Chesapeake Bay TMDL Action Plan Permit No. VA0063177 2018-2023

Prepared for
Department of Public Utilities
Richmond, Virginia
April 12, 2022

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List of Abbreviations

Ac	acre(s)
BMP	best management practice
CIP	Capital Improvement Plan
City	City of Richmond
CSS	combined sewer system
DEQ	Virginia Department of Environmental Quality
EOS	edge of stream
GIS	geographic information system
Guidance Document	Virginia Department of Environmental Quality *Guidance Memo No. 20-2003 Chesapeake Bay TMDL Special Condition Guidance*
Integrated Permit	*Authorization to Discharge under the Virginia Pollution Discharge Elimination System and the Virginia State Water Control Law*
lb	pound(s)
lf	linear foot/feet
MS4	municipal separate storm sewer system
NLCD	National Land Cover Dataset
Plan	Chesapeake Bay TMDL Action Plan
POC	pollutant of concern
RCP	reinforced concrete pipe
TMDL	total maximum daily load
TN	total nitrogen
TP	total phosphorus
TSS	total suspended solids
USGS	United States Geological Survey
VPDES	Virginia Pollutant Discharge Elimination System
yr	year(s)

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Executive Summary

The City of Richmond (City) has developed this second permit term Chesapeake Bay Total Maximum Daily Load (TMDL) Action Plan (Plan) as required in the City's *Authorization to Discharge under the Virginia Pollution Discharge Elimination System (VPDES) and the Virginia State Water Control Law* (Integrated Permit) (Permit No. VA0063177) and in accordance with the Virginia Department of Environmental Quality (DEQ) *Guidance Memo No. 20-2003 Chesapeake Bay TMDL Special Condition Guidance* (Guidance Document) dated February 6, 2021. This Plan requires documentation of new legal authorities used to meet the requirements of the Plan, the pollutant load and cumulative reduction calculations for each river basin, best management practices (BMPs) implemented as of July 1, 2018, and BMPs planned to be implemented during the current permit term. Table ES-1 provides an overview of the Integrated Permit requirements and the corresponding section where the requirement is addressed.

Table ES-1. Overview of the Chesapeake Bay TMDL Action Plan Document Requirements

Integrated Permit Section	Description of Requirement	Corresponding Section of this Plan	Page Number(s)
IV.F.10.a	New or modified legal authority	Section 2	2-1
IV.F.10.b	Estimated existing source loads	Section 3.2	3-2
IV.F.10.b	Required pollutant reductions	Section 3.3	3-3
IV.F.10.c	Total reductions achieved as of July 1, 2018	Section 4.2.6	4-1 and 4-7
IV.F.10.d	BMPs implemented prior to July 1, 2018	Section 4.2	3-6 and 4-1
IV.F.10.e	BMPs to be implemented in the second permit term	Section 4.3	4-7

The 2009 municipal separate storm sewer system (MS4) service area was delineated for the first permit term Plan. The Guidance Document indicates that permittees should review the MS4 service area in the second permit term Plan. The City has confirmed that the entire City boundary is located within both the 2000 and 2010 US Census Urbanized Area, so no modifications have been made to the MS4 service area within the City. Additionally, the inflow areas from Henrico and Chesterfield County were reviewed against their respective Plans and it was determined that each county has included these areas within their own MS4 service areas. Therefore, the City has removed the inflow areas from the nutrient and sediment calculations to avoid double counting the required reductions. Figure ES-1 shows the exclusion areas and the MS4 service area. Table ES-2 summarizes the total exclusion and inclusion areas in the MS4 service area.

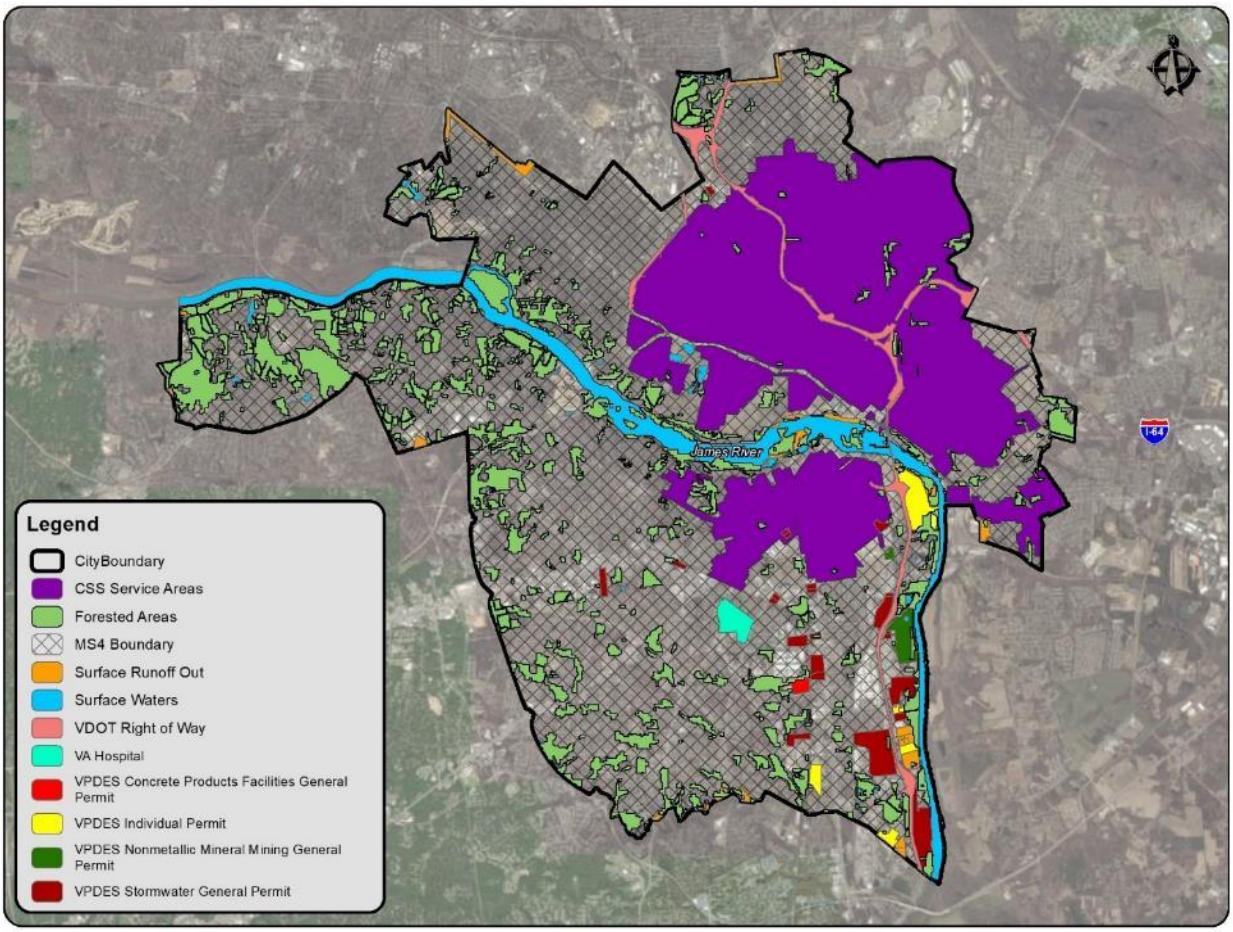

Figure ES-1. City of Richmond MS4 service area and exclusion areas.

Table ES-2. Areas of Inclusion and Exclusion from the MS4 Service Area

Area Category	Area (Ac)
City of Richmond Boundary	40,011
Exclusion Areas (inside City boundary)	18,631
Inclusion Area (outside of City boundary)	0
Total MS4 Service Area	**21,380**

The 2009 land cover characteristics were estimated in the first permit term Plan from the 2014 impervious land cover provided by the City and historical rates of land cover change. The annual pollutant of concern (POC) loads for existing development were calculated from the 2009 land cover using the edge of stream (EOS) loading rates provided in the Integrated Permit for the James River Basin, as shown in Table ES-3.

Table ES-3. Existing Source Loads for the James River Basin					
Subsource	Pollutant	Total Existing Acres Served by MS4 (06/30/09)	2009 EOS Loading Rate (lb/ac/yr)	Estimated Total POC Load Based on 2009 Progress Run (lb/yr)	Estimated Total POC Load (lb/yr)
Regulated Urban impervious	Total Nitrogen	7,223.95	9.39	67,8323	166,784
Regulated Urban Pervious		14,156.05	6.99	98,951	
Regulated Urban impervious	Total Phosphorus	7,223.95	1.76	12,714	19,792
Regulated Urban Pervious		14,156.05	0.50	7,078	
Regulated Urban impervious	Total Suspended Solids	7,223.95	676.94	4,890,181	6,321,074
Regulated Urban Pervious		14,156.05	101.08	1,430,893	

After the existing source loads were revised to remove the duplicative inflow areas, the cumulative (first and second permit term) progress requirement of 40 percent reduction was calculated for existing development and new sources initiating construction between July 1, 2009, and June 30, 2019 (Integrated Permit Section IV.F.3). The required reductions for new sources were calculated using the aggregate accounting method as described in Example II.2 of the Guidance Document dated February 6, 2021. The cumulative (first and second permit term) required reductions are summarized in Table ES-4. The City does not anticipate the construction of any grandfathered projects (Integrated Permit Section IV.F.4) initiating construction after July 1, 2014.

Table ES-4. Total Reductions Required During Second Permit Cycle				
Pollutant	Cumulative Required Reductions from Existing Development (lb/yr)	Required Reductions from New Sources (lb/yr)	Required Reductions from Grandfathered Projects (lb/yr)	Cumulative Required Reductions (lb/yr)
Total Nitrogen	4,817	124	0	4,941
Total Phosphorus	1,019	72	0	1,091
Total Suspended Solids	441,296	32,297	0	473,593

The City is currently operating a program to select and implement projects to achieve the required reductions for the current and future permit cycles. The projects identified by the City for this Plan include:

- Projects completed before July 1, 2018
- Green alley stormwater management projects
- Little Westham Creek stream restoration
- Pocosham Creek stream restoration
- Pine Camp Creek stream restoration

Projects Completed Before July 1, 2018

During the first permit term, the City completed five projects and programs to reduce pollutants and sediment as required by the previous general MS4 permit. A list of the project names and the pollutant reduction credits are summarized in Table ES-5.

