FINAL

CHESAPEAKE BAY PHASE II
TOTAL MAXIMUM DAILY LOAD ACTION PLAN

FOR

JOINT BASE LANGLEY EUSTIS – LANGLEY

Prepared For:

Air Force Civil Engineer Center (AFCEC)
772nd Enterprise Sourcing Squadron/PKA
2261 Hughes Avenue, Suite 163
JBSA TX 78236-9861

633 CES/CEIE
Joint Base Langley Eustis–Langley
37 Sweeney Blvd
JBLE-Langley VA 23665

Prepared By:

CTI-URS Environmental Services, LLC
1600 Perimeter Park Drive, Suite 400
Morrisville NC 27560

September 2019

Contract No. FA8903-16-D-0053
Task Order No. FA890-18-F-0266

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633 CES/CEIE	633d Civil Engineer Squadron/Environmental Element
ABW	Air Base Wing
ACC	Air Combat Command
AFCEC	Air Force Civil Engineer Center
BMP	Best management practice
CFR	Code of Federal Regulations
CUES	CTI-URS Environmental Services, LLC
EOS	Edge of Stream
EPA	Environmental Protection Agency
GIS	Geographical information system
HSG	Hydrologic soil group
JBLE–Langley	Joint Base Langley Eustis–Langley
L2	Level 2
lbs/ac/yr	Pounds per acre per year
lbs/yr	Pounds per year
lbs/ft/yr	Pounds per foot per year
MCM	Minimum control measure
MS4	Municipal Separate Storm Sewer System
NACA	National Advisory Council for Aeronautics
NASA	National Aeronautics and Space Administration
NPDES	National Pollutant Discharge Elimination System
NRCS	Natural Resources Conservation Service
POC	Pollutant of concern
TMDL	Total Maximum Daily Load
TN	Total nitrogen
TP	Total phosphorous
VAC	Virginia Administrative Code
VDEQ	Virginia Department of Environmental Quality
VGIN	Virginia Geographic Information Network
VPDES	Virginia Pollutant Discharge Elimination System
VSMP	Virginia Stormwater Management Program
WIP	Watershed Implementation Plan

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Statement of Limitations

This plan was prepared in accordance with the customary thoroughness and competence of environmental science and engineering consulting professionals and in accordance with the standard for professional services for a national consulting firm at the time these services were provided. The analysis, conclusions and recommendations expressed in this report were developed based upon a limited scope of services and the information made available at the time this work was conducted.

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Chesapeake Bay TMDL Action Plan Requirements Cross-Reference Table		
Guidance Memo 15-2005 Chesapeake Bay TMDL Special Condition Guidance (18 May 2015)		**JBLE–Langley TMDL Action Plan Section**
1	Current program and existing legal authority	2.0
2	New or modified legal authority	2.0
3	Means and methods to address discharges from new sources	5.0
4	Estimated existing source loads and calculated total pollutant of concern (POC) required reductions	4.0
5	Means and methods to meet the required reductions and schedule	5.0
6	Means and methods to offset increased loads from new sources initiating construction between 1 July 2009 and 30 June 2014	5.1
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1.0 INTRODUCTION

1.1 Purpose and Objective

In 2010, the United States Environmental Protection Agency (EPA) established the Chesapeake Bay Total Maximum Daily Load (TMDL) to address excess nitrogen, phosphorus and total suspended solids (pollutants of concern or POCs) in the bay (EPA, 2010). A TMDL is the maximum amount of a pollutant that a water body can assimilate and still support its designated use. The Chesapeake Bay watershed encompasses over 64,000 square miles across the District of Columbia and large sections of Delaware, Maryland, New York, Pennsylvania, West Virginia and Virginia.

In the Phase I and Phase II Chesapeake Bay Watershed Implementation Plan (WIP) for the Chesapeake Bay TMDL, the Commonwealth of Virginia committed to a phased approach to reducing nutrients and suspended solids discharging from Municipal Separate Storm Sewer Systems (MS4s). Section I.D of the Joint Base Langley Eustis–Langley (JBLE–Langley) MS4 permit (VAR040140, effective 1 November 2018) requires the base to prepare a Chesapeake Bay TMDL Action Plan that demonstrates future plans to meet the required nutrient and suspended solids reductions. The plan must be submitted to the Virginia Department of Environmental Quality (VDEQ) for review and approval.

This Chesapeake Bay TMDL Action Plan was prepared by CTI-URS Environmental Services, LLC (CUES) for JBLE–Langley under Air Force Civil Engineer Center (AFCEC) Contract No. FA8903-16-D-0053, Task Order No. FA890-18-F-0266.

The Action Plan is an annual report on the progress made by the base in meeting the Chesapeake Bay TMDL pollutant reduction requirements, specifically the Level 2 (L2) scoping run as specified in the 2010 Phase I WIP (VDEQ, 2010). The L2 reductions are to be met in phases corresponding to the permit cycles, as outlined in Table 1-1.

Table 1-1. Pollutant Percent Reduction Requirements by Permit Cycle

Permit Cycle	Timeframe	Cycle Percent Reduction	Cumulative Percent Reduction
1	2013-2018	5%	5%
2	2018-2023	35%	40%
3	2023-2028	60%	100%

The Action Plan presents the JBLE–Langley estimated load contribution, required load reductions and pollutant reduction credits. The plan also reports progress made toward meeting the 35% pollutant reduction requirement (cumulative 40% pollutant reduction) for the second permit cycle. The methodology used to calculate the pollutant loads and credits is based on VDEQ Guidance Memo No. 15-2005 (Guidance Document) (VDEQ, 2015).

1.2 Installation Description

JBLE–Langley is located on the Chesapeake Bay in the southern end of the lower Virginia peninsula, just north of the City of Hampton, Virginia and south of the City of Poquoson, Virginia (Figure 1-1). JBLE–Langley is the oldest continuously active air base in the United States and is home to the 633d Air Base Wing (ABW), Headquarters Air Combat Command (ACC), the 480th Intelligence Wing and other tenant units. The 633d ABW flies the F-22A Raptor and T-38 aircraft.

In 1916, the National Advisory Council for Aeronautics (NACA), the predecessor to the National Aeronautics and Space Administration (NASA), established a joint proving ground for Army, Navy and NACA aircraft. In 1917, the site was designated Langley Field in honor of one of the early pioneers of flight, Samuel Pierpont Langley.

At the outbreak of World War II, Langley took on a new mission – to develop special detector equipment used in anti-submarine warfare. Langley units were pivotal in the sinking of enemy submarines off the United States coast during the war. On 25 May 1946, the Headquarters of the newly formed Tactical Air Command was established at Langley. The Command's mission was to organize, train, equip and maintain combat-ready forces capable of rapid deployment to meet the challenges of peacetime air sovereignty and wartime air defense. In January 1948, Langley Field officially became Langley Air Force Base. Today, the host unit is the 633d ABW, with the mission of maintaining combat capability for rapid global deployment to conduct air superiority operations. On 1 June 1992, JBLE–Langley became the Headquarters of ACC, as Tactical Air Command was deactivated as part of the Air Force's restructuring. Langley Air Force Base became a joint-base with Fort Eustis on 1 October 2010, forming Joint Base Langley Eustis.

1.3 Plan Organization

This TMDL Action Plan is organized into the following sections:

- Section 1.0 presents an overview of the plan purpose and objective, installation description and plan organization.
- Section 2.0 describes the JBLE–Langley industrial and MS4 stormwater programs.
- Section 3.0 discusses the JBLE–Langley MS4 service area.
- Section 4.0 provides the load reduction calculations.
- Section 5.0 discusses the pollutant credit calculations.
- Section 6.0 provides a summary of load reductions and credits for the second cycle.
- Section 7.0 discusses the public notice process.
- Section 8.0 contains a list of references used during preparation of this plan.

