeake Bay Program
2019-0003 03	2023/2024	Filtering Practices	Tree Box Filter	6/29/2024	0.057	0.057	0.09	0.96	66.77	45%	25%	55%	0.07	0.56	32.84	Chesapeake Bay Program
2019-0003 04	2023/2024	Filtering Practices	Tree Box Filter	6/29/2024	0.057	0.057	0.09	0.96	66.77	45%	25%	55%	0.07	0.56	32.84	Chesapeake Bay Program
2019-0003 05	2023/2024	Filtering Practices	Tree Box Filter	6/29/2024	0.057	0.057	0.09	0.96	66.77	45%	25%	55%	0.07	0.56	32.84	Chesapeake Bay Program
2019-0003 06	2023/2024	Filtering Practices	Tree Box Filter	6/29/2024	0.057	0.057	0.09	0.96	66.77	45%	25%	55%	0.07	0.56	32.84	Chesapeake Bay Program
2019-0003 07	2023/2024	Filtering Practices	Tree Box Filter	6/29/2024	0.057	0.057	0.09	0.96	66.77	45%	25%	55%	0.07	0.56	32.84	Chesapeake Bay Program
2019-0003 08	2023/2024	Filtering Practices	Tree Box Filter	6/29/2024	0.057	0.057	0.09	0.96	66.77	45%	25%	55%	0.07	0.56	32.84	Chesapeake Bay Program
2019-0003 09	2023/2024	Filtering Practices	Tree Box Filter	6/29/2024	0.057	0.057	0.09	0.96	66.77	45%	25%	55%	0.07	0.56	32.84	Chesapeake Bay Program
2019-0003 10	2023/2024	Filtering Practices	Tree Box Filter	6/29/2024	0.057	0.057	0.09	0.96	66.77	45%	25%	55%	0.07	0.56	32.84	Chesapeake Bay Program
2019-0003 11	2023/2024	Filtering Practices	Tree Box Filter	6/29/2024	0.057	0.057	0.09	0.96	66.77	45%	25%	55%	0.07	0.56	32.84	Chesapeake Bay Program
2019-0003 12	2023/2024	Filtering Practices	Tree Box Filter	6/29/2024	0.057	0.057	0.09	0.96	66.77	45%	25%	55%	0.07	0.56	32.84	Chesapeake Bay Program
2019-0003 13	2023/2024	Filtering Practices	Tree Box Filter	6/29/2024	0.057	0.057	0.09	0.96	66.77	45%	25%	55%	0.07	0.56	32.84	Chesapeake Bay Program
2019-0003 14	2023/2024	Filtering Practices	Tree Box Filter	6/29/2024	0.34	0.24	0.43	5.05	298.70	45%	25%	55%	0.32	2.65	150.14	Chesapeake Bay Program
2019-0004 01	2023/2024	Permeable Pavement w/o Sand, Veg. C/D soils, underdrain	Permeable Pavement	2/2/2024	0.4629	0.4629	0.75	7.80	542.20	20%	10%	55%	0.59	4.21	276.83	Chesapeake Bay Program
2019-0004 02	2023/2024	Dry Detention Ponds and Hydrodynamic Structures	Manufactured Treatment Device - Hydrodynamic	2/2/2024	2.6754	2.0183	3.54	40.65	2479.59	45%	25%	55%	0.82	0.00	384.74	VA BMP Clearinghouse-MTD
2019-0004 03	2023/2024	Bioretention C/D Soils, underdrain	Bioretention Filter	2/2/2024	0.6273	0.4583	0.81	9.43	566.53	45%	25%	55%	0.60	5.95	281.52	Va BMP Clearinghouse-MTD

