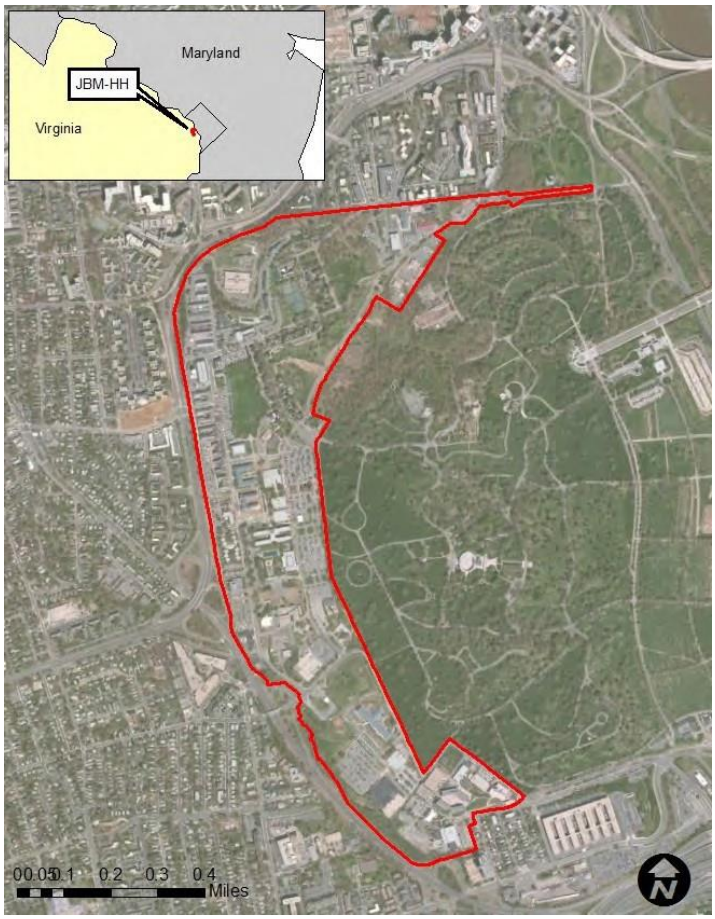
CHESAPEAKE BAY TOTAL MAXIMUM DAILY LOAD (TMDL) ACTION PLAN FOR JOINT BASE MYER-HENDERSON HALL
THIRD PHASE DRAFT



Prepared for:

Joint Base Myer-Henderson Hall
Directorate of Public Works 111 Stewart Rd, Bldg 321 Fort Myer, VA 22211-1199

Prepared by:

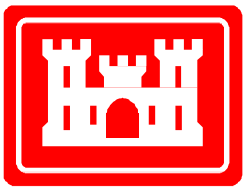
U.S. Army Corps of Engineers, Baltimore District
2 Hopkins Plaza
Baltimore, Maryland 21201

Updated by:

AECOM
12420 Milestone Center Drive, Suite 150
Germantown, Maryland 20876

DECEMBER 2015
REVISED SEPTEMBER 2023

CHESAPEAKE BAY TOTAL MAXIMUM DAILY LOAD (TMDL) ACTION PLAN FOR JOINT BASE MYER- HENDERSON HALL
THIRD PHASE DRAFT



Prepared for:

Joint Base Myer-Henderson Hall Directorate of Public Works 111 Stewart Rd, Bldg 321
Fort Myer, VA 22211-1199

and

US Army Environmental Command 2450 Connell Road
Fort Sam Houston, TX 78234-7664

Prepared by:

U.S. Army Corps of Engineers Baltimore District
2 Hopkins Plaza
Baltimore, Maryland 21201

REVISED SEPTEMBER 2023

by:

AECOM
12420 Milestone Center Drive, Suite 150
Germantown, Maryland 20876

EXECUTIVE SUMMARY

Introduction

United States Installation Management Command (IMCOM) tasked the United States Army Corps of Engineers (USACE) to provide technical data pertaining to Chesapeake Bay pollutant load reduction requirements for Joint Base Myer-Henderson Hall (JBM-HH), Virginia. Fort McNair, located in the District of Columbia, will be addressed in a separate opportunity assessment.