Table ES-5. Reductions for Projects Completed Before July 1, 2018

Project	Total Nitrogen (lb /yr)	Total Phosphorus (lb /yr)	Total Suspended Solids (lb /yr)
Development and redevelopment sites	67.8	15.2	4,441
Green alley stormwater management program	20.7	3.5	1,662
Cherokee Lake wet pond enhancement	872	198	16,680
Forest Hill Park wet pond retrofit	1,354	299	25,155
Maury Cemetery Stream Restoration	894	176	58,720
Total Pollutant Removal (lb /yr)	3,209	692	106,658

Green Alley Stormwater Management Program

The purpose of the City's Green Alley Stormwater Management Program is to implement low impact development techniques, infiltrate and filter stormwater, and demonstrate the potential of green infrastructure practices in the City. The City completed 13 projects prior to July 1, 2018, including 7 projects in the MS4 service area, which are reported in Table ES-5. An additional project in the Forest View neighborhood is expected to be completed during the current permit term. The project will replace existing impervious surfaces with 0.44 acres of permeable pavement, providing treatment of 0.44 acres. The project will reduce pollutants by 4.0 lb/yr total nitrogen (TN), 0.56 lb/yr total phosphorus (TP), and 208.5 lb/yr total suspended solids (TSS).

Little Westham Creek Stream Restoration

Little Westham Creek is located on the campus of the University of Richmond. The project site is bounded by River Road to the south, the Country Club of Virginia-Westhampton to the east, Westhampton Way to the north, and the University of Intramural Fields on UR Drive to the west. The stream restoration is part of a larger restoration project called the Gambles Mill Eco-Corridor, which includes several initiatives implemented by or in partnership with the University of Richmond.

The stream restoration was completed in 2019 and restored approximately 2,300 linear feet (lf) of stream channel, resulting in the reduction of 4,073 lb/yr TN, 1,590 lb/yr TP, and 548,000 lb/yr TSS, as calculated based on the Chesapeake Bay Program Stream Restoration Protocols, which are described in the report, *Recommendations of the Expert Panel to Define Removal Rates for Individual Stream Restoration Projects* dated September 8, 2014 (2014 Stream Restoration Protocols), which was the current stream restoration guidance at the time of project completion.

Pocosham Creek Stream Restoration

The Pocosham Creek stream restoration project is located on a tributary of Pocoshock Creek that flows into Falling Creek, which ultimately discharges to the James River. The tributary drains approximately 3,625 acres of mostly suburban and forested lands in the southwest side of the City, west of the James River. Approximately half of the watershed is located within the City limits, and the other half is in Chesterfield County, and it is entirely within the US census urbanized area. The

project restored approximately 5,500 lf of stream channel and included the addition of a bankfull floodplain bench, in-stream structures, and walking trails. Using the 2014 Stream Restoration Protocols, the pollutant reductions achieved by the project are 4,696 lb/yr TN, 1,061 lb/yr TP, and 354,013 lb/yr TSS. Construction of this project was completed in August of 2019.

Pine Camp Creek Stream Restoration

Pine Camp Creek references an unnamed tributary located behind the Pine Camp Arts and Community Center on the northern side of Richmond. The project site is completely within the City's regulated area and the creek flow to Horse Creek, which drains to the Chickahominy River, and ultimately flows to the James River and the Chesapeake Bay. The proposed project will restore 2,220 lf of the channel between Old Book Road and Horse Creek.

The stream receives drainage from 198 acres of mixed turf, forest, and impervious land cover. The reach exhibits bank erosion and degraded stability. Planned improvements will address these issues as well as enhancing water quality for receiving waters and stream ecology. Restoration plans for the stream channel also address the pipe separation and failure of a 60-inch reinforced concrete pipe (RCP) with is a stormwater runoff outfall from Old Brook Road.

The proposed stream restoration will include step-pools/plunge pools for energy dissipation at pipe outfalls into the creek, a series of step-pools in a steep section of the creek, wetland areas on a floodplain bench downstream, and increased sinuosity and vegetative cover throughout the stream reach. These natural channel design techniques are intended to provide pollutant abatement and improve water quality, improve diversity of aquatic habitat areas, and reduce bank erosion. Using the 2014 Stream Restoration Protocols and the 2019 *Recommendations for Crediting Outfall and Gully Stabilization Projects in the Chesapeake Bay Watershed* expert panel report, the completed project is expected to provide the following nutrient reductions: 7,841 lb/yr of TN, 3,566 lb/yr of TP, and 4,383,306 lb/yr of TSS.

Summary of Nutrient and Sediment Reductions

The projects included in this Plan have either been completed since July 1, 2018, or are in the design or planning process. The POC reductions for each project are shown in Table ES-6. At a minimum, the City will ensure that projects will be in construction by June 30, 2023, to meet the 40 percent required progress. Progress greater than 40 percent will be credited toward the third permit term Plan.

Table ES-6. Cumulative Second Permit Term Pollutant Reduction Credits

Project	Total Nitrogen (lb /yr)	Total Phosphorus (lb /yr)	Total Suspended Solids (lb /yr)
Projects Completed Before July 1, 2018	3,209	692	106,658
Green alley stormwater management program	4	0.56	208
Little Westham Creek stream restoration	4,073	1,590	548,000
Pocosham Creek stream restoration	4,696	1,061	354,013
Pine Camp Creek stream restoration	7,841	3,566	4,383,306
Total	19,823	6,910	5,391,977

The second permit term required reductions will be exceeded, and the additional nutrient and sediment reductions will be applied to the reductions required in the third permit term. The credit from this Plan to be applied in the third permit term includes 14,882 lb/yr TN, 5,918 lb/yr TP, and 4,918,384 lb/yr TSS, as shown in Table ES-7.

Table ES-7. Reductions to be Applied in the Third Permit Term

Project	Total Nitrogen (lb /yr)	Total Phosphorus (lb /yr)	Total Suspended Solids (lb /yr)
Second Permit Term Reductions Achieved	19,823	6,910	5,391,977
Second Permit Term Required Reduction	4,941	1,090	473,593
Reductions to be Applied in Third Permit Term	14,882	5,819	4,918,384

The City is planning additional projects for future fiscal years. Specific project data are not yet available for inclusion in this Plan; however, the City will document these projects as they are designed and constructed and incorporate them into future plans and annual reports.

In addition to a review of the MS4 service area and the identification of projects to meet the 40 percent required reduction, the City has provided a review of the legal authority it has to implement the Chesapeake Bay TMDL. This review is provided in Section 2.

This second permit term TMDL Action Plan will become effective within 90 days of its submittal to DEQ, unless DEQ notifies the City otherwise. It represents the City's plan for meeting its Integrated Permit requirements for the Chesapeake Bay TMDL Special Condition through 2023.

Section 1

Introduction

The City of Richmond (City) has developed this second permit term Total Maximum Daily Load (TMDL) Action Plan (Plan) for the Chesapeake Bay nutrient and sediment TMDL, as required by the City's *Authorization to Discharge under the Virginia Pollution Discharge Elimination System (VPDES) and the Virginia State Water Control Law* (Integrated Permit) (Permit No. VA0063177). Though the Integrated Permit encompasses requirements for the City wastewater, combined sewer, and municipal separate storm sewer systems (MS4), this Plan addresses discharges from only the MS4. It was developed according to the Virginia Department of Environmental Quality (DEQ) *Guidance Memo No. 20-2003 Chesapeake Bay TMDL Special Condition Guidance* (Guidance Document) dated February 6, 2021. This Plan is the second of three plans to be developed by the City over three permit terms to reduce the total nitrogen (TN), total phosphorus (TP), and total suspended solids (TSS) loads from urban stormwater runoff.

The City is located within the James River Basin in central Virginia, and has a total land area of 40,011 acres, as shown in Figure 1-1. It is bordered by Chesterfield and Henrico Counties and is bisected by the James River. The City is located entirely within the 2010 US Census Urban Area named Richmond, Virginia.

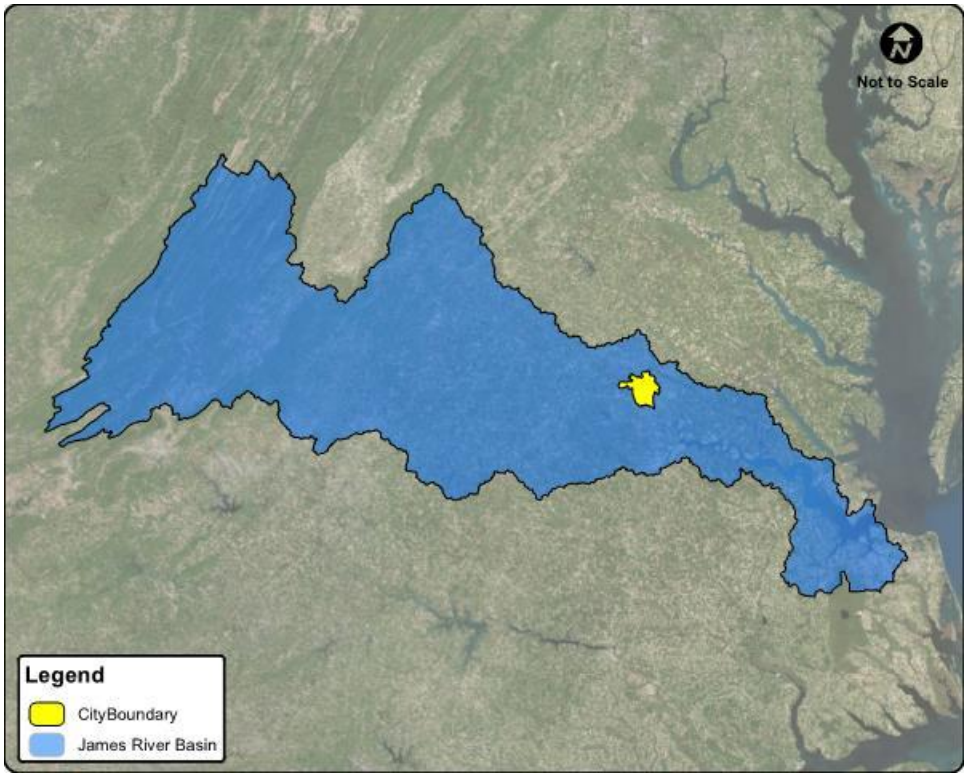

Figure 1-1. Richmond and the James River Basin.

The following sections describe the delineation of the 2009 City MS4 service area, modifications to the calculation of the pollutant of concern (POC) loads and reduction requirements, projects that the City has implemented to reduce pollutant loads, and projects that the City plans to implement to meet the reductions. This Plan also includes an evaluation of new legal authorities to implement the Plan.

Section 2

Legal Authority for TMDL Implementation

The Integrated Permit requires that the Plan document new or modified legal authorities, including ordinances, permits, policy, specific contract language, orders, and inter-jurisdictional agreements.