BMP ID	Reporting PY	Chesapeake Bay Program BMP Type	BMP Name (Full)	Date Installed	Acres Treated	Impervious Acres Treated	TP Load (lbs/yr)	TN Load (lbs/yr)	TSS (lbs/yr)	TP BMP Efficiency	TN Efficiency	TSS Efficiency	TP Removed (lbs/yr)	TN Removed (lbs/yr)	TSS Removed (lbs/yr)	Efficency Method
2020-1025 01	2023/2024	Bioretention C/D Soils, underdrain	Bioretention Filter	5/3/2024	0.58	0.17	0.44	6.99	271.20	45%	25%	55%	0.33	2.75	154.84	Chesapeake Bay Program
2020-1025 02	2023/2024	Bioretention C/D Soils, underdrain	Bioretention Filter	5/3/2024	0.08	0.02	0.06	0.94	33.97	45%	25%	55%	0.04	0.35	18.77	Chesapeake Bay Program
2020-1025 03	2023/2024	Bioretention C/D Soils, underdrain	Bioretention Filter	5/3/2024	0.13	0.03	0.09	1.51	52.72	45%	25%	55%	0.07	0.56	32.84	Chesapeake Bay Program
2020-1025 04	2023/2024	Bioretention C/D Soils, underdrain	Bioretention Filter	5/3/2024	0.06	0	0.02	0.60	10.55	45%	25%	55%	0.02	0.16	9.38	Chesapeake Bay Program
2020-1025 05	2023/2024	Bioretention C/D Soils, underdrain	Bioretention Filter	5/3/2024	0.07	0	0.03	0.70	12.31	45%	25%	55%	0.03	0.18	14.08	Chesapeake Bay Program
2020-1025 06	2023/2024	Bioretention C/D Soils, underdrain	Bioretention Filter	5/3/2024	0.06	0	0.02	0.60	10.55	45%	25%	55%	0.02	0.16	9.38	Chesapeake Bay Program
2020-1025 07	2023/2024	Bioretention C/D Soils, underdrain	Bioretention Filter	5/3/2024	0.11	0.05	0.11	1.45	69.11	45%	25%	55%	0.08	0.65	37.54	Chesapeake Bay Program
2020-1025 08	2023/2024	Bioretention C/D Soils, underdrain	Bioretention Filter	5/3/2024	0.07	0.02	0.05	0.84	32.22	45%	25%	55%	0.04	0.33	18.77	Chesapeake Bay Program
2020-1025 09	2023/2024	Bioretention C/D Soils, underdrain	Bioretention Filter	5/3/2024	0.21	0.08	0.18	2.66	116.56	45%	25%	55%	0.14	1.13	65.69	Chesapeake Bay Program
2020-1025 10	2023/2024	Bioretention C/D Soils, underdrain	Bioretention Filter	5/3/2024	0.08	0.03	0.07	1.01	43.93	45%	25%	55%	0.05	0.43	23.46	Chesapeake Bay Program
2020-1025 11	2023/2024	Bioretention C/D Soils, underdrain	Bioretention Filter	5/3/2024	0.13	0.03	0.09	1.51	52.72	45%	25%	55%	0.07	0.56	32.84	Chesapeake Bay Program
2020-1025 12	2023/2024	Bioretention C/D Soils, underdrain	Bioretention Filter	5/3/2024	0.14	0.02	0.08	1.55	44.52	45%	25%	55%	0.06	0.51	28.15	Chesapeake Bay Program
2020-1025 13	2023/2024	Bioretention C/D Soils, underdrain	Bioretention Filter	5/3/2024	0.15	0.04	0.11	1.78	66.19	45%	25%	55%	0.08	0.68	37.54	Chesapeake Bay Program
2020-1025 14	2023/2024	Bioretention C/D Soils, underdrain	Bioretention Filter	5/3/2024	0.17	0.04	0.12	1.98	69.71	45%	25%	55%	0.09	1.39	42.23	Chesapeake Bay Program
2020-1025 15	2023/2024	Bioretention C/D Soils, underdrain	Bioretention Filter	5/3/2024	0.29	0.07	0.20	3.40	120.67	45%	25%	55%	0.15	1.27	79.76	Chesapeake Bay Program
2020-1025 16	2023/2024	Bioretention C/D Soils, underdrain	Bioretention Filter	5/3/2024	0.49	0.28	0.54	6.84	364.89	45%	25%	55%	0.49	4.05	229.91	Chesapeake Bay Program
2020-0002	2023/2024	Permeable Pavement w/o Sand, Veg. C/D soils, underdrain	Permeable Pavement	1/17/2024	0.03	0.03	0.05	0.53	35.51	20%	10%	55%	0.04	0.29	18.77	Chesapeake Bay Program
2018-0005	2023/2024	Stream Restoration	Stream Restoration	6/7/2024	225	135	---	---	---	---	---	---	257.00	658.00	489818.00	Chesapeake Bay Program
SIT82-0021	2023/2024	Green Roof	Green Roof	8/9/2023	0.01	0.01	0.02	0.17	11.71	80%	85%	90%	0.01	0.00	4.69	Chesapeake Bay Program
				Totals	**254.62**	**157.41**	**39.27**	**450.50**	**27,521.99**	---	---	---	**276.91**	**758.93**	**499,169.15**	

Appendix C

BMP Technical Memorandum & Pollution Calculations

Lake Cook Technical Memorandum
Four Mile Run Stream Restoration Technical Memorandum
Ben Brenman Pollutant Calculations

DRAFT

Lake Cook Technical Memorandum

DRAFT

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.

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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**

Four Mile Run Stream Restoration Technical Memorandum

DRAFT

Technical Memorandum

To: City of Alexandria

From: Brian Finerfrock, Eliana Rios

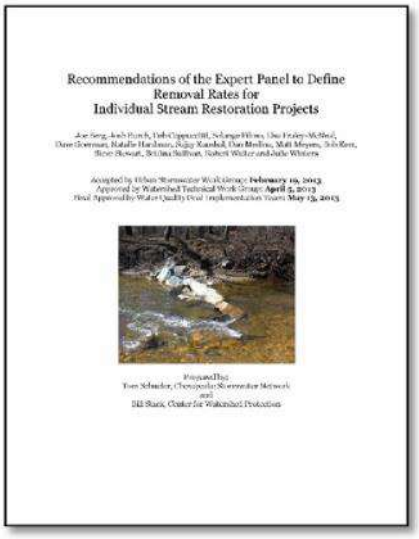
Rummel, Klepper & Kahl, LLP

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.