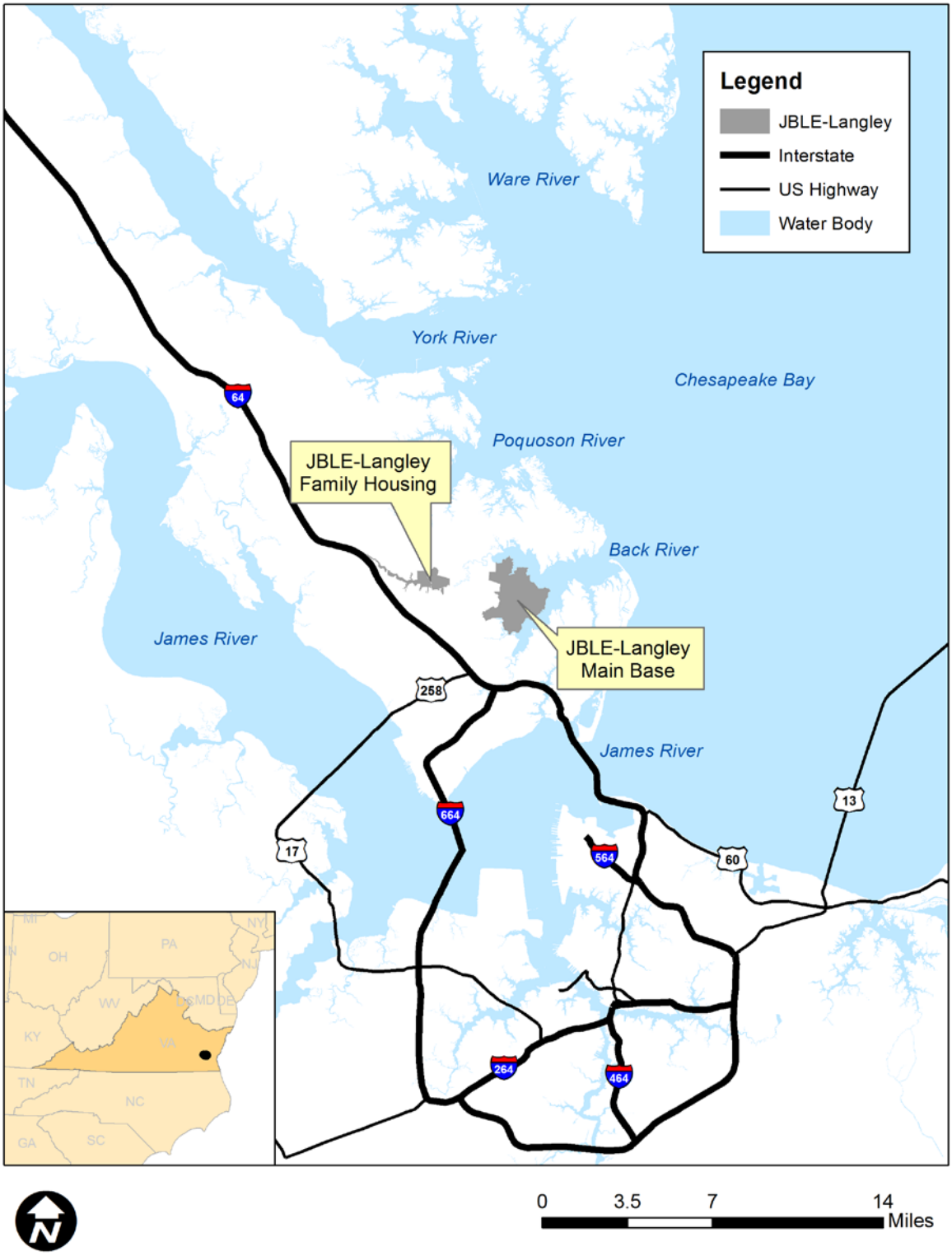

Figure 1-1. Site Location Map, JBLE–Langley

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2.0 STORMWATER PROGRAM OVERVIEW

JBLE–Langley is authorized to discharge stormwater from the installation in accordance with two permits issued by the VDEQ as discussed in the subsections below.

2.1 Industrial Stormwater Program Overview

In November 1990, federal stormwater discharge requirements (known as the Phase I National Pollutant Discharge Elimination System [NPDES] Program) were promulgated as part of the NPDES under the Clean Water Act (55 Federal Register 48062-48901). These regulations, as stated in Title 40 of the Code of Federal Regulations (CFR) Parts 122, 123 and 124, require the owners of "facilities that discharge stormwater associated with industrial activity" to apply for a stormwater permit if stormwater is discharged to (1) waters of the United States or (2) MS4s.

NPDES permits are issued either by a United States EPA Regional office or by states that have been granted NPDES permitting authority. JBLE–Langley is located in the Commonwealth of Virginia, which has NPDES permitting authority. VDEQ administers the commonwealth's NPDES program and issues Virginia Pollutant Discharge Elimination System (VPDES) permits. The VDEQ requirements for stormwater permitting are located in the Virginia Administrative Code (VAC), 9VAC25 and are not substantially different from the federal guidelines contained in 40 CFR 122.

A facility is subject to the regulations only if its activities fit the definition of "industrial" as specified by the 11 categories in 40 CFR 122.26(b)(14)(i)-(xi). The industrial stormwater VPDES permit issued to JBLE–Langley (VAR052285, effective 1 July 2014), incorporates the definition of industrial activity from 40 CFR 122.26. The primary industrial activities of JBLE–Langley fall within the following sectors: 1) air transportation, 2) scrap and waste recycling facilities, material recovery facilities and 3) transportation and warehousing. VPDES Permit No. VAR052285, issued to JBLE–Langley, includes specific stormwater management requirements for each of these three sectors.

2.2 MS4 Program Overview

Discharges from MS4s are regulated under the Virginia Stormwater Management Act, the Virginia Stormwater Management Program (VSMP) Permit regulations and the Clean Water Act as point source discharges. MS4 regulations were developed and implemented in two phases. Implementation of the first phase began in the early 1990s and required that operators of MS4s serving populations of greater than 100,000 people (per the 1990 decennial census) apply for and obtain a permit to discharge stormwater from their outfalls. The second phase of MS4 regulations became effective 23 March 2003 and required that operators of small MS4s in "urbanized areas" (as defined by the latest census) obtain a permit to discharge stormwater from their outfalls.

VDEQ issued MS4 Permit No. VAR040140 to JBLE–Langley which became effective on 3 August 2017. The reissuance of the permit for the second permitting cycle became effective on 1 November 2018. The permit requires JBLE–Langley to develop, implement and enforce an MS4 Program designed to reduce

the discharge of pollutants from the MS4 to the maximum extent practicable, to protect water quality. The permit requires the base to implement six minimum control measures (MCMs) or best management practices (BMPs) as follows:

- MCM 1: Public education and outreach on stormwater impacts
- MCM 2: Public involvement / participation
- MCM 3: Illicit discharge detection and elimination
- MCM 4: Construction site stormwater runoff control
- MCM 5: Post-construction stormwater management in new development and development on prior developed lands
- MCM 6: Pollution prevention / good housekeeping for municipal operations

In addition to implementing these MCMs, Part II, *TMDL Special Conditions*, of the MS4 permit VAR040140 requires JBLE–Langley to prepare a Chesapeake Bay TMDL Action Plan that demonstrates future plans to meet the required nutrient and suspended solids reductions.

Each year the base submits to VDEQ an MS4 Annual Report documenting progress toward implementing the MCMs and special conditions identified in the installation MS4 Program Plan.