The Clean Water Act (CWA) established a basic structure for regulating pollutants in United States waters to make them "fishable and swimmable." States are responsible for implementing these requirements through Watershed Implementation Plans (WIP), and the Environmental Protection Agency (EPA) is responsible for enforcing the regulation.

There are three pollutants identified as having the greatest impact on the Chesapeake Bay: total nitrogen (TN), total phosphorus (TP), and sediment, measured as total suspended solids (TSS). States have identified impaired waters and together with the EPA, developed a "pollution diet" to restore them. This pollution diet is known as a Total Maximum Daily Load (TMDL), or the amount of pollutant a waterbody can carry and still achieve its designated uses (drinking water, recreation, etc.). The Commonwealth of Virginia will utilize Municipal Storm Sewer System (MS4) permits to ensure developed lands achieve nutrient and sediment reduction requirements. This study was performed to satisfy the Chesapeake Bay TMDL Action Plan requirement in Section I C of the 2013 Virginia General VPDES Permit for Discharges of Stormwater from Small Municipal Separate Storm Sewer Systems (2013 MS4 General Permit). This document has been revised to comply with the 2023 MS4 General Permit issued by the Virginia Department of Environmental Quality (DEQ) and expected to become effective 01 November 2023.

Data Collection and Mapping

Land use, soils, stormwater infrastructure and drainage area data were collected and mapped in order to calculate baseline and current load rates for TN, TP, and TSS as runoff from the installation and to determine methods for reducing those pollutant loads.

Field Investigation

Existing infrastructure that is designed to treat stormwater runoff on the installation, or Best Management Practices (BMPs) were inventoried, inspected and entered into a database. The database was designed as a tracking and record keeping tool to help the installation manage their stormwater program over time. It can be used to track required pollutant reductions and to generate annual progress reports. BMP's will be inspected in 2018 as part of MS4 permit requirements.

Establishment of Baseline Pollutant Loads

DEQ published guidance for pollutant load reduction requirements (DEQ, 2015) that used Chesapeake Bay Program (CBP) models to provide load rates for the Potomac River to be used to calculate installation-specific baseline load rates using land use data. Using 2009 land use data and the methods provided in the DEQ guidance, an estimated 3,272.40 pounds (lbs) of TN, 252.05 lbs of TP and 168,742.40 lbs of TSS per year are deposited into waterways from JBM-HH.

Pollutant Load Reductions

The Phase I WIP provides a general framework for meeting Chesapeake Bay TMDL requirements. The Phase II WIP provides a more specific plan and schedule for meeting the requirements. It details that based on the 2009 baseline conditions, 9 percent of TN loads, 16 percent of TP loads, and 20 percent of TSS loads from impervious regulated acres, and 6 percent of TN loads, 7.25 percent of TP loads and 8.75 percent TSS loads from pervious regulated acres be reduced by the end of the third permit cycle in 2028. For JBM-HH, this equates to 260.72 lbs of TN, 36.31 lbs of TP and 31,535.77 lbs of TSS that must be reduced from the annual pollutant loads by June 30, 2028. Five percent of these reductions were completed by the end of the first permit cycle in 2018, and 35 percent are required to be completed by the end of the second permit cycle in 2023.

Virginia Action Plan Guidance provided a table of pollution reduction efficiencies for several types of BMPs (DEQ, 2015). Reduction efficiencies for bioswales, bioretention and permeable pavers were averaged together for each TN, TP, and TSS and applied to the baseline loads for each area of interest.

Since the 2009 baseline, some pollutant reduction has already been realized at JBM-HH. During the first permit cycle, the demolition of a barracks building and the land's conversion from impervious surface to grass and the implementation of several structural BMPs contributed reductions of 48.3 lbs of TN, 6.23 lbs of TP, and 2,707.48 lbs of TSS per year. These reductions far exceeded the first permit cycle required reductions. Specific information on these structural BMPs can be found in Table 6.4.

BMPs implemented for the second permit cycle required reductions are identified in Section 6. Proposed BMPs and additional areas identified at JBM-HH where BMPs can be implemented to achieve reductions required for the third permit cycle are identified in Section 7 of this report. A schedule for BMP implementation to satisfy each permit cycle requirement is included in Section 8.