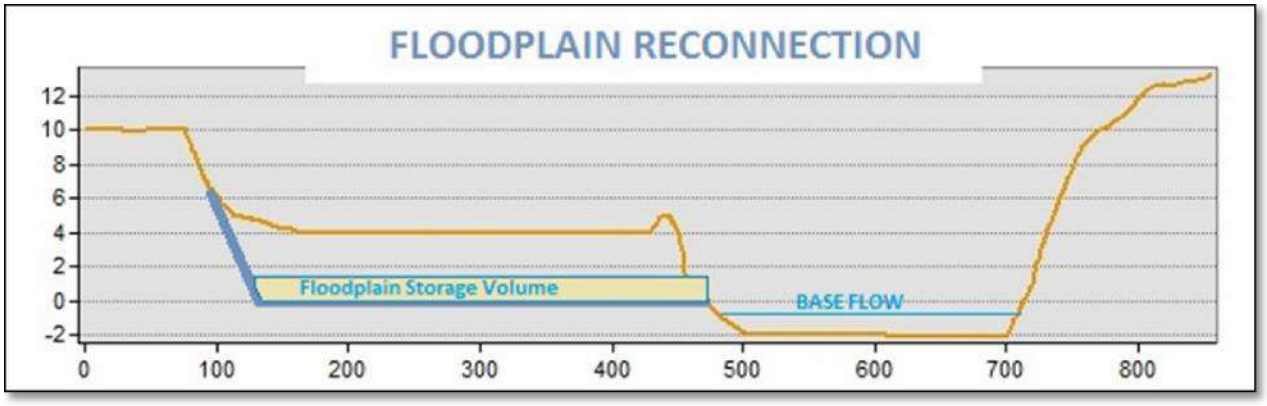
Introduction


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

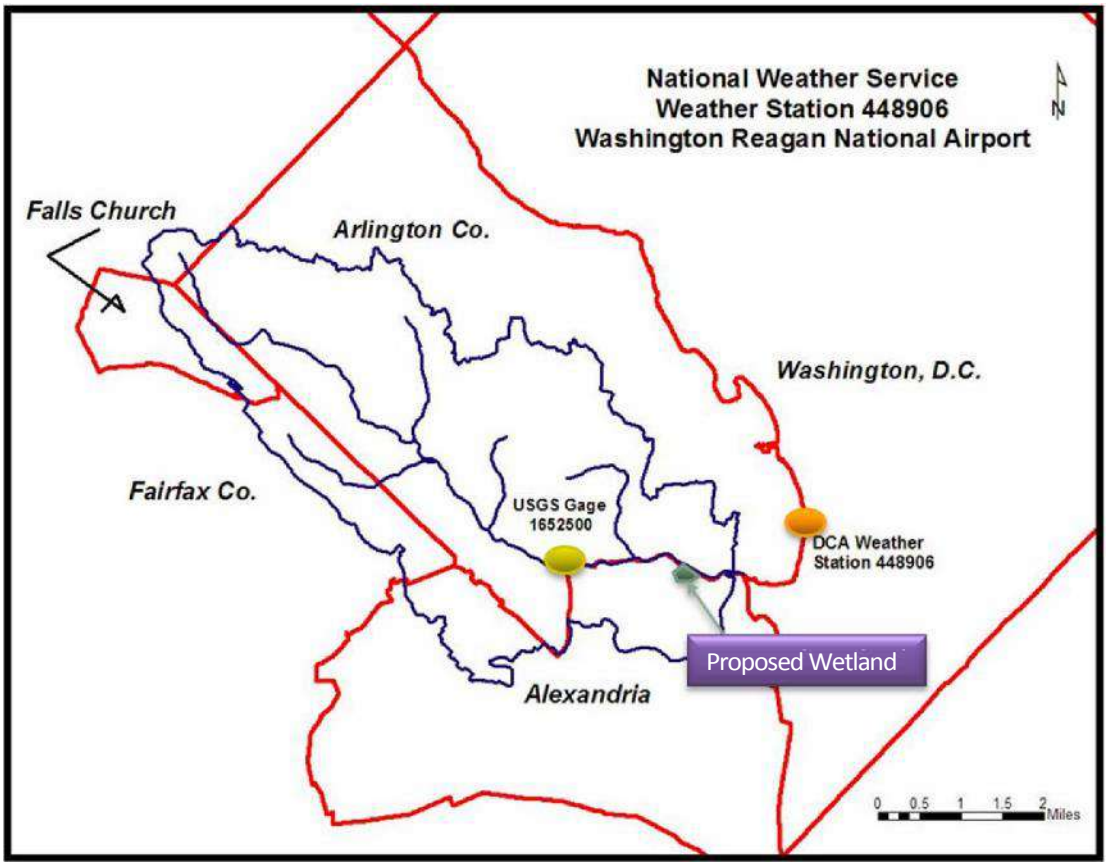
The proposed wetland is a tidally influenced wetland, located in the Four Mile Run Park, in the City of Alexandria. The proposed wetland is planned to be 2 acres in size, with a design intended to minimize phragmite colonization.