3.0 MS4 SERVICE AREA

A determination of the base pollutant load requires an estimate of the area served by the permittee's MS4 as of 30 June 2009. This was accomplished by creating a geographical information system (GIS) land cover shapefile based on 2009 aerial imagery obtained from the Virginia GIS Clearinghouse (Virginia Geographic Information Network [VGIN], 2009). The following land cover types were manually delineated across the entire base: impervious, pervious, forest, agriculture (a six-acre horse pasture), natural areas (mostly tidal wetlands and marshes) and open water. Impervious areas included buildings, roads, parking lots, sidewalks, railroads and airfield runways. Pervious areas included turf and landscaped areas. Forested lands included trees with a minimum diameter at breast height (varying according to tree population density) and a minimum contiguous area of 30 x 30 meters, as specified in the Guidance Document.

The MS4 service area was conservatively classified as impervious (regulated urban impervious) or pervious (regulated urban pervious). The base is fully covered by the 2010 U.S. Census urban area, so no adjustment to the MS4 service area due to non-overlapping U.S. Census urban area was required. A desktop review of the base topography revealed no receiving/exporting sheet flow runoff from/to an adjacent permittee, so no adjustment to the MS4 service area was necessary.

The Guidance Document allows for land covered under another VPDES permit to be excluded from the MS4 service area. Portions of the base were covered under industrial permit VAR052285 as of 30 June 2009. The industrial drainage areas covered under permit VAR052285 were delineated to account for this area. The industrial drainage area shapefile was then combined with the 2009 land cover shapefile using the ArcGIS Intersect tool to produce the final 2009 land cover shapefile. The industrial areas were not included in the MS4 service area.

The land cover delineation process outlined above was repeated using 2018 imagery available on the Virginia GIS Clearinghouse (VGIN, 2018). Aerial imagery from 2018 was chosen to develop the 2019 land cover layer as it is the most recent data available. The 2019 land cover layer was then combined with the industrial layer to identify "unregulated areas." The final 2019 land cover layer was used to calculate loads due to New Sources (see Section 4.2) and BMP credits (see Section 5). A summary of the base's land cover is presented in Table 3-1.

Table 3-1. Land Cover Summary for the 2009 and 2019 Timeframes

Land Use	Acres (2009)	Acres (2019)
Regulated Urban Impervious	400.3	428.9
Regulated Urban Pervious	907.2	882.6
Regulated Forest	296.8	292.8
Regulated Pasture	14.0	14.0
Regulated Natural Area	494.9	494.9
Regulated Water	247.0	247.0
Unregulated Impervious	479.5	449.4
Unregulated Pervious	722.3	757.0
Unregulated Forest	18.5	13.6
Unregulated Pasture	0.6	0.9
Unregulated Natural Area	58.2	58.1
Unregulated Water	1.3	1.3
Total	**3,640.5**	**3,640.5**

Note:
Minor calculation discrepancies are accounted for in rounding

Maps of the industrial permitted areas, 2009 land cover, MS4 service area and 2019 land cover are presented as Figures 3-1 through 3-4, respectively.