The City obtained an integrated permit from the Virginia DEQ, consolidating the VPDES regulatory requirements for the MS4, combined sewer system, wastewater system, and wastewater treatment plant. The Integrated Permit (Permit No. VA0063177) went into effect on October 1, 2018, and will expire on September 30, 2023. The combined permit simplifies reporting, including progress toward the Chesapeake Bay TMDL, and incorporates other elements from the Phase II MS4 permit previously held by the City.

No new legal authority is required to implement this Plan or meet the requirements described in the Integrated Permit. This Plan complies with the requirements described in Part IV.F.10 of the Integrated Permit.

Section 3

POC Loads and Required Reductions

In accordance with the Integrated Permit and Guidance Document dated February 6, 2021, POC loads and second permit required reductions were calculated from the City's MS4 service area and land cover as of June 30, 2009. For the first permit term plan, titled *Chesapeake Bay TMDL Action Plan Permit No. VAR040005 2013-2018*, the MS4 service area was delineated from the City boundary and 2000 US Census Urban Area, excluding the combined sewer system (CSS) service area, other MS4 and VPDES permittees, forested areas, open water bodies, and areas of surface runoff away from the MS4. The City also evaluated areas of surface runoff into the MS4 and included these areas in its service area.

For the second permit term, the MS4 service area was modified to remove areas outside the City that may flow into the MS4. This is due to their inclusion in the MS4 service areas of the owning neighboring counties, which led to double counting of loads and required reductions from these possible inflow areas to the City.

After the MS4 service area was modified, the land cover characteristics as of June 30, 2009, were estimated, and POC loads and reduction requirements were modified to remove the inflow areas based upon the James River Basin rates provided in the Integrated Permit. Finally, additional loads from new sources were evaluated and the cumulative first and second permit term required reductions were calculated. Each of these steps is described further in subsections below.

3.1 Modification of the MS4 Service Area

In accordance with the previous Guidance Document dated May 18, 2015, the MS4 service area was originally delineated using the 2000 US Census Urban Areas and the City boundary in the first permit term Plan. For the second permit term, the MS4 service area must be delineated with the 2010 US Census Urban Area boundary; however, because the City is entirely contained by both the 2000 and 2010 US Census Area, there are no associated changed to the extent of the MS4 service area as per to Guidance Document dated February 6, 2021.

As delineated for the City's first permit term Plan, the MS4 service area included inflow areas from Henrico and Chesterfield Counties. After review, it was determined that these areas are addressed in Chesapeake Bay TMDL Action Plans of those jurisdictions. Therefore, the inflow areas were removed from the City's MS4 service area to avoid double counting of nutrient and sediment load reduction responsibilities.

The MS4 service area calculations were modified from the first permit term Plan to remove the inflow areas, as shown in Table 3-1. The development of the exclusion areas is documented in the first permit term Plan. The final MS4 service area to be used in the POC load and required reduction calculations is 21,380 acres.

Table 3-1. Areas of Inclusion and Exclusion from the MS4 Service Area	
Area Category	Area (Ac)
City of Richmond Boundary	40,011
Exclusion Areas (inside City boundary)	18,631
Inclusion Area (outside City boundary)	0
Total MS4 Service Area	**21,380**

3.2 Estimated Existing Source Loads

The baseline (2009) annual POC loading rates, as documented in the City first permit term Plan, and calculated according to the Guidance Document dated May 18, 2015, were estimated by the Chesapeake Bay Program using the Phase 5.3.2 version of the Chesapeake Bay Watershed Model. The 2009 pervious and impervious land cover within the service area were previously estimated using the City's 2014 impervious land cover and the 2006 and 2011 United States Geological Survey (USGS) National Land Cover Dataset (NLCD) land cover GIS files in the first permit term Plan. The annual POC loads for the City were then calculated using the 2009 pervious and impervious lands cover conditions within the MS4 service area. No modifications have been made to this land cover methodology from the first permit term Plan.

3.2.1 2009 Pervious and Impervious Land Cover

The 2009 land cover characteristics were estimated from the 2014 impervious area in the City and an estimate of the annual average change in land cover, which itself was derived from the 2006 and 2011 USGS NLCD GIS files. The impervious cover files were clipped to the MS4 service area, and the pervious cover was calculated as the remaining area, as shown in Figure 3-1 and Table 3-2.

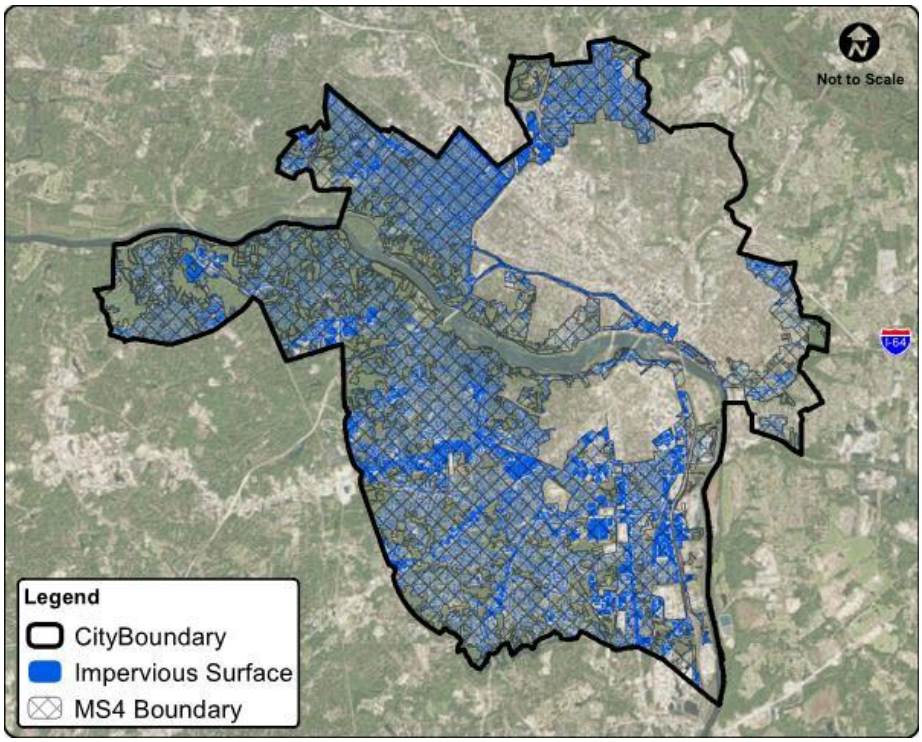

Figure 3-1. Impervious areas within the MS4 service area.

Table 3-2. MS4 Service Area Land Cover in 2009 and 2014					
Land Cover	2014 MS4 Land Cover (ac)[a]	2006 NLCD Land Cover (ac)[b]	2011 NLCD Land Cover (ac)[b]	2006-2011 USGS Average Annual Change	Estimated 2009 MS4 Land Cover (ac)[c]
Impervious	7,378	5,799	5,953	0.144%	7,224
Pervious	14,002	15,544	15,390	-0.144%	14,156
Total Area	21,380	21,343	21,343		21,380

a. *Impervious land cover provided by the City from the GIS basemap dataset. Impervious land cover was digitized from aerial imagery.*

b. *Pervious and Impervious land covers calculated from USGS land cover raster imagery. Data resolution is a 30-meter grid.*

c. *Dataset is an estimate of the historical land cover. GIS datasets from 2009 were not available.*

3.2.2 Annual POC Load Calculations – Existing Sources as of 2009

The second permit term MS4 service area defined in Section 3.1, and the land cover estimates described in Section 3.2.1, were used to calculate the annual pollutant loads under 2009 conditions. The annual pollutant loading rates are prescribed in the Integrated Permit by drainage basin. Pollutant loading rates have been defined for pervious and impervious urban lands for TN, TP, and TSS at the edge of stream (EOS).

Table 3-3 presents the existing source loads for the City, within the James River Basin, as calculated from loading rates in Table 3 of the Integrated Permit. The existing source loads are 166,784 pounds per year (lb/yr) of TN, 19,792 lb/yr of TP, and 6,321,074 lb/yr of TSS.

Table 3-3. Existing (2009) Source Loads for the James River Basin					
Subsource	Pollutant	Total Existing Acres Served by MS4 (06/30/09)	2009 EOS Loading Rate (lb/Ac/yr)	Estimated Total POC Load Based on 2009 Progress Run (lb/yr)	Estimated Total POC Load (lb/yr)
Regulated Urban impervious	Total Nitrogen	7,223.95	9.39	67,8323	166,784
Regulated Urban Pervious		14,156.05	6.99	98,951	
Regulated Urban impervious	Total Phosphorus	7,223.95	1.76	12,714	19,792
Regulated Urban Pervious		14,156.05	0.50	7,078	
Regulated Urban impervious	Total Suspended Solids	7,223.95	676.94	4,890,181	6,321,074
Regulated Urban Pervious		14,156.05	101.08	1,430,893	

3.3 Required Pollutant Reductions

The required reductions of POCs from existing (2009) sources in the Integrated Permit are consistent with the Chesapeake Bay TMDL and the Virginia Phase I, II, and III Watershed Implementation Plans, and are based on the Chesapeake Bay Watershed Model Phase 5.3.2 L2 scoping run for existing developed lands. The total required reductions from the annual pollutant loading rates vary for each

pollutant and land cover. As specified in the Virginia Phase III Watershed Improvement Plan, the required second permit term pollutant reductions are an additional 35 percent of the total required reductions specified in the L2 scoping run. By the end of second permit term, a total of 40 percent of the total required reductions will be achieved. The City has identified projects to achieve the required pollution reductions to the maximum extent practicable for the second permit term as detailed in Section 4 of this Plan. The total required reductions across all three permit terms and cumulative first and second permit term reductions per acre for the James River Basin are identified in Table 3-4.

Table 3-4. Required POC Reduction Rates from Existing (2009) Sources for the James River Basin

Subsource	Pollutant	2009 EOS Loading Rate (lb/ac/yr)	Total Percent Required Reduction	Total Required Reduction (lb/ac/yr)	First and Second Permit Term Required Reduction (lb/ac/yr)
Regulated Urban impervious	Total Nitrogen	9.39	9%	0.8451	0.33804
Regulated Urban Pervious		6.99	6%	0.4194	0.16776
Regulated Urban impervious	Total Phosphorus	1.76	16%	0.2816	0.11264
Regulated Urban Pervious		0.5	7.25%	0.03625	0.0145
Regulated Urban impervious	Total Suspended Solids	676.94	20%	135.388	54.1552
Regulated Urban Pervious		101.08	8.75%	8.8445	3.5378

Table 3-5 presents the City's required reductions from existing sources, as calculated from reduction rates in Table 3 of the City Integrated Permit. The cumulative first and second permit term required reductions for existing sources within the City are 4,817 lb/yr of TN, 1,019 lb/yr of TP, and 441,296 lb/yr of TSS.