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.

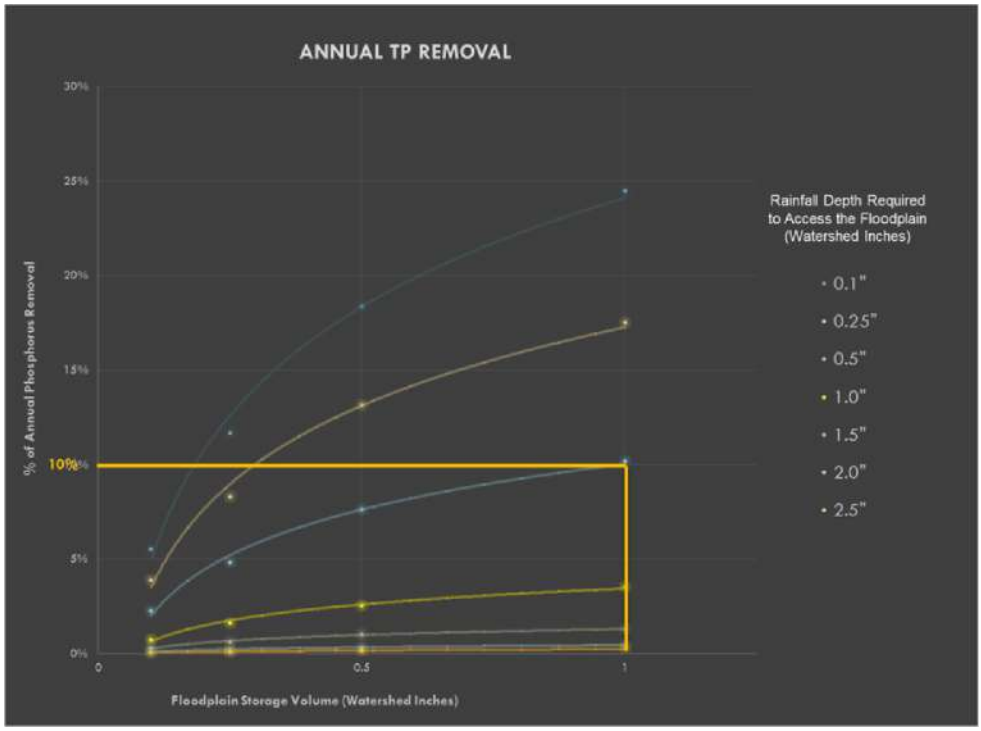
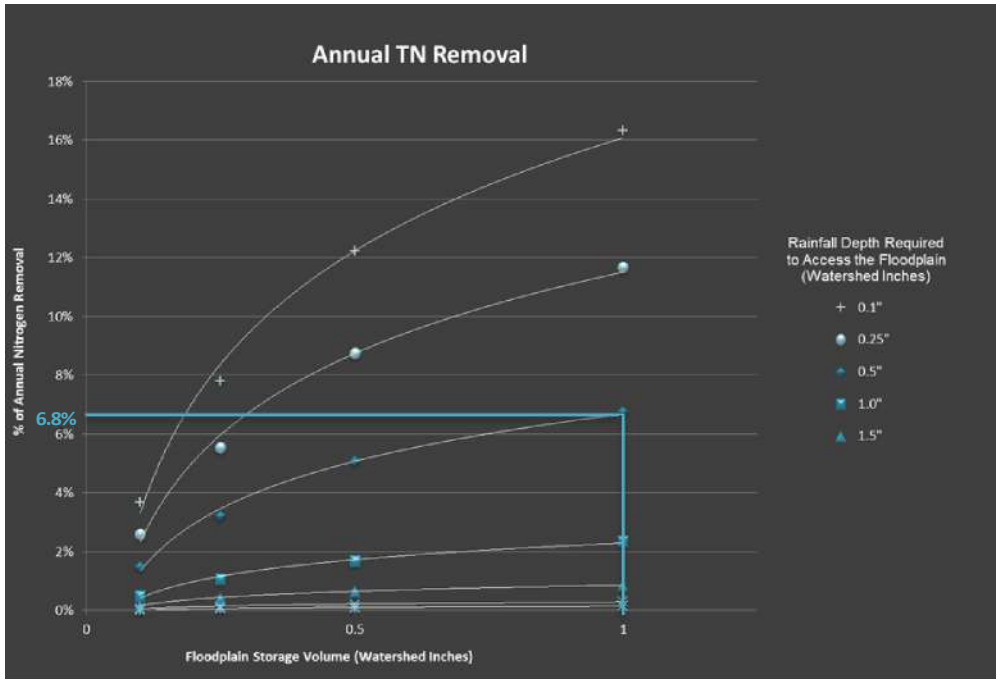


Figure 1-Annual Total Phoshorus (TN) removal as afunction offloodplain storage volume for several rainfall thresholds that allow runoff to access the floodplain.