Costs

The total cost to implement BMPs to satisfy the first phase of the permit for JBM-HH was $2,995,239, excluding the cost of the building demolition. The total cost to implement BMPs to satisfy the second phase of the permit for JBM-HH was $3,389,451, excluding the cost of the BMPs associated with the Perimeter Security Fence project. The total cost to construct the proposed BMPs listed in Section 7 has yet to be determined.

Installation Point of Contact

Richard LaFreniere
JBM-HH Directorate of Public Works (DPW)
Chief, Environmental Management Division (EMD)
703-696-8055
richard.p.lafreniere2.civ@army.mil

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

WORKS CITED

CBF. (2014). *State of the Bay.* Chesapeake Bay Foundation.

Chesapeake Stormwater Network, et al. (2016, May 19). *Recommendations of the Expert Panel to Define Removal Rates for Street and Storm Drain Cleaning Practices - Final Report.* Chesapeake Stormwater Network, Chesapeake Research Consortium, and Virginia Tech.

Commonwealth of Virginia. (2013). *General VPDES Permit for Discharges of Stormwater from Small Municipal Separate Storm Sewer Systems.*

DCR. (1999). *Virginia Stormwater Management Handbook.* Virginia Department of Conservation and Recreation. DEQ. (2015). *Chesapeake Bay TMDL Special Condition Guidance.*

DEQ. (2015). Chesapeake Bay TMDL Special Condition Guidance.

EPA. (1972). *Clean Water Act.* Washington, D.C.

EPA. (2010). *Chesapeake Bay Total Maximum Daily Load for Nitrogen, Phosphorus and Sediment.* Washington, D.C.

EPA. (n.d.). *Water Quality Planning and Management Regulations.* 40 CFR Part 130.

FLCC. (2009). *Executive Order 13508 Strategy for Protecting and Restoring the Chesapeake Bay Watershed.* Washington, D.C.: Federal Leadership Committee for the Chesapeake.

Hagan, D. K. (2011). *Costs of Stormwater Practices in Maryland Counties.* Solomons, Maryland: University of Maryland Center for Environmental Science, Chesapeake Biological Laboratory.

USDA NCRS. (2013, Decemner 6). *United States Department of Agriculture Natural Resources Service* . Retrieved November 11, 2014, from Web Soil Survey: http://websoilsurvey.nrcs.usda.gov/app/HomePage.htm

LIST OF ACRONYMS

Area of Interest ..... AOI
Best Management Practices ..... BMP
Chesapeake Bay Foundation..... CBF
Chesapeake Bay Program ..... CBP
Chesapeake Bay Program Watershed Model..... CBPWM
Clean Water Act ..... CWA
Department of Environmental Quality..... DEQ
Digital Elevation Modeling..... DEM
Edge of stream ..... EOS
Environmental Site Design ..... ESD
Environmental Passive Integrated Chamber..... EPIC
Executive Order ..... EO
Geographic Information System ..... GIS
Global Positioning System..... GPS
Hydrologic Soil Group..... HSG
Installation Management Command ..... IMCOM
Joint Base Myer-Henderson Hall..... JBM-HH
Level 2 ..... L2
Light Detection and Ranging ..... LiDAR
Low Impact Development..... LID
Municipal Storm Water Sewer System..... MS4
National Pollutant Discharge Elimination System ..... NPDES
Natural Resource Conservation Service ..... NRCS
North American Vertical Datum of 1988 ..... NAVD88
Pollutants of concern..... POC
Total Maximum Daily Load ..... TMDL
Total nitrogen..... TN
Total phosphorus..... TP
Total suspended solids ..... TSS
United States ..... US
United States Army Corps of Engineers ..... USACE
United States Environmental Protection Agency ..... EPA
Universal Transverse Mercator..... UTM
Virginia ..... VA
Virginia Pollution Discharge Elimination System..... VPDES
Watershed Implementation Plans ..... WIP
Web Soil Survey ..... WSS

1 INTRODUCTION

1.1 BACKGROUND AND PURPOSE

The Clean Water Act (CWA) established a basic structure for regulating pollutants in United States (US) waters (EPA, 1972). Despite efforts to comply with these requirements, the Chesapeake Bay continues to fall short of State water quality standards and CWA goals (CBF, 2014). The Environmental Protection Agency (EPA) established the requirements for state Watershed Implementation Plans (WIP) as part of a larger Chesapeake Bay Total Maximum Daily Load (TMDL) accountability framework.