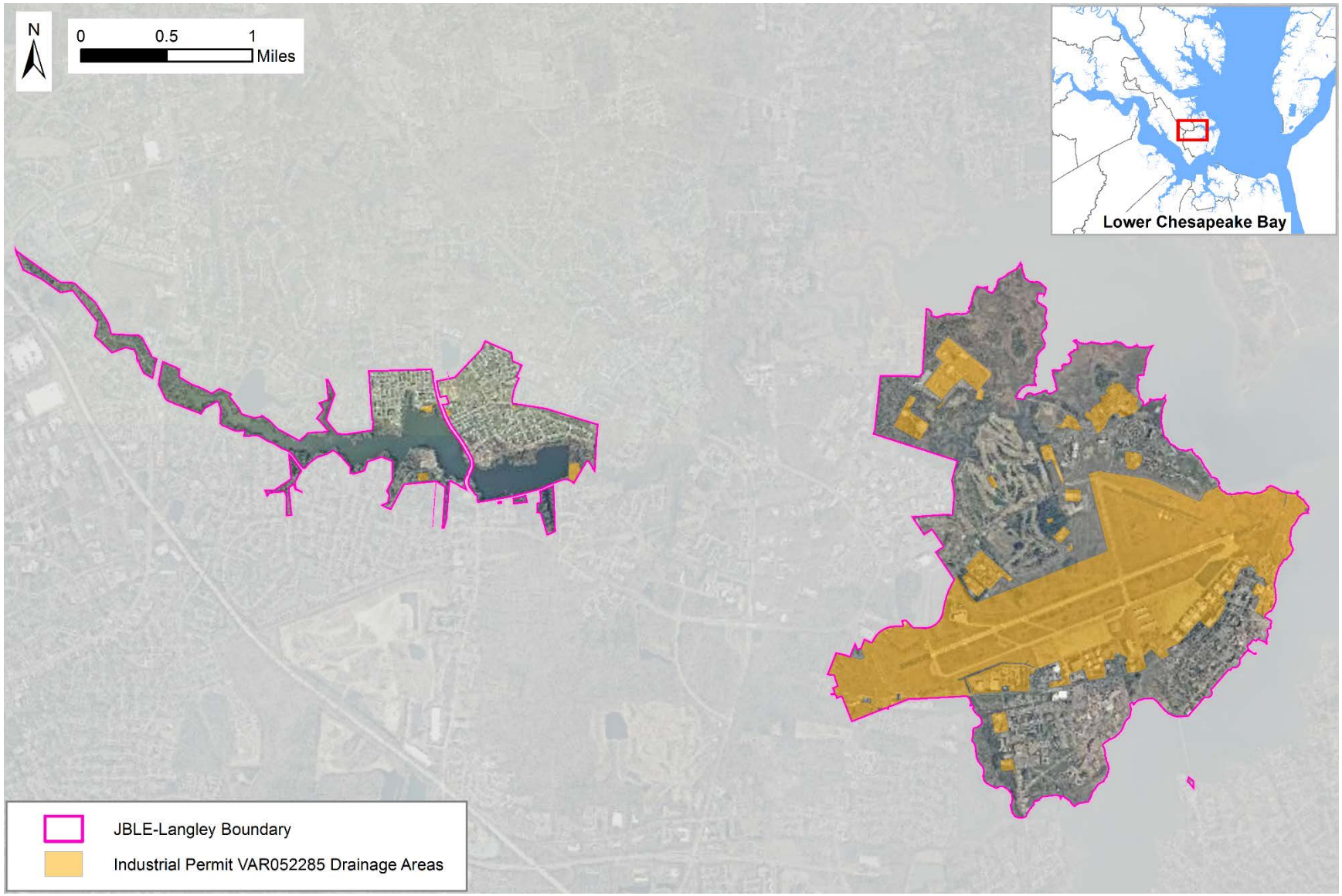

Figure 3-1. JBLE–Langley Industrial Permit VAR052285 Drainage Areas

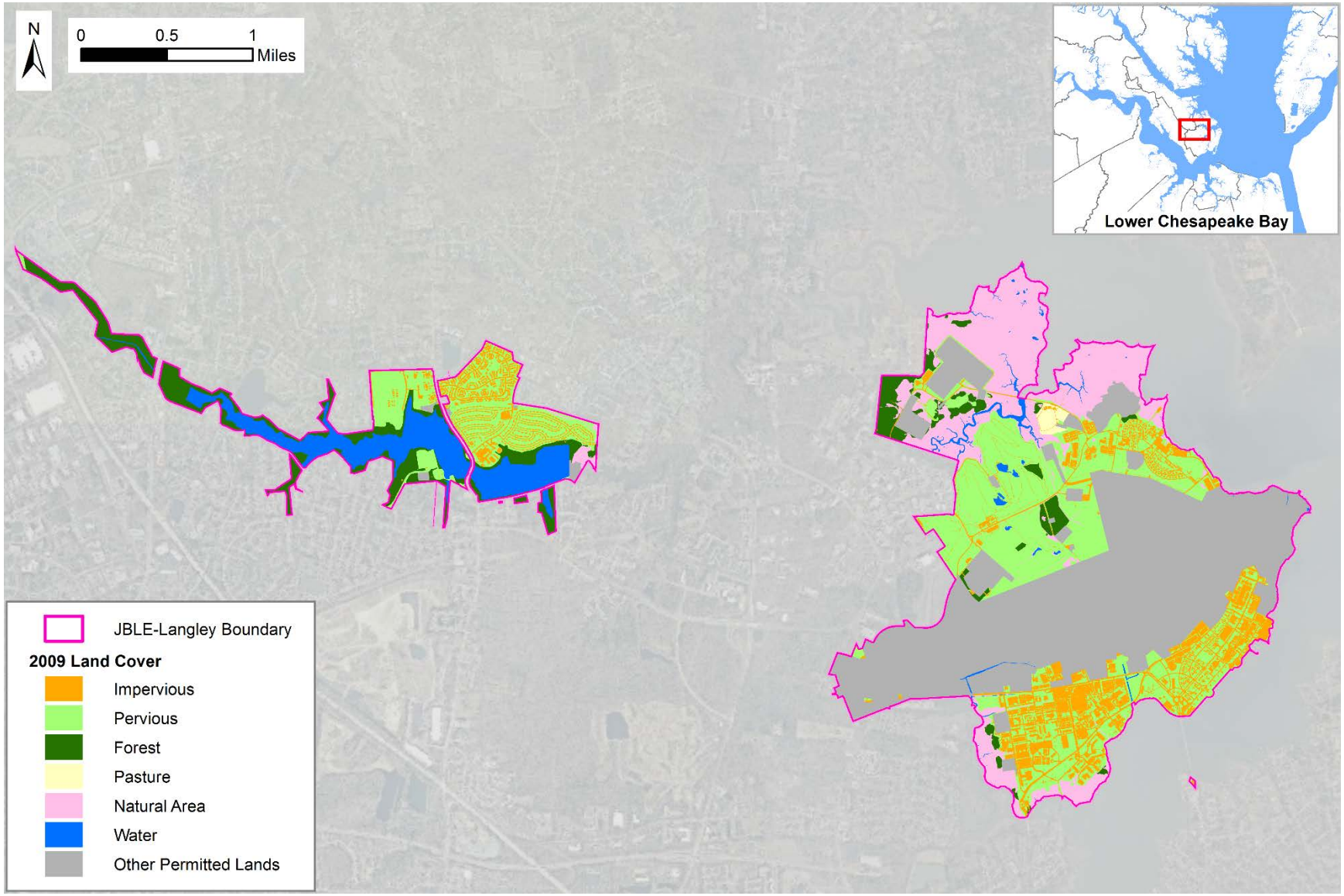

Figure 3-2. JBLE–Langley Land Cover Present during 2009

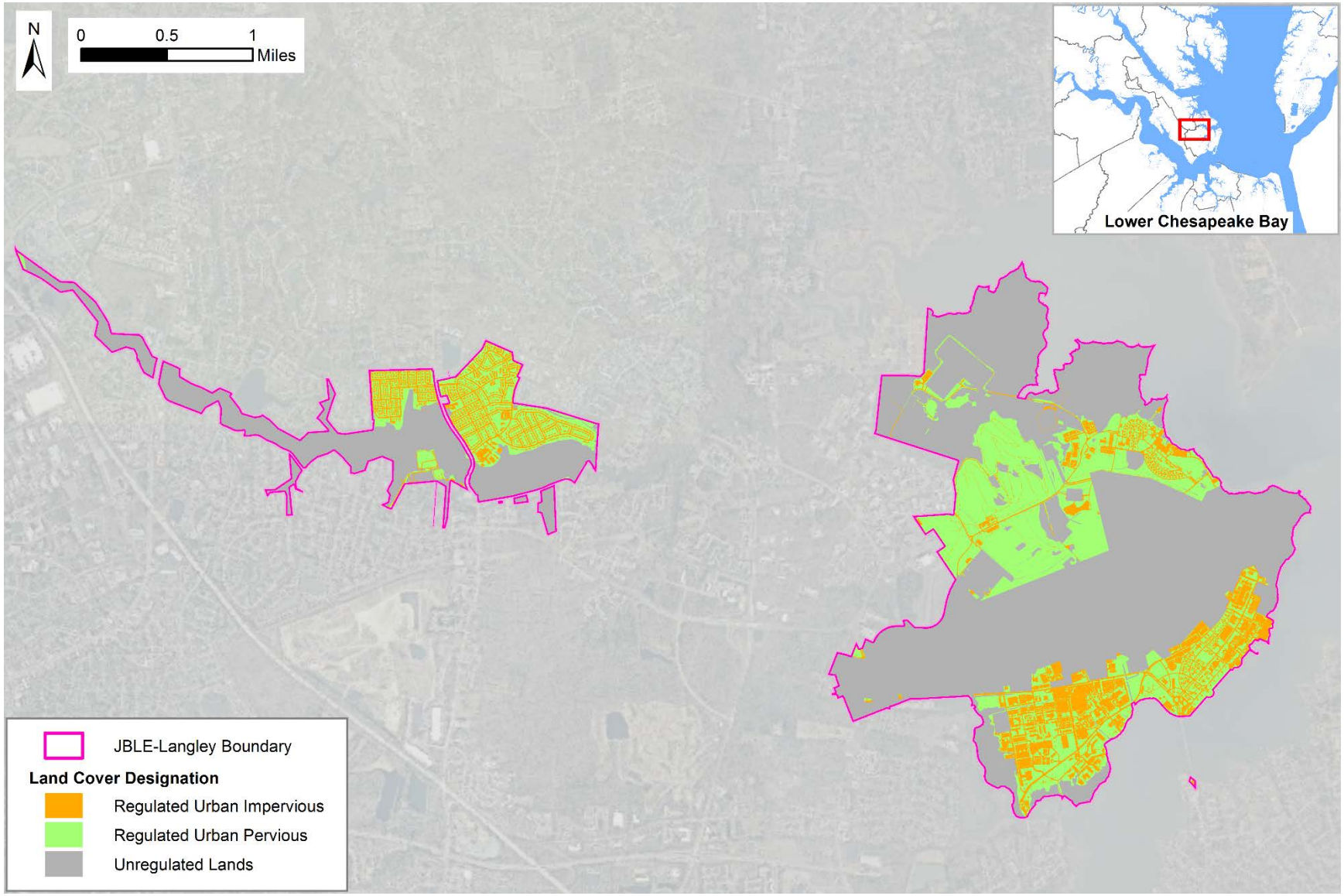

Figure 3-3. JBLE–Langley MS4 Service Area

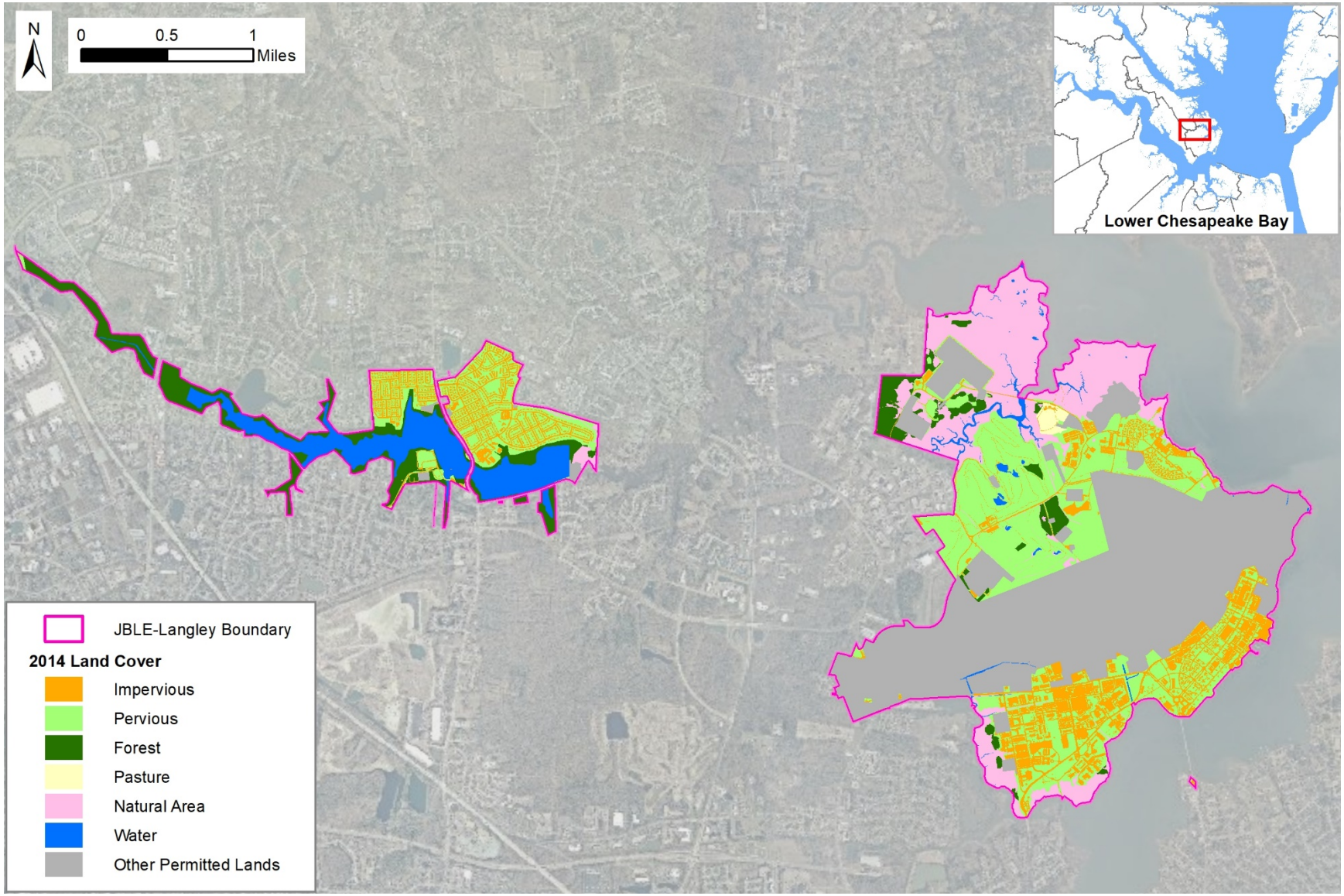

Figure 3-4. JBLE–Langley 2019 Land Cover

4.0 LOAD REDUCTION CALCULATIONS

Pollutant load reductions for existing sources (contributed by the base as of 30 June 2009) and new sources (contributed by the base between 1 July 2009 and 30 June 2019) are discussed in the subsections below.

4.1 Existing Source Loads

The Existing Source loads for the base (i.e., the pollutant loads contributed by the base as of 30 June 2009) were calculated using the land cover loading rates from Table 2d (York River Basin) and the Table 2d template of the Guidance Document (VDEQ, 2015), as presented in Table 4-1.

Table 4-1. Existing Source Loads [Table 2d]

Land Cover (Subsource)	Pollutant	Total Existing Acres Served by MS4 (30 June 2009)	2009 EOS Loading Rate (lbs/ac/yr)	Estimated Total POC Load Based on 2009 Progress Run (lbs/yr)	
Regulated Urban Impervious	Nitrogen	400.3	7.31	2,926.1	9,866.5
Regulated Urban Pervious		907.2	7.65	6,940.4	
Regulated Urban Impervious	Phosphorus	400.3	1.51	604.4	1,067.1
Regulated Urban Pervious		907.2	0.51	462.7	
Regulated Urban Impervious	Total Suspended Solids	400.3	456.68	182,803.5	248,832.9
Regulated Urban Pervious		907.2	72.78	66,029.3	

Note and acronyms:
Minor calculation discrepancies are accounted for in rounding.
EOS – Edge of Stream
lbs/ac/yr – Pounds per acre per year
lbs/yr – Pounds per year

The required reductions for the second permit cycle (cumulative 40% of the L2 scoping reduction), presented in Table 4-2, were calculated using Table 3d of the MS4 permit (VAR040140).

Table 4-2. Second Permit Cycle Required Load Reductions from Existing Source Loads [Table 3d]

Land Cover (Subsource)	Pollutant	Total Existing Acres Served by MS4 (30 June 2009)	Second Permit Cycle Required Reduction in Loading Rate (lbs/ac/yr)	Total Reduction Required in the Second Permit Cycle (lbs/yr)	
Regulated Urban Impervious	Nitrogen	400.3	0.26316	105.3	271.9
Regulated Urban Pervious		907.2	0.18360	166.6	
Regulated Urban Impervious	Phosphorus	400.3	0.09664	38.7	52.1
Regulated Urban Pervious		907.2	0.01479	13.4	
Regulated Urban Impervious	Total Suspended Solids	400.3	36.53440	14,624.3	16,935.3
Regulated Urban Pervious		907.2	2.54730	2,311.0	

Note and Acronyms:
Minor calculation discrepancies are accounted for in rounding.
lbs/ac/yr – Pounds per acre per year
lbs/yr – Pounds per year

4.2 New Source Loads