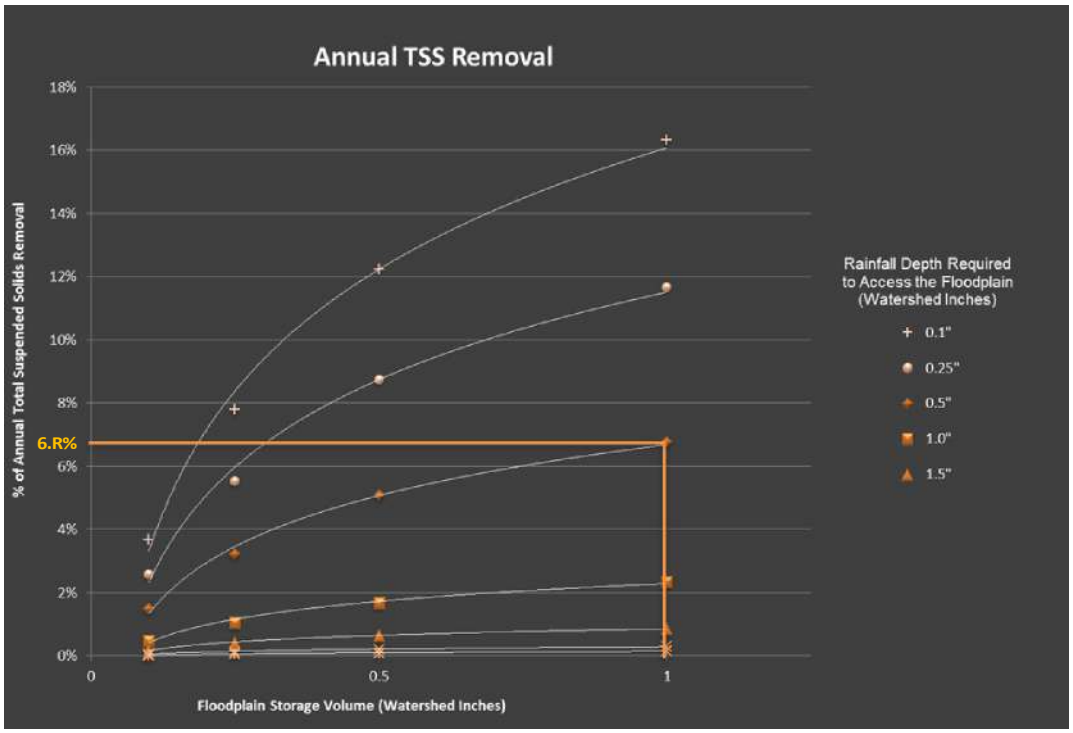
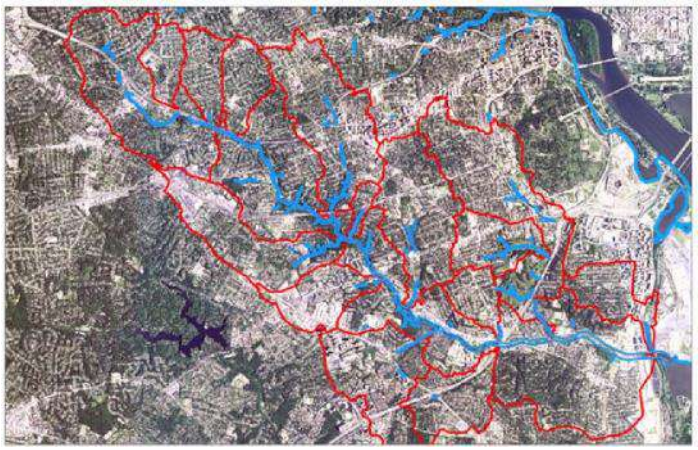


Figure 3-Annual Total Suspended Solids (TSS) removal as a function offloodplain storage volume for several rainfall thresholds that allow runoff to access the floodplain

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)

Ben Brenman Pollutant Calculations

DRAFT

City of Alexandria, Virginia

TECHNICAL MEMORANDUM

DATE: August 21, 2017

SUBJECT: Ben Brenman Pond Retrofit Pollutant Removal Calculations

PREPARED BY: City of Alexandria and URS

Purpose

The City of Alexandria has been proactive in its approach to meeting the Chesapeake Bay Total Maximum Daily Load (TMDL) reductions specified in its Municipal Separate Storm Sewer System (MS4) permit. The City identified retrofitting its exiting stormwater ponds as a first step towards meeting its required Chesapeake Bay TMDL reductions. A study commissioned by the City in August 2012 identified several wet ponds as candidates for water quality improvement retrofits. In December 2014, the City received a Stormwater Local Assistance Fund (SLAF) grant from the Virginia Department of Environmental Quality (VA DEQ) to help fund retrofitting Ben Brenman Pond to meet the design criteria for a Virginia Best Management Practice (BMP) Clearinghouse Level 2 Wet Pond.

The purpose of this technical memorandum is to describe the proposed retrofits to Ben Brenman Pond and to summarize the water quality benefits in terms of pounds of nitrogen, phosphorus, and total suspended solids.