Table 3-5. Second Permit Term Required Reductions from Existing (2009) Sources for the James River Basin					
Subsource	Pollutant	Total Existing Acres Served by MS4 (06/30/09)	First and Second Permit Cycle Required Reduction in Loading Rate (lb/ac/yr)	Total Reduction Required Second Permit Cycle (lb/yr)	Total Reduction Required Second Permit Cycle (lb/yr)
Regulated Urban impervious	Total Nitrogen	7,224	0.33804	2,441.98	4,817
Regulated Urban Pervious		14,156	0.16776	2,374.82	
Regulated Urban impervious	Total Phosphorus	7,224	0.11264	813.71	1,019
Regulated Urban Pervious		14,156	0.0145	205.26	
Regulated Urban impervious	Total Suspended Solids	7,224	54.1552	391,214.46	441,296
Regulated Urban Pervious		14,156	3.5378	50,081.27	

3.4 Additional Source Loads and Required Reductions

In addition to the required pollution reductions for existing development, the City must account for any increased pollutant loads from new sources and grandfathered projects. New sources are addressed in Section IV.F.3 of the Integrated Permit. Grandfathered projects are addressed in Section IV.F.4 of the Integrated Permit. By the end of the second permit term, the City is required to provide treatment to remove 40 percent of the net increase in pollutant loads for any developments that meet the criteria of new source loads. The City must also completely offset the increase in pollutant loads for any project that meets the criteria for grandfathered projects.

3.4.1 Means and Methods to Offset Increased Loads from New Sources Initiating Construction between July 1, 2009, and June 30, 2019

Section IV.F.3 of the Integrated Permit pertains to certain projects that initiated construction between July 1, 2009, and June 30, 2019, and meet the following criteria:

- Greater than one acre of land disturbance
- Increase in the POC loads from existing condition
- An impervious land cover condition greater than 16 percent for the design of post-development stormwater management facilities

The City is required to provide additional POC load reductions for any project that meets the Section IV.F.3 criteria. Within the City, projects constructed between July 1, 2009, and July 1, 2014, may qualify as a new source. After July 1, 2014, projects were required to meet or exceed the Section IV.F.3 criteria through the City regulations and standards. For those projects initiating construction between July 1, 2009, and July 1, 2014, the aggregate accounting method was selected in the 2015 *Chesapeake Bay TMDL Action Plan* to determine the additional treatment requirements from new sources, as initially described in Example II.2 in the Guidance Document dated May 18, 2015, and retained in the Guidance Document dated February 6, 2021.

The additional POC reductions associated Section IV.F.3 were calculated using the steps described in the first permit term Plan. Tables 3-6 and 3-7 estimate the post-development POC loads and the estimated changes in loads from June 30, 2009, to July 1, 2014, for the updated MS4 service area modified in this Plan.

Table 3-6. Post-Development Conditions July 1, 2014

Subsource	Pollutant	Total Existing Acres Served by the MS4 (07/01/14)	2009 EOS Loading Rate (lb/Ac)	Estimated Total POC Load as of 07/01/14
Regulated Urban Impervious	Total Nitrogen	7,378	9.39	69,279
Regulated Urban Pervious		14,002	6.99	97,874
Regulated Urban Impervious	Total Phosphorus	7,378	1.76	12,985
Regulated Urban Pervious		14,002	0.50	7,001
Regulated Urban Impervious	Total Suspended Solids	7,378	676.94	4,994,463
Regulated Urban Pervious		14,002	101.08	1,415,322

Table 3-7. Total Load Changes from New Sources between June 30, 2009, and July 1, 2014

Subsource	Pollutant	Estimated Total POC Load as of 07/01/14 (lb/yr)	Estimated Total POC Load as of 06/30/09 (lb/yr)	Load Change (lb/yr)	Total Load Change (lb/yr)
Regulated Urban Impervious	Total Nitrogen	69,279	67,853	1,446	370
Regulated Urban Pervious		97,874	98,951	(1,077)	
Regulated Urban Impervious	Total Phosphorus	12,985	12,714	271	194
Regulated Urban Pervious		7,001	7,078	(77)	
Regulated Urban Impervious	Total Suspended Solids	4,994,463	4,890,181	104,283	88,711
Regulated Urban Pervious		1,415,332	1,430,893	(15,571)	

Next, the best management practices (BMPs) that were implemented between June 30, 2009, and July 1, 2014, were evaluated to determine the total treatment provided. Per the 2015 *Chesapeake Bay TMDL Action Plan*, the total POC reduction from BMPs is 59.90 lb for TN, 15.40 lb for TP, and 7,968.70 lb for TSS. The POC reduction from BMPs was subtracted from the total change in loads, as shown in Table 3-8.

Table 3-8. Net Load Change (Total Load Change Minus Reductions from Implemented BMPs)			
Pollutant	Total Load Change (lb/yr)	Reductions from On-site BMPs (lb/yr)	Net Load Change (lb/yr)
Total Nitrogen	370	59.90	310
Total Phosphorus	194	15.40	179
Total Suspended Solids	88,711	7,968.70	80,743

The City is required to treat the entire net load change to the maximum extent practicable during the three permit terms in 5 percent, 35 percent, and 60 percent increments. In the current (second) permit term, the City is required to offset a cumulative 40 percent of the net load change to the maximum extent practicable (Table 3-9) associated with new sources. The method utilized by the City to achieve the required reductions is discussed in Section 4.

Table 3-9. Additional Reductions Required During Second Permit Cycle			
Pollutant	Net Load Change (lb/yr)	Required Reduction during Second Permit Cycle	Additional Reductions Required during Second Permit Cycle (lb/yr)
Total Nitrogen	310	40%	124
Total Phosphorus	179	40%	72
Total Suspended Solids	80,743	40%	32,297

3.4.2 Means and Methods to Offset Increased Loads from Grandfathered Projects that Begin Construction after July 1, 2014

Section IV.F.4 of the Integrated Permit applies to all projects with construction initiated after July 1, 2014, and designs that meet the following requirements:

- Greater than one acre of land disturbance
- Increase in the pollutant loads from existing condition
- An impervious land cover condition greater than 16 percent for the design of post-development stormwater management facilities

The City is required to provide additional pollutant load reductions for any project that meets the Section IV.F.4 requirements above prior to project construction completion. The reduction requirement is calculated as the difference between (1) the post-development loading rate; and (2) the loading rate associated with sixteen percent impervious cover.

The City revised its VSMP requirements to meet the 16 percent impervious land cover requirements for the design of post-development stormwater management facilities in 2009. Since the requirements were revised in 2009, the City does not anticipate that any projects will meet the criteria for Section IV.F.4.

3.5 Cumulative First and Second Permit Term Required Reductions

The total required reductions by the end of second permit term cycle are the combined total POC loads from existing developments and new sources for both the first and second permit cycles. The

cumulative required reductions through the second permit term are 4,941 lb of TN, 1,091 lb of TP, and 473,593 lb of TSS, as shown in Table 3-10.

Table 3-10. Total Reductions Required Through Second Permit Cycle

Pollutant	Baseline Required Reductions (lb/yr)	Required Reductions from New Sources (lb/yr)	Required Reductions from Grandfathered Projects (lb/yr)	Total Second Permit Term Required Reductions (lb/yr)
Total Nitrogen	4,817	124	0	4,941
Total Phosphorus	1,019	72	0	1,091
Total Suspended Solids	441,296	32,297	0	473,593

Section 4

Means and Methods to Meet Required Reductions

The Integrated Permit requires that the Plan identify the means and methods to meet the required nutrient and sediment reductions. The City has completed and planned stream restoration projects, wet pond retrofits, green alley restoration, and calculated nutrient and sediment reductions obtained by redevelopment projects that meet Virginia Stormwater Management Program (VSMP) requirements or development projects that over-sized BMPs to reduce pollutant loads. All methods discussed in this Plan are prescribed by expert panels approved by the Chesapeake Bay Program or the Guidance Document. The following sections discuss projects completed prior to July 1, 2018, and those completed or planned to be complete before the end of the 2018-2023 permit term.

4.1 Historical BMP Data

Prior to the first permit term, the City provided DEQ with information on BMPs installed prior to July 1, 2009. No additional historical projects are provided as a part of this Plan.

4.2 Projects Completed Prior to July 1, 2018

The following five projects and programs were completed prior to July 1, 2018:

- Development and redevelopment sites
- Green alley improvements
- Maury Cemetery stream restoration
- Cherokee Lake wet pond enhancement
- Forest Hill Park wet pond retrofit

Project locations are identified in Figure 1 of Appendix A.

4.2.1 Development and Redevelopment Projects

Per the Guidance Document, permittees may receive credit for pollutant reductions from BMPs installed to meet VSMP requirements under the following conditions:

- Pollutant reductions are the results of a redevelopment project completed after July 1, 2014
- The BMP was installed to meet development standards stricter than the state standards after July 1, 2012
- The BMP was oversized, and the excess capacity has not been used to offset other development

The City reviewed site development plans of 21 projects completed in the MS4 service area between July 1, 2014, and July 27, 2017, and calculated the nutrient and sediment credit received based on the above criteria. For redevelopment projects, the pollutant reductions are calculated from the total difference in pre- and post-development loading from the site. For new development, the pollutant reductions claimed by the City are those that exceed the minimum reduction requirements. The POC

load reductions for those projects in the MS4 service area are 67.75 lb/yr TN, 15.23 lb/yr TP, and 4,441.22 lb/yr TSS. A list of the projects included in the review can be found in Appendix B.

4.2.2 Green Alley Stormwater Management Projects

The City is implementing the Green Alley Program to improve stormwater management in alleys across the City. The purpose of the Program is to implement low impact development techniques, infiltrate and filter stormwater, and demonstrate the potential of green infrastructure practices in the City. The City completed 13 projects prior to July 1, 2018. Of those projects, seven are within the City MS4 service area, the locations of which are shown in Figure 4-1. The pollutant reductions achieved by the individual projects, and cumulatively by the Green Alley Stormwater Management Program, are summarized in Table 4-1.