In addition to the Existing Source loads, the base is required to offset any additional New Source loads from development that was initiated between 1 July 2009 and 30 June 2019. The New Source loads for the base were calculated using the aggregate accounting method presented in Appendix II of the Guidance Document (VDEQ, 2015). As the first step, the 2019 pollutant loads were calculated using Table II.3 in the Guidance Document (VDEQ, 2015), as presented in Table 4-3.

Table 4-3. New Source Loads [Table II.3]

Land Cover (Subsource)	Pollutant	Total Existing Acres Served by MS4 (30 June 2019)	2009 EOS Loading Rate (lbs/ac/yr)	Estimated Total POC Load as of 30 June 2019 (lbs/yr)	
Regulated Urban Impervious	Nitrogen	428.9	7.31	3,135.5	9,887.3
Regulated Urban Pervious		882.6	7.65	6,751.8	
Regulated Urban Impervious	Phosphorus	428.9	1.51	647.7	1,097.8
Regulated Urban Pervious		882.6	0.51	450.1	
Regulated Urban Impervious	Total Suspended Solids	428.9	456.68	195,883.6	259,677.2
Regulated Urban Pervious		882.6	72.28	63,793.6	

Note and acronyms:
Minor calculation discrepancies are accounted for in rounding.
EOS – Edge of Stream
lbs/ac/yr – Pounds per acre per year
lbs/yr – Pounds per year

The difference or Total Load Change between 2009 (Table 4-1) and 2019 (Table 4-3) was calculated using Table II.4 in the Guidance Document (VDEQ, 2015), as presented in Table 4-4.

Table 4-4. Load Changes from New Sources Using the Aggregate Accounting Method [Table II.4]

Land Cover (Subsource)	Pollutant	Estimated Total POC Load as of 30 June 2019 (lbs/yr)	Estimated Total POC Load as of 30 June 2009 (lbs/yr)	Total Load Change (lbs/yr)	
Regulated Urban Impervious	Nitrogen	3,135.5	2,926.1	209.4	20.7
Regulated Urban Pervious		6,751.8	6,940.4	-188.6	
Regulated Urban Impervious	Phosphorus	647.7	604.4	43.2	30.7
Regulated Urban Pervious		450.1	462.7	-12.6	
Regulated Urban Impervious	Total Suspended Solids	195,883.6	182,803.5	13,080.1	11,285.6
Regulated Urban Pervious		64,234.9	66,029.3	-1,794.5	

Note and Acronym:
Minor calculation discrepancies are accounted for in rounding.
lbs/yr – Pounds per year

Using Table II.5 in the Guidance Document, the Total Load Change from Table 4-4 is adjusted by any credits earned from BMPs implemented during the 2009–2018 timeframe to arrive at the Net Load Change. BMPs installed after 1 July 2009 were included in this analysis when they were implemented under conditions of redevelopment, as described in Appendix V.E of the Guidance Document (VDEQ, 2015). Section 5.1 provides additional information about credits from existing BMPs earned during the 2009–2018 timeframe. The base is required to offset 40% of the Net Load Change by the end of the second permit cycle, as shown in Table 4-5.