Background

Ben Brenman Pond, also referred to as Cameron Station Pond, is located in Ben Brenman Park and was originally constructed in the late 1990s as a stormwater management facility for the adjacent Cameron Station residential development. The pond receives drainage from approximately 255 acres of urban land in the City and is located in the Backlick Run watershed. Backlick Run is a tributary to Holmes Run which flows into Cameron Run and then the Potomac River. Approximately 179 acres (62 percent) of the drainage area for Ben Brenman Pond is impervious. The pond has a surface area of approximately 6.1 acres. In addition to serving as a stormwater management facility, the pond is a popular amenity to the Cameron Station residents, and Ben Brenman Park is heavily used by the local residents.

Proposed Retrofits

Improvement to the existing Ben Brenman Pond will involve adding or retrofitting water quality features in order for the pond to meeting the Level 2 Wet Pond criteria as outlined in *Virginia DEQ Stormwater Design Specification No. 14 – Wet Pond, Version 1.9, dated March 1, 2011*.

Also, the retrofitted pond will provide water quality treatment for previously untreated stormwater in the Backlick Run watershed. Low flows from adjacent storm sewer systems will be diverted to the pond, which will provide water quality treatment for an additional 35 acres of regulated urban pervious and impervious land. The following sections provide detailed descriptions of the proposed retrofits.

Pond and Forebay Treatment Volume

A treatment volume of 24.5 acre-feet is required to meet Level 2 design criteria for the proposed 290 acres (after diversion of the additional 35 acres) being routed to the pond. As outlined in the Virginia DEQ Stormwater Design Specification for Wet Ponds, this treatment volume may consist of the volume entirely below the normal pool elevation, or a combination of the volume associated with extended detention above the normal pool elevation and the volume below the normal pool elevation. Currently, Ben Brenman Pond has a storage volume of approximately 23.8 acre-feet. After the pond is retrofitted, the treatment volume will increase to approximately 27 acre-feet.

Multiple Cell Design

Storage in the pond is currently provided within two cells: a sediment forebay and the larger main pond. Since the entire treatment volume will be contained below the normal pool elevation, the pond must have at least 3 internal cells to meet the Level 2 design criteria. The proposed design includes dividing the main pond cell into two cells using a weir structure across the narrowest portion of the pond.

Sediment Forebay

The sediment forebay is located on the west side of the pond and is separated from the main pond by an earthen berm. The design plans for the pond show a storage volume of 1.7 acre-feet for the forebay, which is approximately 0.5 acre-feet smaller than what the VA DEQ Stormwater Design Specification require for a Level 1 Wet Pond. Bathymetry conducted in Fall of 2012 indicates that a significant amount of sediment has accumulated in the forebay and the volume has been reduced to approximately 1.1 acre-feet. The proposed retrofit will dredge the existing forebay area to its original constructed volume and increase its volume to 3.7 acre-feet by shifting the location of the earthen weir further into the main pond. The volume of 3.7 acre-feet is consistent with the necessary volume for a sediment forebay of a Level 2 Wet Pond draining 290 acres. The retrofitted forebay will have a surface area of approximately 0.7 acres and account for 11% of the retrofitted pond's surface area.

Aquatic Benches

The existing pond does not include aquatic benches and the as-built plans confirmed that benches were not included in the original construction. The VA DEQ Stormwater Design Specification requires aquatic benches for a Level 2 Wet Pond and, as part of the retrofit, they will be constructed around the perimeter of the pond. The aquatic benches will be 5 feet wide around the perimeter of the sediment forebay and 10 feet wide around the perimeter of the two internal pond cells. They will also serve as a safety feature in the event of someone or something falls into the pond.

Wetlands

The VA DEQ Stormwater Design Specification for Wet Ponds specify that wetlands make up more than 10 percent of the pond area. Based on the *High Marsh Zone* definition found in *Virginia DEQ Stormwater Design Specification No. 13 – Constructed Wetlands,* those portions of the aquatic benches that are within 6 inches (above or below) the normal pool elevation will be considered wetland areas for the purpose of meeting this requirement. The proposed aquatic benches will provide approximately 0.4 acres of wetlands around the perimeter of the pond. In addition, floating wetlands will be added to the pond to meet the remaining 10 percent requirement. Together, the floating wetlands and aquatic bench wetlands will be equal to or greater than the 0.61 acres in size, given the pond surface area of approximately 6.1 acres.

Aerators

The existing pond contains two types of aerators. Originally, the pond was equipped with five aerators that pumped surface water in the form or fountains. Since the pond's construction, the City's park service added additional underwater aerators closer to the bottom of the pond. There is no plan to alter the existing aerators, and they will continue to remain in the pond.

Upflow Filter

Additional water quality improvements are provided by an existing upflow filter consisting of aggregate media. Although, it is not a requirement for a Level 1 or 2 design, the upflow filter will remain in the pond, and will not be altered as part of the retrofit design.