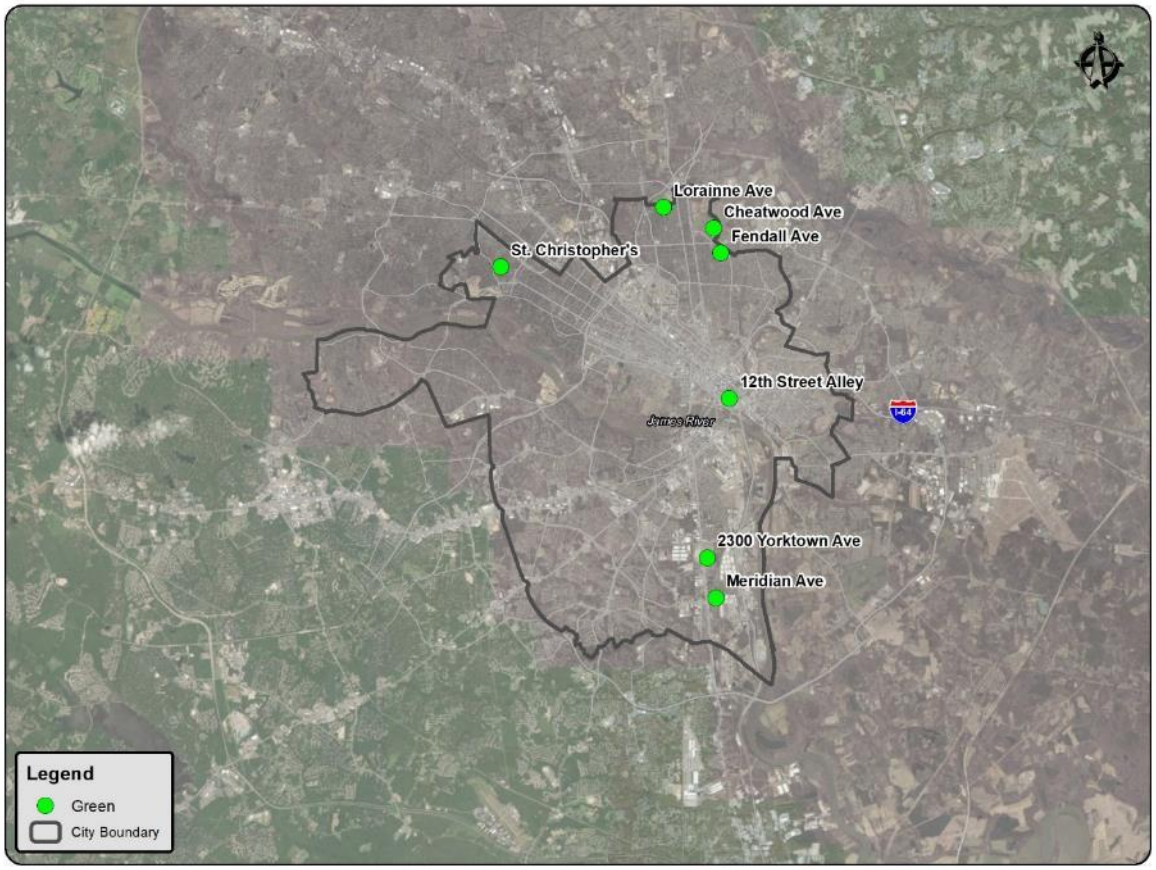

Figure 4-1. Approximate locations of green alley projects completed before July 1, 2018.

Table 4-1. Pollutant Removal Calculations for Green Alley Projects Before July 1, 2018				
Pollutant	**Year Completed**	**Total Nitrogen (lb /yr)**	**Total Phosphorus (lb /yr)**	**Total Suspended Solids (lb /yr)**
Fendall Ave	2011	1.80	0.30	99.2
12th Street	2012	0.80	0.30	297.9
St Christopher's Rd	2012	5.50	1.10	616.00
Meridian Ave	2017	1.00	0.20	76.2
Cheatwood Ave	2017	1.30	0.20	76.2
Lorainne Ave	2017	5.00	0.70	271.1
2300 Block Yorktown Ave	2018	5.25	0.74	225.5
Total Pollutant Removal (lb/yr)		20.65	3.54	1,662.1

Additional Green Alley Stormwater Management Program projects to be completed after July 1, 2018, or are in design and are documented in Section 4.3.2.

4.2.3 Maury Cemetery Stream Restoration

The Maury Cemetery Stream Restoration project, located in the City's Maury Cemetery, restored approximately 1,950 lf of stream channel. The project is bounded to the north by Maury Street, to the south by North Hopkins Road, to the east by an existing CSX railroad, and to the west by Maury Cemetery. The restoration, completed in May 2018, improved the overall function of the Maury Cemetery Stream by preventing erosion, restoring habitat, and improving the water quality in the stream. The approximate project location is shown in Figure 4-2.

Figure 4-2. Approximate location of the Maury Cemetery Creek stream restoration.

Following the development of the 2015 *Chesapeake Bay TMDL Action Plan*, the City re-calculated the pollutant removal using the four Stream Restoration Protocols approved by the Chesapeake Bay Program. The Protocols are described in the report, *Recommendations of the Expert Panel to Define Removal Rates for Individual Stream Restoration Projects* dated September 8, 2014, which was the most recent version of the Stream Restoration Protocols at the time of evaluation and reported to DEQ:

- Credit for prevention sediment during storm flow (Protocol 1)
- Credit for in-stream and riparian nutrient processing within the hyporheic zone during base flow (Protocol 2)
- Credit for floodplain reconnection volume (Protocol 3)

Using the approved methods to determine the credit for each protocol, it is estimated that the restored stream will remove 894 lb/yr of TN, 176 lb/yr of TP, and 58,720 lb/yr of TSS as shown in Table 4-2.

Table 4-2. Pollutant Removal Calculations for Maury Cemetery Stream Restoration*

Pollutant	Total Nitrogen	Total Phosphorus	Total Suspended Solids
Protocol 1	382	176	58,621
Protocol 2	510	0	0
Protocol 3	2	0.2	98
Total Pollutant Removal (lb/yr)	894	176	58,720

** Protocol 4 does not apply to this project and, therefore, is not included in these calculations.*

4.2.4 Cherokee Lake Wet Pond Enhancement

Cherokee Lake is a large detention reservoir in the northwest portion of the City. It collects runoff from 351 acres, which is composed primarily of managed turf (292 acres) and some impervious area (59 acres), and discharges to the James River. The approximate project location is included in Figure 4-3.

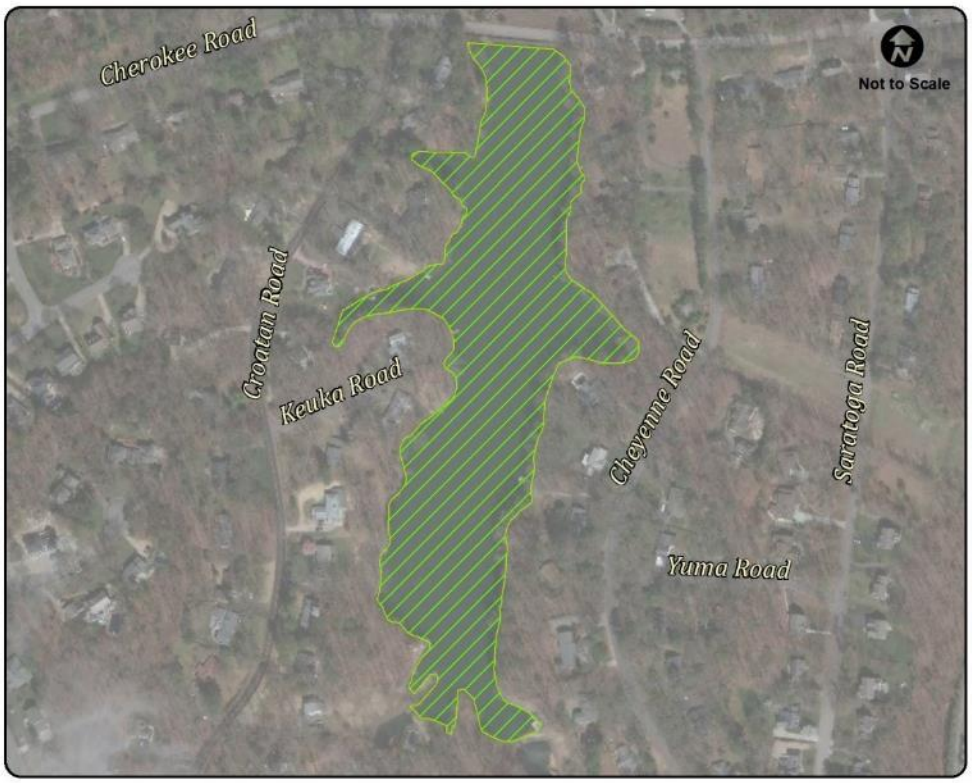

Figure 4-3. Cherokee Lake wet pond enhancement project location

The existing pond was built before 2006 and was not constructed to the current DEQ BMP Clearinghouse specifications. However, the pond was considered to provide some water quality treatment. It was retrofitted to a Level 2 Wet Pond in 2018 with the addition of a forebay to provide extended detention.

To calculate the amount of nutrient removal prior to the enhancements, the unimproved reservoir was treated as a wet pond. However, due to the absence of a riser/low-flow orifice and a forebay, the treatment efficiencies for the existing pond were reduced by 20 percent. The nutrient removal credit claimed by the City is the difference between the pollutant reductions of the enhanced Level 2 Wet Pond minus the existing pollutant removal (Brown and Caldwell, 2018). The calculations are summarized in Table 4-3.

Table 4-3. Pollutant Removal Calculations for Cherokee Lake Wet Pond Enhancement

Pollutant	Removal Efficiency of Existing BMP	Downward Modification	Actual Removal Efficiency of Existing BMP	Untreated Load (lb/yr)	Load Removed by Existing Practice (lb/yr)	Load Removed by Level 2 Wet Pond	Load Removed by Retrofit
Total Nitrogen	20%	20%	16%	3,634.87	581.58	1,453.95	872.37
Total Phosphorus	45%	20%	36%	508.10	182.92	381.07	198.15
Total Suspended Solids	60%	20%	48%	53,462.72	25,662.11	42,341.94	16,679.83

4.2.5 Forest Hill Park Wet Pond Retrofit

Forest Hill Park Lake collects stormwater runoff from 2,688 acres and discharges to the James River. The lake is located north of Forest Hill Avenue and south of the James River. The approximate project location is included in Figure 4-4.