Table 4-5. Net Load Changes from New Sources [Table II.5]

Pollutant	Total Load Change (lbs/yr)	Reductions from BMPs Installed between 1 July 2009 and 30 June 2018 (lbs/yr)	Net Load Change (lbs/yr)	Required Reduction by End of Second Permit Cycle	Additional Reductions Required between 1 July 2018 and 30 June 2023 (lbs/yr)
Nitrogen	20.7	41.5	-20.7	40%	-8.3
Phosphorus	30.7	7.7	22.9	40%	9.2
Total Suspended Solids	11,285.6	7,122.8	4,162.7	40%	1,665.1

Note and Acronym:
Minor calculation discrepancies are accounted for in rounding.
lbs/yr – Pounds per year

4.3 Grandfathered Project Loads

Grandfathered projects are those in accordance with 9VAC25-870-48 (previously numbered 4VAC50-60-48) with an approved site plan prior to 1 July 2012, a state permit issued after 1 July 2014, land disturbance activities commencing after 1 July 2014 that disturb one acre or greater and where the project utilizes an average land cover condition greater than 16% impervious cover in the design of post-development stormwater management facilities and results in an increased pollutant load (VAC, 2014). The base is required to offset any additional pollutant loads due to grandfathered projects. No grandfathered projects were identified.

4.4 Summary of Load Reduction Requirements

A summary of the JBLE–Langley required load reductions is presented in Table 4-6. The values presented in this table represent the 40% reduction requirement to be achieved by 30 June 2023.

Table 4-6. Summary of the Second Permit Cycle Required Load Reductions

Pollutant	Second Permit Cycle Required Reductions (lbs/yr)			
	Existing Sources	New Sources[1]	Grandfathered Projects	Total
Nitrogen	271.9	-8.3	0.0	263.6
Phosphorus	52.1	9.2	0.0	61.3
Total Suspended Solids	16,935.3	1,665.1	0.0	18,600.4

Notes and Acronym:
[1] Credits from BMPs installed during the New Sources timeframe have already been accounted for in this column. Minor calculation discrepancies are accounted for in rounding.
lbs/yr – Pounds per year

5.0 CREDIT CALCULATIONS (MEANS AND METHODS)

The Guidance Document outlines multiple options available to permittees to meet the Chesapeake Bay TMDL pollutant reduction requirements. These options include post-construction BMPs, enhancement of existing BMPs, land use change BMPs, street sweeping programs, stream restoration and riparian buffers and nutrient management plans. Subsequent guidance on credits associated with shoreline restoration are presented in a document titled *Recommendation of the Expert Panel to Define Removal Rates for Shoreline Management Projects* (Forand et al., 2017) and street sweeping are presented in a document titled *Recommendations of the Expert Panel to Define Removal Rates for Street and Storm Drain Cleaning Practices* (Donner et al., 2016). The base's current pollutant credit portfolio includes post-construction BMPs, street sweeping and shoreline restoration to meet the 40% pollutant reduction requirement for the second permit cycle as noted in the subsections below. The load reduction credits were calculated using the methods presented in the Guidance Document and the expert panel guidance (Forand et al., 2017 and Donner et al., 2016).

5.1 Existing BMPs (Post-2006)

A GIS inventory of existing post-construction BMPs present at JBLE–Langley and their drainage areas was developed to help calculate existing credits for the Action Plan. BMPs installed between 1 January 2006 and 30 June 2009 were included in this analysis. BMPs installed prior to 1 January 2006 are not eligible for credit and were thus excluded from consideration for this Action Plan. BMPs installed on or after 1 July 2009 were tracked separately to facilitate the calculation of New Source loads.

A two-step process using GIS and Excel was used to determine the pollutant credit for each BMP. Drainage areas for BMPs were delineated in ArcGIS and the layer was used to intersect the 2019 land cover layer. This produced a table denoting the land cover acreages within each BMP drainage area. The land cover acreages were multiplied by the land cover loading rates provided in Table 2d (for impervious and pervious lands) and Table III.1 (for forested lands) and then summed to determine the pollutant load attributed to the drainage area. The load was then multiplied by the pollutant removal efficiency for each BMP type to determine the load removed (i.e., credit). BMP efficiencies provided in Table V.C.1 of the Guidance Document were used for this analysis (VDEQ, 2015). The efficiency of some BMP types depends on the underlying hydrologic soil group (HSG). GIS data from the Natural Resources Conservation Service (NRCS) Web Soil Survey was used to determine the soil group for each BMP (NRCS, 2017). The above process was implemented for all three POCs.

Eight (8) Filterra Bioretention Systems were installed as part of the LaSalle Gate and Visitor Center redevelopment in 2013. Total phosphorous (TP) removal efficiency for Filterra Systems is provided on the Virginia Stormwater BMP Clearinghouse (VDEQ, 2019). Total nitrogen (TN) and total suspended solids removal efficiencies were calculated for the eight (8) Filterra Systems using BMP efficiencies provided for bioretention with underdrain and C/D soils in Table V.C.1 of the Guidance Document (VDEQ, 2015).

The effect of BMP treatment trains (BMPs in series, where the effluent from an upstream BMP enters the drainage area of a downstream BMP) was also considered. The cumulative effect of BMPs in series is less for a given pollutant than the sum of individual BMPs not in series. This is because the removal efficiency of a downstream BMP is applied to runoff that is cleaner. One benefit of treatment trains is the potential to maximize the load removal efficiency across multiple POCs. For example, pairing an upstream BMP with a high sediment removal rate with a downstream BMP that carries a high nutrient removal rate may be an excellent use of available space in a developed area.

Credits for BMPs implemented on unregulated lands may be awarded, provided any necessary baseline is first met (see page 10 and Example V.E.1 of the Guidance Document). No credits have been claimed for BMPs implemented on unregulated lands because the criteria for receiving credits were not achieved.

Part III.3 of the Guidance Document describes that permittees may not receive credit for BMPs that were installed on or after 1 July 2009 and that were implemented to meet the minimum VSMP technical criteria phosphorous removal requirement for new development or other minimum regulatory requirements. However, permittees may receive credit for those BMPs under circumstances of redevelopment, stricter development requirements, or oversized BMPs. BMPs installed on or after 1 July 2009 were included in this analysis when they were implemented under conditions of redevelopment, as described in Appendix V.E of the Guidance Document (VDEQ, 2015). Credits from BMPs implemented on or after 1 July 2009 were calculated separately in order to track net load change due to new source loads (Table 4-5). The effects of BMP treatment trains and unregulated land were also accounted for BMPs implemented during 2009–2018. Summaries of post-construction BMP types and credits are presented in Table 5-1 and Table 5-2, respectively. BMPs implemented prior to 1 July 2018 and their associated reductions are listed in Appendix A.