The City has noted improved water quality downstream from Ben Brenman Pond that has not been observed downstream from other City-owned retention ponds. This is believed to be at least partially attributed to the upflow filter. A similar upflow filter was added to the retrofit design for nearby Lake Cook, which the City is also retrofitting to help comply with its required Chesapeake Bay TMDL reductions.

Pollutant Calculations

The following sections describe the methodologies and procedures used to compute the existing conditions and proposed retrofit conditions pollutant removals for Ben Brenman Pond. The procedures and methodologies found in Guidance Memo No. 15-2005 (GM15-2005), also referred to as the Chesapeake Bay TMDL Action Plan Guidance, were used in the pollutant calculations.

Existing Conditions

Ben Brenman Pond currently treats 255 acres of urban land due to the existing drainage infrastructure. Since the initial/existing pond was not build to meet the VA Stormwater BMP Clearinghouse standards, the existing pollutant removal rates for Ben Brenman Pond were calculated based on the Chesapeake Bay Program (CBP) established efficiencies for Wet Ponds and Wetlands provided in Table V.C.1 Chesapeake Bay

Program BMPs, Established Efficiencies of GM15-2005.

Table V.C.1 – Chesapeake Bay Program BMPs, Established Efficiencies

Chesapeake Bay Program BMPs	TN	TP	TSS
Wet Ponds and Wetlands	20%	45%	60%

Due to the existing forebay being substantially undersized and the lack of aquatic benches, a downward modification to the Chesapeake Bay Program efficiencies was used. Example V.D.2 in GM15-2005 provides an example of this same approach.

Design Deficiency	***Downward Modification***
Undersized Forebay	10%
No Aquatic Benches	10%
TOTAL	**20%**

After incorporating the downward modifications, the resultant adjusted pollutant removal efficiencies were as follows:

Table 1: Ben Brenman Pond Existing Conditions Pollutant Load Reduction Efficiencies

Pollutant	CBP Efficiency	Downward Modification	Adjusted Efficiency
TN	20%	20%	16%
TP	45%	20%	36%
TSS	60%	20%	48%

The Potomac River Basin 2009 edge of stream loading rates (lbs/acre/yr) can be found in the table below and in Table 2 b of GM15-2005.

Table 2: Potomac River Basin Pollutant Loadings

Pollutant	Land Use	Loading
Nitrogen	Reg Urb Imp	16.86
	Reg Urb Per	10.07
	Forest	5.29
Phosphorus	Reg Urb Imp	1.62
	Reg Urb Per	0.41
	Forest	0.13
Total Suspended Solids	Reg Urb Imp	1171.32
	Reg Urb Per	175.8
	Forest	79.91

It should be noted that the forest loading rate was not used in the calculations because no land within the pond's contributing drainage area was considered to be forested. There are areas of tree cover within the drainage area; however, the Chesapeake Bay Phase 6 TMDL Model categorizes these areas as Tree Canopy over Turf Grass or trees within 30' to 80' of non-road impervious surfaces where the understory is assumed to be turf grass or otherwise altered through compaction, removal of surface organic material, and/or

fertilization. Subsequently, the forest loading rates were not used in the existing condition or proposed retrofitted condition pollutant calculations.

Using the loadings and efficiencies determined above, the total nitrogen, total phosphorus, and total suspended solids removed by the existing pond were computed as shown below.

Table 3: Ben Brenman Pond Existing Conditions Pollutant Load Reductions

Area Treated (ac)	Impervious Treated (ac)	TN Load (lb/yr)	TP Load (lb/yr)	TSS Load (lb/yr)	TN Removed (lb/yr)	TP Removed (lb/yr)	TSS Removed (lb/yr)
255.11	144.1	3547.40	278.96	188,303	567.58	100.42	90,385.33

Proposed Retrofitted Conditions

The retrofitted pond will be designed to treat runoff from the 255 acres of urban land currently draining to it, as well as previously untreated runoff from an additional 35 acres of urban land that will be diverted to the pond.

After retrofitting, the pond will meet the Level 2 design criteria and will be eligible to receive the corresponding pollutant load reductions as presented in Table V.A.1 Virginia Stormwater BMP Clearinghouse BMPs, Established Efficiencies of GM15-2005. The Level 2 Wet Pond efficiencies for TN are 40% (30% in the coastal plain terrain) and for TP are 75% (65% in the coastal plain terrain). Some physiographic maps indicate that the majority of the City of Alexandria falls within the coastal plain region; however, a closer examination of the terrain and other determining characteristics suggests that the west side of the City more closely resembles the piedmont physiographic region. This includes the area where Ben Brenman Pond is located. As a result, the higher efficiencies associated with the non-coastal plain region are used to calculate the pollutant removals for the proposed retrofitted pond.