Section 303 of the CWA requires States to: establish water quality standards based on achieving their designated uses for that water body (drinking, recreation, etc.), develop lists of impaired waters that fail to meet those standards, and estimate the amount of a pollutant that the waterbody can receive and still meet those standards. The amount of a pollutant a waterbody can carry and still satisfy its water quality standards is now known as a Total Maximum Daily Load (TMDL).

CWA Section 402 regulates any point sources discharging pollution into U.S. waters through the National Pollutant Discharge Elimination System (NPDES) program. Municipalities with stormwater conveyance systems are required to obtain a Municipal Storm Water Sewer System (MS4) Phase II General Permit for coverage under the NPDES program. States have chosen to use these permits to enforce the TMDL requirements.

The Chesapeake Bay Protection and Restoration Executive Order (EO) 13508 describes the Chesapeake Bay as a “national treasure” and intends to bring more accountability to Bay cleanup efforts (FLCC, 2009). In response to the EO, EPA published guidance for Federal facilities describing how to comply with the Federal regulations implemented by the States.

In December 2010, EPA published a TMDL for all impaired segments of the Chesapeake Bay watershed in order to help the States establish load allocations. They determined that total nitrogen (TN), total phosphorus (TP) and total suspended solids (TSS) are the pollutants of concern (POC) causing the most environmental damage to the Chesapeake Bay. They then required those states within the Chesapeake Bay watershed to submit Watershed Implementation Plans (WIPs) detailing how they will achieve TMDL requirements for nitrogen, phosphorus, and sediment. The Virginia Phase II WIP presented pollutant load reductions, referred to as Level 2 (L2) scoping run reductions requiring that 9 percent of TN loads, 16 percent of TP loads, and 20 percent of TSS loads from impervious regulated acres, and 6 percent of TN loads, 7.25 percent of TP loads, and 8.75 percent TSS loads from pervious regulated acres be reduced by the end of the third MS4 permit cycle.

United States Army Corps of Engineers (USACE) has been tasked by the Installation Management Command (IMCOM) to provide technical data pertaining to the Chesapeake Bay TMDL for Joint Base Myer-Henderson Hall (JBM-HH). The technical data collected and/or developed during this investigation includes: existing land use; soils; Best Management Practices (BMPs) and stormwater infrastructure locations and conditions; contributing drainage area to each stormwater

BMP; and baseline pollutant load computations. Table 1-1 provides additional description of the data collected.

TABLE 1-1 DATA COLLECTED

Data	Applicability
Facility Boundary	The facility boundary was the first piece of information to be collected. The facility boundary was needed to begin collecting land use, soils, BMPs, and stormwater infrastructure data.
Land Use	A land use category determines the type(s) of practices conducted on that land area. Different practices yield different types and concentrations of pollutants. For example, agricultural land is typically high in nitrogen, due to the use of certain fertilizers.
Soils	Soil characteristics impact the infiltration. For example, urban areas are typically comprised of very compacted soils, which result in higher stormwater and pollutant runoff rates.
BMPs and Drainage to BMPs	Drainage areas to existing BMPs were identified to avoid proposing new BMPs to treat overlapping areas.
Stormwater Infrastructure	Stormwater infrastructure data show how the stormwater is managed within the facility. It was used to delineate BMP drainage areas.

The data collected and developed were used to conduct an opportunity assessment to determine if stormwater BMP retrofits would be favorable to reduce pollutant loads to the Chesapeake Bay. The BMP database will provide a mechanism for managing data and assisting the localities and states with implementing WIPs. Current, accurate Geographic Information System (GIS) data used to conduct this assessment will also assist JBM-HH with future stormwater BMP maintenance and compliance requirements.