Table 5-1. Summary of Existing Post-Construction BMP Types

BMP Type	Timeframe Implemented		Total
	1 Jan 2006 to 30 June 2009	1 July 2009 to 30 June 2018	
Dry Detention Pond	0	11	11
Dry Extended Detention Pond	3	1	4
Swale	3	11	14
Wet Pond or Wetland	1	0	1
Filterra Bioretention Systems	0	8	8
Total	7	31	38

Table 5-2. Summary of Credits from Existing Post-Construction BMPs

BMP Timeframe	Number of BMPs	Credits (lbs/yr)		
		Nitrogen	Phosphorus	Total Suspended Solids
2006–2009	7	6.3	1.0	1,092.6
2009–2018	31	41.5	7.7	7,122.8

Acronym:
lbs/yr – Pounds per year

A map of existing post-construction BMP locations is presented as Figure 5-1.

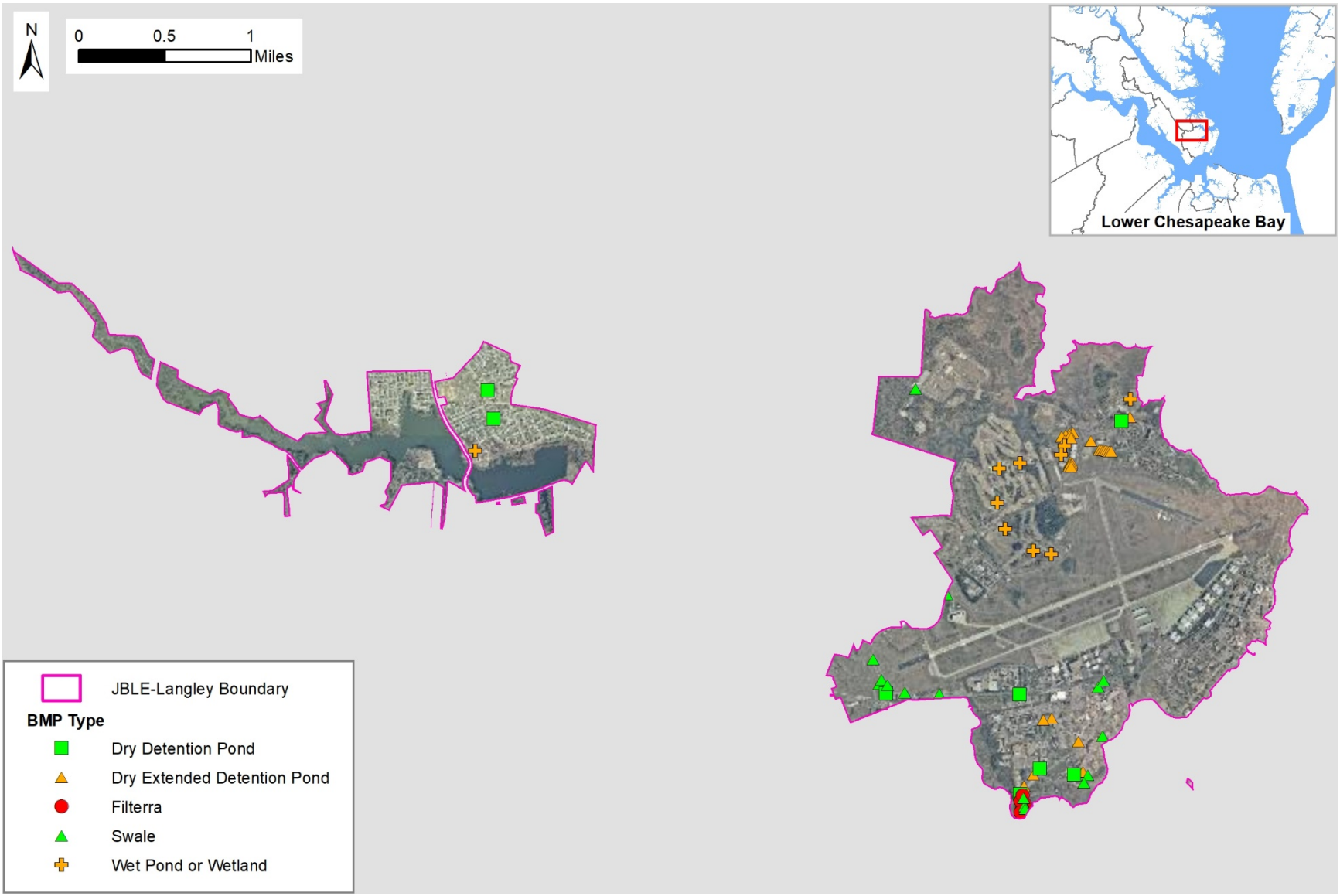

Figure 5-1. JBLE–Langley Existing Post-Construction BMPs

5.2 Street Sweeping

The base performs vacuum powered street sweeping on primary roads, secondary roads and parking lots on a regular basis. Street sweeping credits are calculated based on the methodology described in *Recommendations of the Expert Panel to Define Removal Rates for Street and Storm Drain Cleaning Practices* (Donner et al., 2016). Data on frequency and linear miles of roads swept was provided by the base and used to calculate load reduction credits. A summary of street sweeping credits is presented in Table 5-3.

Table 5-3. Summary of Annual Street Sweeping Credits

Lane-Miles Swept	Acres Swept	Credits (lbs/yr)		
		Nitrogen	Phosphorus	Total Suspended Solids
1,534.0	1,859.4	572.7	185.9	265,893.3

Note and Acronym:
lbs/yr – Pounds per year
Street sweeping credits are calculated based on the methodology described in *Recommendations of the Expert Panel to Define Removal Rates for Street and Storm Drain Cleaning Practices* (Donner et al., 2016)

5.3 Land Use Change

No land use change credit opportunities were identified on the base at this time.

5.4 Shoreline Management

Pollutant load reductions from shoreline restoration activities were calculated using loading rates presented in *Recommendations of the Expert Panel to Define Removal Rates for Shoreline Management Projects* (Forand et al., 2017). The report states that when shoreline management practice parameters are not available, the default values of 0.01218, 0.00861 and 42 pounds per linear foot per year should be used to determine pollutant load reductions for nitrogen, phosphorus and total suspended solids, respectively. A summary of shoreline management credits assigned to restoration projects completed prior to 1 July 2018 is presented in Table 5-4.

Table 5-4. Summary of Shoreline Management Reductions

Pollutant	Shoreline Restoration (linear feet)	Loading Rate (lbs/ft/yr)[1]	Credit (lbs/yr)
Nitrogen	8,550	0.01218	104.1
Phosphorus	8,550	0.00861	73.6
Total Suspended Solids	8,550	42.0	359,100.0

Note and acronyms:
[1] Source: Forand et al., 2017
lbs/ft/yr: Pounds per foot per year
lbs/yr: Pounds per year

5.5 Future BMPs

One additional shoreline management project was implemented at the end of 2018 and another is planned for 2021, totaling 2,075 linear feet. Two stream restoration projects are funded for implementation in 2019 and 2021 totaling 2,285 linear feet. An infiltration basin, three bioswales, three dry swales and three bioswales are also funded for implementation in 2019, treating a total of 2.55 acres. Because all of these projects were or will be implemented after 30 June 2018 no credit is being claimed. Future BMPs with their associated reductions are listed in Appendix B.

The base will continue to investigate the applicability and feasibility of additional BMPs and BMP types in order to meet the pollutant load reduction requirements of the Chesapeake Bay TMDL. Opportunities for effective retrofit options will be explored and prioritized to make the best use of available resources.

5.6 BMP Costs

The current JBLE–Langley pollutant credit portfolio includes post-construction BMPs, street sweeping and shoreline restoration. Street and parking lot sweeping is performed by the base on a regular basis. A summary of BMP implementation costs for projects completed between 1 July 2009 and 30 June 2018 is presented in Table 5-5.

Table 5-5. Summary of BMP Implementation Costs for Projects Completed Between 1 July 2009 and 30 June 2018

BMP Strategy	Implementation Costs
Post-construction BMPs	Not available
Street Sweeping	$114,000 per year
Land Use Change BMPs	Not applicable
Shoreline Management	$400,000

5.7 Summary of Load Reduction Credits

A summary of pollutant credits by BMP strategy is presented in Table 5-6.