Table V.A.1 - Virginia Stormwater BMP Clearinghouse BMPs, Established Efficiencies

Practice Number	Practice	TN	TP
14	Wet Pond 1	30% (20%)[2]	50% (45%)[2]
	Wet Pond 2	40% (30%)[2]	75% (65%)[2]

[2]Lower nutrient removal in parentheses apply to wet ponds in coastal plain terrain

Since there are no established efficiencies for TSS in the Virginia Stormwater BMP Clearinghouse, Appendix V.A of GM15-2005 states that permittees should use the retrofit curves developed by the Bay Program or the CBP Established Efficiencies. Using the treatment volume of the proposed retrofitted pond (27 acre-feet) and the impervious area treated (179.1 acres), a treated runoff depth of 1.81 inches was computed. Using the equations for the retrofit curves, a TSS efficiency value of 77.7% was calculated.

Table 4: Ben Brenman Pond Proposed Conditions Pollutant Load Efficiencies

TN Efficiency	TP Efficiency	TSS Efficiency
40%	75%	77.7%

Using the loadings and efficiencies determined above, the total nitrogen, total phosphorus, and total suspended solids removed by the proposed retrofitted Level 2 pond were computed as shown below.

Table 5: Ben Brenman Pond Proposed Conditions Pollutant Load Reductions

Area Treated (ac)	Impervious Treated (ac)	TN Load (lb/yr)	TP Load (lb/yr)	TSS Load (lb/yr)	TN Removed (lb/yr)	TP Removed (lb/yr)	TSS Removed (lb/yr)
290.11	179.1	3785.05	335.66	229,299	1,514.02	251.74	178,119.26

Incremental Difference in Pollutant Removals

According to GM15-2005, permittees will calculate the credit associated with BMP enhancement, conversion, and restoration using an incremental rate.

The difference between the pollutant loads currently being removed by the existing pond and the loads which will be removed by the proposed retrofitted pond will be equal to the amount that can be associated with the project. Using the existing and proposed pollutant removals, the following values are the pollutant removals associated with the retrofit project and can be applied toward the City's required Chesapeake Bay TMDL pollutant load reductions.

Table 6: Ben Brenman Pond Incremental Pollutant Load Reductions (Credits)

TN Removed (lb/yr)	TP Removed (lb/yr)	TSS Removed (lb/yr)
946.44	151.32	87,733.93

Appendix D

DEQ Correspondence and Action Plan Approval

Phase 1
Phase 2
Phase 3

DRAFT

Phase 1: DEQ Correspondence and Action Plan Approval

DRAFT

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
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E: kelsey.brooks@deq.virginia.gov

DEPARTMENT OF TRANSPORTATION
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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

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
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

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
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

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
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

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
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

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

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

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

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
P.O. Box 178 - City Hall
Alexandria, Virginia 22313
703-746-4025
www.alexandriava.gov

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

Grandfathered Projects

UPDATED Attachment 4B: Grandfathered Projects - Loads, BMP Reducations, 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**

Phase 2: DEQ Correspondence and Action Plan Approval

DRAFT

Joni Calmbacher

From: Joni Calmbacher
Sent: Friday, October 18, 2019 6:24 PM
To: 'Tuthill, Anna'
Cc: Jesse Maines
Subject: City of Alexandria Phase 2 Chesapeake Bay Action Plan
Attachments: Alexandria Phase 2 ChesBay AP 2019.09.24.pdf

Anna,

Please find the City of Alexandria's Phase 2 Chesapeake Bay TMDL Action Plan attached. Should you have any questions or comments, please reach out to Jesse (contact information is below).

Jesse Maines, MPA, PMP
Jesse.Maines@alexandriava.gov
Division Chief
T&ES, Stormwater Management
703.746.4643 (direct)
571.414.8237 (mobile)

Thank you,
Joni

Commonwealth of Virginia

VIRGINIA DEPARTMENT OF ENVIRONMENTAL QUALITY

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Matthew J. Strickler
Secretary of Natural and Historic Resources

David K. Paylor
Director
(804) 698-4000

July 12, 2021

Mark Jinks
City of Alexandria
301 King St., Rm3500
Alexandria, VA 22314

Re: Review of VAR040057 Municipal Separate Storm Sewer System (MS4) Chesapeake Bay Total Maximum Daily Load (TMDL) Action Plan for Achieving 40% Reduction Requirements

Transmitted electronically: mark.jinks@alexandriava.gov

Dear Mr. Jinks:

The Department of Environmental Quality (DEQ) has completed the review of the Chesapeake Bay TMDL action plan submitted in accordance with 9VAC25-890-40 Part II.A.11 of the MS4 General Permit. DEQ has no additional questions at this time.

Please note that permittees utilizing street cleaning as part of their Chesapeake Bay TMDL action plan should be aware of new pollution reduction calculation requirements that will take effect after June 30, 2022 in accordance with Guidance Memo No, GM-20-2003 (Appendix V.G).

Also, note that any modifications to the Chesapeake Bay TMDL Action Plan shall be summarized in your annual report in accordance with Part I.C.4 of the MS4 General Permit.

If you have any questions please contact me at Jeffrey.selengut@deq.virginia.gov or (804) 698-4265.

Sincerely,

Jeffrey Selengut
MS4 Permit Writer

Cc: Derick Winn, Central Office
Anna Tuthill, Northern Regional Office

Phase 3: DEQ Correspondence and Action Plan Approval (Forthcoming)

DRAFT