This study was undertaken to satisfy the Chesapeake Bay TMDL Action Plan requirement in Section I C of the 2013 Virginia General VPDES Permit for Discharges of Stormwater from Small Municipal Separate Storm Sewer Systems (2013 MS4 General Permit). This document was previously revised to comply with the 2018 MS4 General Permit issued by the Virginia Department of Environmental Quality (DEQ) and effective 01 November 2018; this revision was prepared to comply with the Draft 2023 MS4 General Permit.

1.2 STUDY AREA

The study area for this investigation is Joint Base Myer-Henderson Hall, which occupies approximately 269 acres within Arlington County, Virginia. The Virginia MS4 General Permit for JBM-HH applies to U.S. Army Installation Fort Myer (Fort Myer) and Marine Corps Headquarters Battalion Henderson Hall (Henderson Hall), which are jointly referred to as "the installation" throughout this Plan. JBM-HH borders Arlington National Cemetery to the west, and is located in the Potomac River watershed, which is part of the Chesapeake Bay Watershed (Figure 1-1). Arlington National Cemetery, adjacent to JBM-HH, and Fort McNair, in the District of Columbia, were not included in this opportunity assessment.

At the time of the original TMDL Study in 2015, of the installation's 268.95 acres, 263.03 acres were regulated under the MS4 permit and 5.92 acres were covered by a VPDES permit for industrial discharges (VAR05). Based on Virginia Department of Environmental Quality's (DEQ) May 2015 VA TMDL Guidance (DEQ, 2015), any land regulated under a General VPDES permit for industrial discharges may be excluded from this opportunity assessment. JBM-HH's VPDES Industrial Permit was terminated in 2019 and now all of the installation's 268.95 acres are covered under the MS4 Permit. Based on the permit language, the pollutant reduction goals and this Action Plan will continue to be based on the original TMDL study.

FIGURE 1-1 JBM-HH LOCATION

1.3 REPORT OUTLINE

The tasks required to complete this study and satisfy 2018 General MS4 Permit Part II.A.11 requirements are described in the following sections of this report. Section 2 reviews the current and future MS4 program and legal authorities (II.A.11.a). Section 3 describes the development of GIS data layers that were used in the calculation of current baseline pollutant loads. Section 4 describes the stormwater BMP database created for JBM-HH. Section 5 describes calculation of baseline loads. Section 6 details the nutrient reduction requirements and a plan to meet those requirements. Section 7 shows the suggested BMPs implementation schedule. Section 8 explains the costs to complete the reduction requirements. Section 9 includes conclusions from this study.

TABLE 1-2 RELATING MS4 PERMIT TO THIS REPORT

MS4 Permit Requirement for Action Plan Update	Section in Action Plan
Part II.A.11.a. New or modified legal authorities.	Section 2
Part II.A.11.b. The load and cumulative reduction calculations.	Section 6
Part II.A.11.c. Total reductions achieved in first permit cycle.	Section 6.1
Part II.A.11.d. A list of BMPs implemented to achieve reductions, including date of implementation and reductions achieved.	Section 6.1
Part II.A.11.e. The BMPs to be implemented by the permittee prior to the expiration of this permit to meet the cumulative reductions.	Section 7
Part II.A.11.f. Summary of any comments received as a result of public participation, responses, and resulting revisions made to the Action Plan.	Section 7.3

2 MS4 PROGRAM AND LEGAL AUTHORITIES

The provisions contained in the MS4 Permit and associated regulations will be enforced through JBM-HH policy memorandums and standardized procedures for project review and implementation. A draft Installation-wide stormwater policy was developed and approved in 2016 to address the Installation's compliance with the 2013 Virginia MS4 Permit, the Virginia general industrial stormwater permit, and other stormwater regulations. The policy outlines proper protocols for minimizing stormwater pollution during activities that directly and indirectly impact stormwater. The base-wide policy was updated in September 2019 to reflect the 2018 MS4 Permit, and again in 2020 and 2021 to expand the Environmental Management Division's authority in pollution prevention matters.

3 DATA COLLECTION AND MAPPING

GIS was used to create, analyze and plan all geographically related information. These data were created as shapefiles, which can be used to accurately measure the spatial area needed to perform land use and load reduction calculations. Each data set is in Universal Transverse Mercator (UTM) Zone 18 North American Vertical Datum of 1988 (NAVD88) horizontal coordinate system.