Table 5-6. Summary of Load Reduction Credits by BMP Strategy

Pollutant	Credits (lbs/yr)				
	Post-construction BMPs		Street Sweeping	Shoreline Restoration	Credits from Existing BMPs (lbs/yr)[1]
	Completed between 1 Jan 2006 and 30 June 2009	Completed on or after 1 July 2009			
Nitrogen	6.3	41.5	572.7	104.1	683.1
Phosphorus	1.0	7.7	185.9	73.6	260.6
Total Suspended Solids	1,092.6	7,122.8	265,893.3	359,100.0	626,086.0

Note and Acronym:
[1] Does not include credits related to New Sources that were previously accounted for in Table 4-5 [Table II.5]
lbs/yr – Pounds per year

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6.0 PROGRESS SUMMARY

Part II (TMDL Special Conditions) of the MS4 Permit requires the base to meet the Chesapeake Bay TMDL requirements by reducing total nitrogen, total phosphorus and total suspended solids loads by 40% of the Chesapeake Bay L2 scoping reductions by 30 June 2023. The base's load contribution required load reductions and pollutant credits outlined in this Action Plan were calculated using the methodology described in VDEQ's Guidance Document (VDEQ, 2015). A summary of the required load reductions is presented in Table 6-1 and the second permit cycle pollutant credits are presented in Table 6-2.

Table 6-1. Summary of Permit Cycles 1, 2 and 3 Reduction Requirements

Pollutant	Required Load Reduction by 2018 (lbs/yr)	Required Load Reduction by 2023 (lbs/yr)	Required Load Reduction by 2028 (lbs/yr)
Nitrogen	33.0	263.6	659.1
Phosphorus	7.7	61.3	153.2
Total Suspended Solids	2,325.1	18,600.4	46,501.0

Acronym:
lbs/yr – Pounds per year

Table 6-2. Summary of Second Permit Cycle Reduction Requirements and Credits

Pollutant	Second Permit Cycle Cumulative Percent Reduction Requirement	Required Load Reduction by 2023 (lbs/yr)	Credits from Existing BMPs (lbs/yr)[1]	Second Permit Cycle Target Met?
Nitrogen	40%	263.6	683.1	Yes
Phosphorus	40%	61.3	260.6	Yes
Total Suspended Solids	40%	18,600.4	626,086.0	Yes

Note and Acronym:
[1] Does not include credits related to New Sources that were previously accounted for in Table 4-5 [Table II.5]
lbs/yr – Pounds per year

If the BMPs considered in this analysis are maintained and fully functional to provide the design performance, it is the conclusion of this analysis that the base currently meets its second permit cycle reduction requirement goals for all the POCs. The base will continue to investigate the applicability and feasibility of additional BMPs and BMP types in order to meet the future milestone pollutant load reduction requirements of the Chesapeake Bay TMDL.

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7.0 PUBLIC COMMENTS

The base encourages the public's participation in the development and implementation of this Chesapeake Bay TMDL Action Plan. In keeping with this objective, the base has uploaded this Action Plan to its website, https://www.jble.af.mil/About-Us/Units/Air-Force/Langley-Environmental/. Comments received will be taken into consideration when finalizing the Action Plan with VDEQ.

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8.0 REFERENCES

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Appendix A

BMPs Implemented Prior to 1 July 2018

Appendix A
BMPs Implemented Prior to 1 July 2018

BMP Type	Date Installed	Latitude	Longitude	Reductions within MS4 Service Area (lb/yr)		
				TN	TP	TSS
Dry Extended Detention Pond	2009	37.095154	-76.357777	0.34	0.06	57.59
Dry Extended Detention Pond	2009	37.095134	-76.357578	0.28	0.04	35.09
Swale	2012	37.075067	-76.381627	0.00	0.00	0.00
Dry Detention Pond	2012	37.074495	-76.380903	0.00	0.00	0.00
Swale	2012	37.075376	-76.381025	0.00	0.00	0.00
Swale	2012	37.07446	-76.378894	0.00	0.00	0.00
Swale	2006	37.077942	-76.382171	0.00	0.00	0.00
Dry Extended Detention Pond	2012	37.068056	-76.360048	1.66	0.24	199.64
Swale	2012	37.067781	-76.359545	0.28	0.03	29.58
Swale	2012	37.067149	-76.359943	0.67	0.09	112.75
Swale	2011	37.071135	-76.358055	23.09	3.60	5001.44
Dry Extended Detention Pond	2008	37.0706	-76.360535	3.21	0.51	431.12
Wet Pond	2009	37.099548	-76.355627	0.00	0.00	0.06
Swale	2009	37.075222	-76.358549	1.01	0.16	220.73
Swale	2009	37.075794	-76.357982	1.42	0.24	348.04
Dry Detention Pond	2012	37.065987	-76.366677	0.19	0.04	10.71
Dry Detention Pond	2013	37.097141	-76.422678	3.25	0.79	197.04
Dry Detention Pond	2013	37.099519	-76.423363	2.83	0.60	139.38
Dry Detention Pond	2013	37.073553	-76.384704	0.08	0.02	4.08
Filterra Bioretention Systems	2013	37.065988	-76.366401	0.47	0.12	41.45
Swale	2013	37.065764	-76.366235	0.13	0.01	9.95
Filterra Bioretention Systems	2013	37.065545	-76.36657	0.67	0.19	62.80
Filterra Bioretention Systems	2013	37.065283	-76.366183	0.67	0.20	69.55
Swale	2013	37.06512	-76.366146	0.13	0.02	32.29
Swale	2013	37.064901	-76.3661	0.13	0.02	32.44
Filterra Bioretention Systems	2013	37.064779	-76.366056	0.60	0.18	61.71
Filterra Bioretention Systems	2013	37.064861	-76.366419	0.56	0.18	62.07
Filterra Bioretention Systems	2013	37.064842	-76.366404	0.29	0.11	39.57
Filterra Bioretention Systems	2013	37.064533	-76.366524	0.28	0.10	37.97
Filterra Bioretention Systems	2013	37.064503	-76.366494	0.12	0.04	14.72

Appendix B

BMPs to be Implemented Between 1 July 2018 and 31 October 2023

Appendix B
BMPs to be Implemented Between 1 July 2018 and 31 October 2023

BMP Type	Planned Installation Date	Project Name / Location	POC Removal Rate			POC Reductions (lb/yr)		
			TN	TP	TSS	TN	TP	TSS
Shoreline Management	2018	Building 90	0.01218 lbs/ft/yr	0.00861 lbs/ft/yr	42 lbs/ft/yr	8.8	6.2	30,450.0
Shoreline Management	2021	Marina	0.01218 lbs/ft/yr	0.00861 lbs/ft/yr	42 lbs/ft/yr	16.4	11.6	56,700.0
Stream Restoration	2019	Shellbank area (Tide Mill Creek)	0.075 lbs/ft/yr	0.068 lbs/ft/yr	15.13 lbs/ft/yr	58.9	53.4	11,877.1
Stream Restoration	2021	Brick Kiln Creek	0.075 lbs/ft/yr	0.068 lbs/ft/yr	15.13 lbs/ft/yr	112.5	102.0	22,695.0
Infiltration Basin	2019	Fuel Dock Project	80%	85%	90%	3.8	4.0	4.2
Swale	2019	Fuel Dock Project	10%	10%	50%	0.5	0.5	2.3
Swale	2019	Fuel Dock Project	10%	10%	50%	0.5	0.5	2.6
Swale	2019	Fuel Dock Project	10%	10%	50%	0.1	0.1	0.5
Swale	2019	Fuel Pier Site	10%	10%	50%	0.4	0.4	1.8
Swale	2019	West TideMill Creek	10%	10%	50%	NA	NA	NA