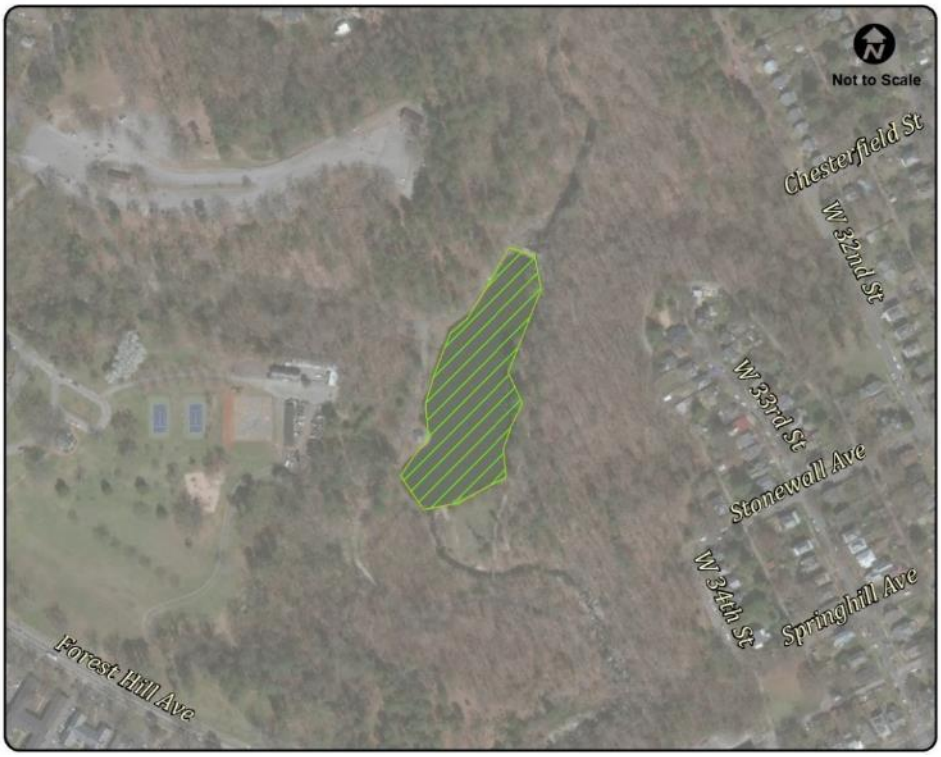

Figure 4-4. Forest Hill wet pond retrofit project location

The lake, which was built in 2009, was completely silted when the site was selected to be retrofit. Therefore, the pre-retrofit pollutant reduction was considered to be zero. In 2010, the lake was dredged, and construction of forebays and an adjacent wetland area was completed in 2018. Based on the volumetric capacity of the new wet pond and wetlands, the combined system can treat 430 acres. The pollutant removal efficiency of the pond is based on that of a Level 1 Wet Pond. Therefore, the retrofitted system can remove 1,354 lb/yr TN, 299 lb/yr TP, and 25,155 lb/yr TSS (Brown and Caldwell, 2018), as shown in Table 4-4.

Table 4-4. Pollutant Removal Calculations for Forest Hill Park Wet Pond Retrofit

Pollutant	Total Nitrogen	Total Phosphorus	Total Suspended Solids
Pollutant Removal (lb/yr)	1,354	299	25,155

4.2.6 Reductions Achieved by July 1, 2018

The nutrient and sediment annual load reductions from the above projects are summarized and shown in Table 4-5.

Table 4-5. Reductions for Projects Completed Before July 1, 2018

Project	Total Nitrogen (lb /yr)	Total Phosphorus (lb /yr)	Total Suspended Solids (lb /yr)
Development and redevelopment sites	67.8	15.2	4,441
Green alley improvements	20.7	3.5	1,662
Cherokee Lake wet pond enhancement	872	198	16,680
Forest Hill Park wet pond retrofit	1,354	299	25,155
Maury Cemetery Stream Restoration	894	176	58,720
Total Pollutant Removal (lb /yr)	3,209	692	106,658

4.3 Projects Completed or To Be Completed by End of the Second Permit Term

The City has identified four projects to achieve the remaining required reductions for the current permit cycles:

- Green alley stormwater management program
- Little Westham Creek stream restoration
- Pocosham Creek stream restoration
- Pine Camp Creek stream restoration

These projects were completed after July 1, 2018, are in design or construction, or are anticipated to be completed prior to the end of the current permit term. Each project location is identified in Figure 1 of Appendix A. Alternative projects may be substituted during the current permit cycle at the City's discretion to achieve the required POC reductions.

4.3.1 Green Alley Stormwater Management Program Projects

The City will continue to implement the Green Alley Stormwater Management Program to improve stormwater management in alleys in downtown Richmond. The City will complete an additional green alley project in the Forest View neighborhood before the end of the current permit term. The project location is shown in Figure 4-5.

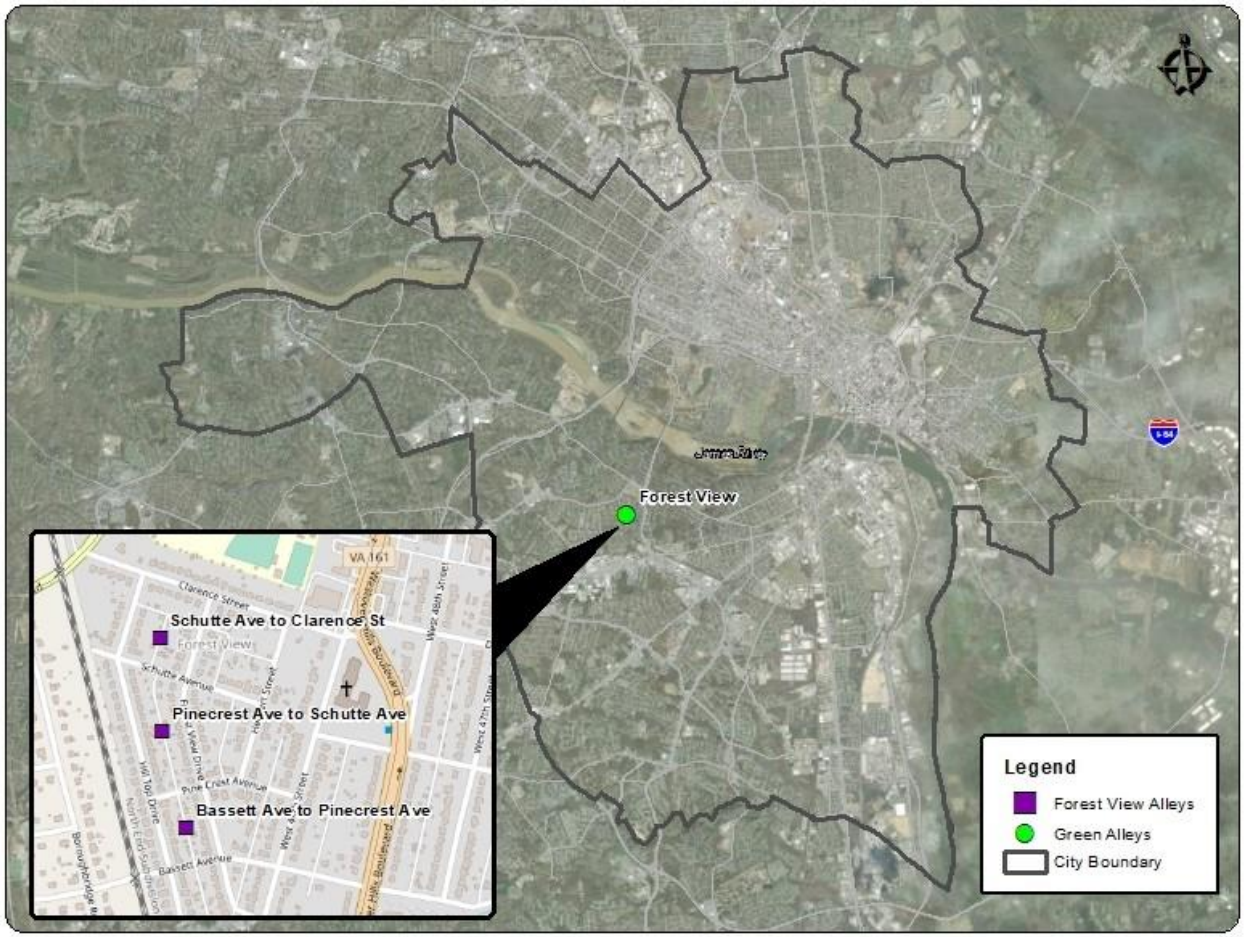

Figure 4-5. Approximate locations of the green alley improvements to be completed after July 1, 2018.

Table 4-6 summarizes the pollutant removal provided by the green alley. The project is a Permeable Pavement Level 1 BMP; therefore, the practice is assumed to remove 59 percent of the TN and TP load and 70% of the TSS load from the BMP drainage area, which is also included in Table 4-6.

Table 4-6. Projected Pollutant Removal Calculations for Forest View Green Alley

Permeable Alley Location	Impervious Area Treated (ac)	Total Nitrogen (lb/yr)	Total Phosphorus (lb/yr)	Total Suspended Solids (lb/yr)
Bassett Avenue to Pinecrest Avenue	0.12	1.09	0.15	56.86
Pinecrest Avenue to Schutte Avenue	0.22	2.0	0.28	104.25
Schutte Avenue to Clarence Street	0.10	0.91	0.13	47.39
Total Pollutant Removal	0.44	4.00	0.56	208.50

The Forest View neighborhood project is in design and will replace 0.44 acres of impervious surfaces with permeable pavers to increase the infiltration of stormwater runoff. The project is anticipated to be completed in 2021.

4.3.2 Little Westham Creek Stream Restoration

Little Westham Creek is located on the campus of the University of Richmond, as shown in Figure 4-6. The project site is bounded by River Road to the south, the Country Club of Virginia-Westhampton to the east, Westhampton Way to the north, and the University of Intramural Fields on UR Drive to the west. The drainage area for this stream is regulated urban and forested land and lies within the city's regulated area. The stream restoration is part of a larger restoration project called the Gambles Mill Eco-Corridor, which includes several initiatives implemented by or in partnership with the University of Richmond. The Eco-Corridor also includes a walking trail and educational signage, a meadow with native plant species, and a stormwater demonstration area with a bioswale, rain garden, and level spreaders. The site also functions as a working classroom for students. Pre-restoration conditions of the stream, including an outfall (left) and an old, exposed wastewater pipe (right) are depicted in Figure 4-7.

Figure 4-6. Approximate location of the Little Westham Creek stream restoration project

Figure 4-7. Pre-restoration images of Little Westham Creek.

The stream restoration was completed in 2019. The project restored 2,300 lf of stream, resulting in the removal of 1,224 lb/year of total phosphorus. The credit for the project was calculated using the 2014 Stream Restoration Protocols. The pollutant removal achieved through each Protocol is summarized in Table 4-7 below.

Table 4-7. Pollutant Removal Calculations for Little Westham Creek Stream Restoration

Pollutant	Total Nitrogen	Total Phosphorus	Total Suspended Solids
Protocol 1	3,452	1,590	548,000
Protocol 2	621	N/A	N/A
Total Load Reductions (lb/yr)	4,073	1,590	548,000

Annual inspections of post-restoration conditions for Little Westham Creek are monitored through site photography, BEHI assessments, and post-construction surveys.

4.3.3 Pocosham Creek Stream Restoration

The Pocosham Creek stream restoration project is located on a tributary of Pocoshock Creek that flows into Falling Creek, which flows to the James River. The unnamed tributary, near Pocosham Drive, drains approximately 3,625 acres of mostly suburban and forest lands in the southwestern part of the City, west of the James River. Approximately half of the watershed is located within the City limits, and the other half is in Chesterfield County. The restoration project restored 5,293 lf of stream channel. The project drainage area and location are shown in Figures 4-8 and 4-9.

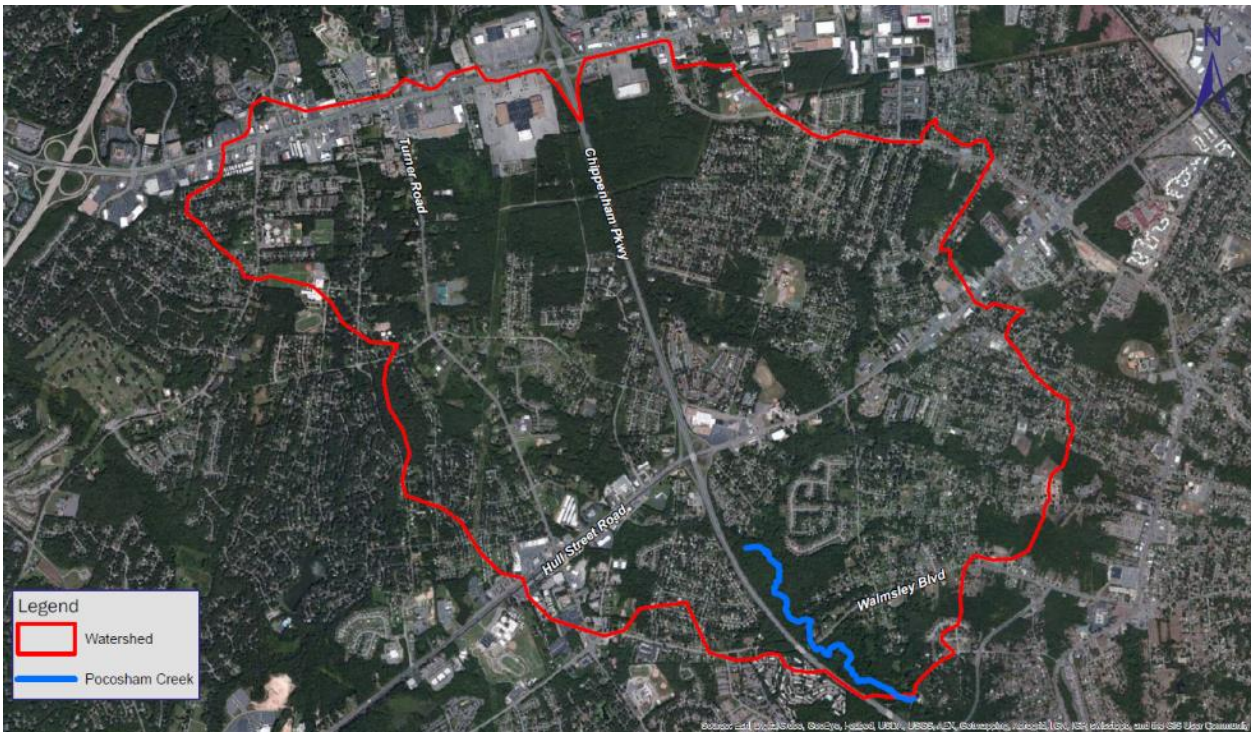

Figure 4-8. Drainage area contributing to the Pocosham Creek stream.

Figure 4-9. Approximate location of the Pocosham Creek stream restoration.

The project included repairs to eroding sections of the creek and the addition of a bankfull floodplain bench to reduce velocities and erosion. The pre-restoration conditions of the channel are depicted in Figure 4-10. In-stream structures, such as cross vanes, j-hook vanes, and vanes were implemented to improve stability and create and enhance habitat within the creek corridor. The project also incorporates walking trails to improve access and amenities in Pocosham Park. Construction was completed in August 2019.

Figure 4-10. Images of pre-restoration condition of Pocosham Creek stream channel.

Using the 2014 Stream Restoration Protocols, the pollutant reductions from the restored stream are 4,696 lb/yr TN, 1,061 lb/yr TP, and 354,013 lb/yr TSS, as shown in Table 4-8.

Table 4-8. Pollutant Removal Calculations for Pocosham Creek Stream Restoration			
Pollutant	Total Nitrogen	Total Phosphorus	Total Suspended Solids
Protocol 1	2,296	1,058	352,500
Protocol 2	2,359	0	0
Protocol 3	40	4	1,513
Pollutant Removal (lb/yr)	4,696	1,061	354,013

4.3.4 Pine Camp Creek Stream Restoration

Pine Camp Creek references an unnamed tributary located behind the Pine Camp Arts and Community Center on the northern side of Richmond. The project will restore 2,220 lf of stream between Old Brook Road and the confluence with Horse Creek, which flows to the Chickahominy River. The forested land around the creek is visited frequently students from a nearby middle and high school as well as residents from the surrounding neighborhoods for education and recreation. The proposed restoration site receives drainage from approximately 198 acres of forested, turf, and impervious lands. All developed land that drains to the site is part of the City's MS4 service area.

The current conditions of the stream show signs of bank erosion. Planned improvements focus on addressing these issues as well as water quality improvement. Restoration plans for the stream channel also address pipe separation and failure of a 60" RCP Stormwater pipe located on Old Brook Rd. The approximate project drainage area and location are shown in Figures 4-11 and 4-12.

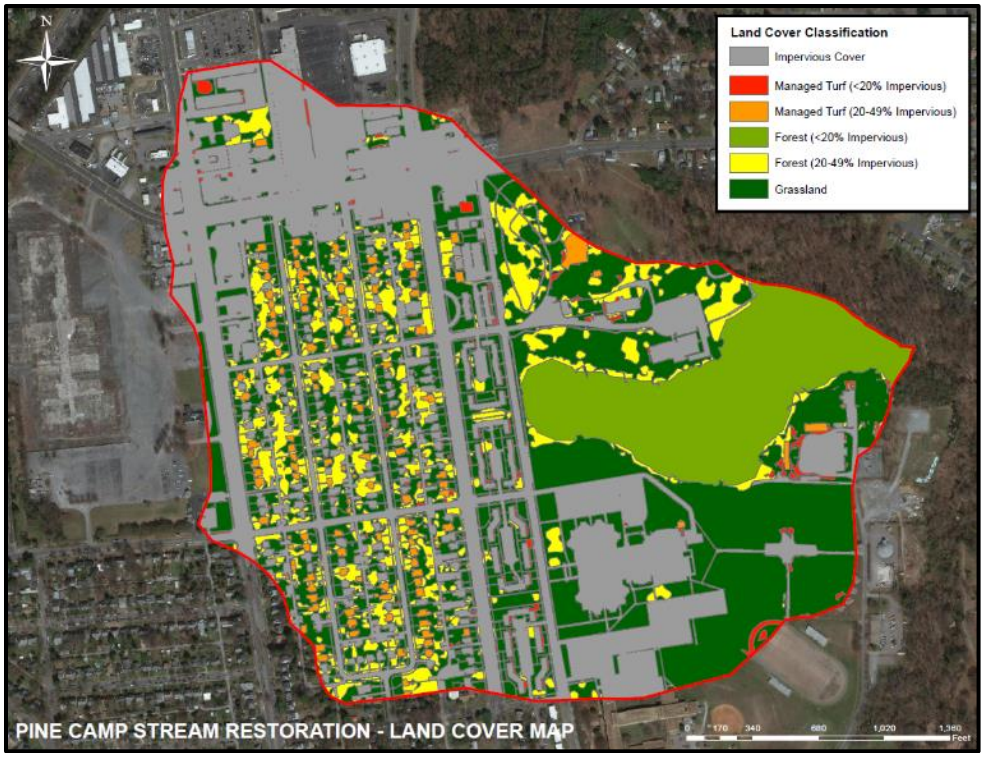

Figure 4-11. Drainage area and land coverage contributing to Pine Camp Creek stream.

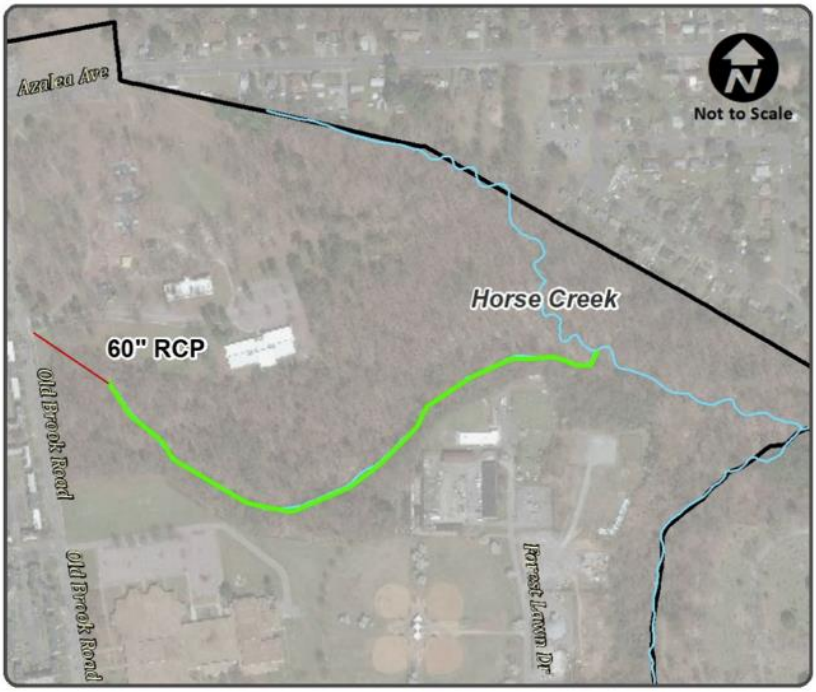

Figure 4-12. Approximate location of the Pine Camp Creek stream restoration.

The project will employ natural channel design practices to emphasize contribution to stream functional improvements while reducing stormwater pollutants. Images in Figure 4-13 display the pre-existing conditions of the unnamed tributary, including debris build-up and bank erosion. Proposed stream restoration efforts will involve step-pools/plunge pools for energy dissipation at pipe outfalls into the creek, a series of step-pools in a steep section of the creek, wetland areas on a floodplain bench downstream, and increased sinuosity and vegetative cover throughout the stream reach. These natural channel design techniques are intended to provide pollutant abatement and improve water quality, improve diversity of aquatic habitat areas, and reduce bank erosion.

Figure 4-13. Pre-restoration condition of Pine Camp Creek stream channel.

Using the 2014 Stream Restoration Protocols and the *Recommendations for Crediting Outfall and Gully Stabilization Projects in the Chesapeake Bay Watershed* expert panel report dated October 15, 2019, the project is estimated to remove 7,841 lb/yr of TN, 3,566 lb/yr of TP, and 4,383,306 lb/yr of TSS as shown in Table 4-9.

Table 4-9. Pollutant Removal Calculations for Pine Camp Creek Stream Restoration

Pollutant	Total Nitrogen (lb/yr)	Total Phosphorus (lb/yr)	Total Suspended Solids (lb/yr)
Protocol 1	7,630	3,563	4,356,650
Protocol 2	203.6	0	0
Protocol 5	7.56	3.27	26,656
Pollutant Removal (lb/yr)	7,841	3,566	4,383,306

The project design was completed in December 2020 and construction is planned to be completed for the Spring of 2022.

4.3.5 Cumulative Pollutant Load Reductions

POC load reductions from the projects completed prior to July 1, 2018, and the five projects completed or anticipated to be complete by the end of the second permit term are summarized in Table 4-10, along with the total pollutant load reductions from all projects completed or planned to date.

Table 4-10. Cumulative Second Permit Term Pollutant Reduction Credits

Project	Total Nitrogen (lb /yr)	Total Phosphorus (lb /yr)	Total Suspended Solids (lb /yr)
Projects Completed Before July 1, 2018	3,209	692	106,658
Green alley stormwater management program	4	0.56	208
Little Westham Creek stream restoration	4,073	1,590	548,000
Pocosham Creek stream restoration	4,696	1,061	354,013
Pine Camp Creek stream restoration	7,841	3,566	4,383,306
Total	19,823	6,910	5,391,977

The cumulative first and second permit term required reductions will be exceeded, and the additional pollutant load reductions will be included in the third permit term Plan, as shown in Table 4-11.

Table 4-11. Second Permit Term Pollutant Reduction Requirements and Third Permit Term Credit			
Project	Total Nitrogen (lb /yr)	Total Phosphorus (lb /yr)	Total Suspended Solids (lb /yr)
Second Permit Term Reductions Achieved	19,823	6,910	5,391,977
Second Permit Term Required Reduction	4,941	1,090	473,593
Reductions to be Applied in Third Permit Term	14,882	5,819	4,918,384

4.4 A List of Future Projects and Associated Acreage that Qualify as Grandfathered

The City does not anticipate any developments that will meet the criteria for grandfathered projects, as defined in Section 2.4.2.

Section 5

Conclusion

The City developed this second permit term Plan as required in the City Integrated Permit Number VA0063177 and in accordance with the DEQ Guidance Document dated February 6, 2021. This Plan concludes that the second permit term pollutant reduction requirements calculated in Section 3 are met by the projects identified in Section 4 of the Plan.

During the third permit cycle, it is anticipated that permittees will be required to reduce an additional 60 percent POC reductions to the maximum extent practicable. The projects identified in this second permit term Plan exceed the cumulative first and second permit term required 40 percent reductions. Additional reductions achieved during the second permit term will be applied toward achieving the third permit term required 60 percent reductions. The City will continue to plan for compliance and provide updates to implementation within the Integrated Permit Annual Reports.

Section 6

Limitations

This document was prepared solely for the City of Richmond in accordance with professional standards at the time the services were performed, and in accordance with the contract between the City of Richmond and Brown and Caldwell dated January 24, 2020. This document is governed by the specific scope of work authorized by the City of Richmond; it is not intended to be relied upon by any other party except for regulatory authorities contemplated by the scope of work. We have relied on information or instructions provided by the City of Richmond and other parties and, unless otherwise expressly indicated, have made no independent investigation as to the validity, completeness, or accuracy of such information.

Section 7

References

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Appendix A: Maps

Figure A-1: Chesapeake Bay TMDL Action Plan Projects

City of Richmond

Figure 1
Projects Completed Through Second Permit Phase

April 2021

0 1 2
Miles

Legend

- Green Alley

Project

- Cherokee Lake
- Forest Hill Park
- Little Westham Creek
- Maury Cemetery Creek
- Pine Camp Creek
- Pocosham Creek
- Stream
- Water Features
- City Boundary
- MS4 Boundary

Appendix B: List of Projects with Credit from Redevelopment, Development, and Over-sized BMPs

IMPERVIOUS REDUCTION PORTION OF CREDIT CALCULATION										BMP LOAD REMOVAL PORTION OF CREDIT CALCULATION							TOTAL CREDIT		
Permit #	Project Drains To	Project Type	Year That Credits are Effective	Month That Credits are Effective	Start of Reporting Period that Credits are Effective	Pre-BMP SITE Change in P Load (lbs/yr)	Reduction of P Loading from Impervious Area Restoration (lbs/yr)	Reduction of N Loading from Impervious Area Restoration (lbs/yr)	Reduction of TSS Loading from Impervious Area Restoration (lbs/yr)	Sum of P Removal from ALL BMPs Per SITE (lbs/yr)	Sum of N Removal from ALL BMPs per SITE (lbs/yr)	Sum of TSS Removal from ALL BMPs per SITE (lbs/yr)	BMPs P TMDL CREDIT (lbs/yr)	Removal Proportion to Use for Credit	BMPs N TMDL CREDIT (lbs/yr)	BMPs TSS TMDL CREDIT (lbs/yr)	Total P Credit (lbs/yr)	Total N Credit (lbs/yr)	Total TSS Credit (lbs/yr)
RSMP14091501	MS4	Redevelopment	2014	11	July 1, 2014	3.74	0.00	0.00	0.00	4.11	26.61	1780.49	0.37	0.09	2.40	160.29	0.37	2.40	160.29
RSMP14121601	MS4	Redevelopment	2015	9	July 1, 2015	12.89	0.00	0.00	0.00	16.08	35.39	6040.91	3.19	0.20	7.02	1198.41	3.19	7.02	1198.41
RSMP15081102	MS4	Redevelopment	2015	10	July 1, 2015	0.00	0.60	3.12	252.54	0.09	0.20	0.00	0.09	1.00	0.20	0.00	0.69	3.32	252.54
C13093001	MS4	New	2014	7	July 1, 2014	2.08	0.00	0.00	0.00	2.08	7.74	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C14022703	MS4	Redevelopment	2015	4	July 1, 2014	0.00	0.02	0.10	8.42	0.77	0.00	0.00	0.77	1.00	0.00	0.00	0.79	0.10	8.42
RSMP14101001B14112004	MS4	Redevelopment	2015	12	July 1, 2015	0.22	0.00	0.00	0.00	0.89	6.54	270.38	0.67	0.75	4.92	203.54	0.67	4.92	203.54
RSMP15020501	MS4	Redevelopment	2016	2	July 1, 2015	0.21	0.00	0.00	0.00	3.02	18.22	1167.56	2.81	0.93	16.95	1086.29	2.81	16.95	1086.29
RSMP16020301	MS4	Redevelopment	2016	4	July 1, 2015	0.07	0.00	0.00	0.00	0.10	0.22	0.00	0.03	0.30	0.07	0.00	0.03	0.07	0.00
B12112908	MS4	Redevelopment	2014	7	July 1, 2014	0.00	0.10	0.54	43.35	0.00	0.00	0.00	0.00		0.00	0.00	0.10	0.54	43.35
RSMP14071601	MS4	Redevelopment	2015	12	July 1, 2015	1.84	0.00	0.00	0.00	2.37	19.74	1322.37	0.53	0.22	4.42	296.17	0.53	4.42	296.17
RSMP15042701	MS4	New	2015	6	July 1, 2014	0.02	0.00	0.00	0.00	0.04	0.46	25.66	0.02	0.38	0.17	9.65	0.02	0.17	9.65
C14041001	MS4	Redevelopment	2015	8	July 1, 2015	3.96	0.00	0.00	0.00	2.90	7.25	1712.64	-1.06	-0.37	-2.65	-626.00	0.00	0.00	0.00
RSMP14082901	MS4	New	2015	8	July 1, 2015	1.69	0.00	0.00	0.00	2.29	17.44	751.86	0.60	0.26	4.60	198.17	0.60	4.60	198.17
B99032512	MS4	Redevelopment	2017	7	July 1, 2017	0.00	0.10	0.53	43.23	0.19	1.36	59.11	0.19	1.00	1.36	59.11	0.29	1.89	102.34
RSMP16042002	MS4	Redevelopment	2017	5	July 1, 2016	3.75	0.00	0.00	0.00	6.19	28.81	156.33	2.44	0.39	11.36	61.62	2.44	11.36	61.62
RSMP15020501	MS4	Redevelopment	2017	2	July 1, 2016	0.28	0.00	0.00	0.00	3.02	18.22	1167.56	2.74	0.91	16.53	1059.20	2.74	16.53	1059.20
RSMP15112301	MS4	Redevelopment	2016	7	July 1, 2016	0.00	0.11	0.57	46.30	0.44	1.64	0.00	0.44	1.00	1.64	0.00	0.55	2.21	46.30
RSMP14120401	MS4	New	2016	3	July 1, 2015	16.11	0.00	0.00	0.00	17.73	55.63	5075.01	1.62	0.09	5.09	464.17	1.62	5.09	464.17
RSMP15070901	MS4	Redevelopment	2017	2	July 1, 2016	0.09	0.00	0.00	0.00	0.30	0.66	0.00	0.21	0.70	0.46	0.00	0.21	0.46	0.00
RSMP-009425-2016	MS4	Redevelopment	2017	2	July 1, 2016	0.00	0.00	0.00	0.00	0.02	0.04	0.00	0.02	1.00	0.04	0.00	0.02	0.04	0.00
RSMP-009701-2016	MS4	New	2017	7	July 1, 2017	0.00	0.85	4.40	356.25	0.00	0.00	0.00	0.00		0.00	0.00	0.85	4.40	356.25