3.1 LAND USE

Accurate land use data is essential for baseline and reduction load calculations. Considerable effort was made to collect and develop the most accurate data and categorize it in two different ways for multiple uses. Virginia TMDL Guidance classification was necessary for Action Plan calculations; Chesapeake Bay Program (CBP) classifications will be used for model runs.

Land use polygons were attributed with land uses relevant to Virginia Guidance calculations (i.e. regulated urban impervious and regulated urban pervious). The polygons were also attributed using the same categories of land cover as those used by the CBP and their watershed model (construction, forest, hay, hay with nutrients, high intensity impervious urban, high intensity pervious urban, low intensity impervious urban, high intensity pervious urban, unfertilized grass, and water) (see Table 3-1 Land Use Classifications).

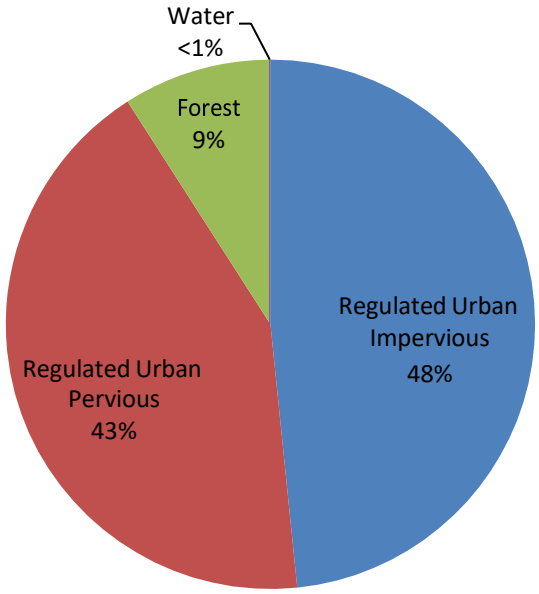
The EPA required each state to submit guidance for how to achieve the goals set forth in the WIP. Virginia Department of Environmental Quality provided draft guidance to USACE in 2013, which provided instructions to permittees for estimating pollutant source loads as of June 30, 2009 (DEQ, 2015). Before guidance was released setting 2009 as the baseline year, land use layers were developed using the most up to date information at the time (2013 aerial imagery). In response to that draft guidance, existing land use was digitized using the 2009 aerial imagery. As a result, land use layers were developed for both 2009 and 2013 conditions. The digitized imagery was used to calculate baseline load rates and the baseline load rates were then used to establish L2 reductions (see Section 5-1).

TABLE 3-1 LAND USE CLASSIFICATIONS

VA Land Use	CBP Land Use	General Description
Regulated Urban Impervious	High Intensity Impervious Urban/ Low Intensity Impervious urban	building, road, parking
Regulated Urban Pervious	High Intensity Pervious Urban/ Low Intensity Pervious urban	beach, gravel, lawn, shrubs
N/A	construction	bare earth
N/A	forest	forest, wetland
N/A	hay	row crops, not fertilized
N/A	hay with nutrients	row crops, fertilized
N/A	unfertilized grass	brush
N/A	water	water

Forty-eight percent of JBM-HH's 263.03 acres, excluding the 5.92 acres of areas formerly covered under the industrial stormwater permit, is categorized as regulated urban impervious urban land cover (127.27 acres). This includes building rooftops, parking areas, sidewalks, and recreational courts. An estimated 43 percent (111.88 acres) is categorized as regulated urban pervious land cover, or beach, gravel, lawn, or shrubs. Forest comprises 9 percent of the land (23.66 acres). Another 0.22 acres of the installation's total area is comprised of water, which accounts for less than 1 percent of the installations total area (Figure 3- 1).

FIGURE 3-1 LAND USE SUMMARY FOR JBM-HH



3.2 SOILS

Soil type was used to determine preliminary BMP site locations for planning purposes. Reduction efficiency and cost effectiveness are generally maximized when BMPs are implemented in A and B soils, and B soils make up 97 percent of the installation (260.05 acres). It is more expensive and fewer nutrients are reduced when BMPs are built in C and D soils, which are not present on the installation. The remaining three percent of the installation (8.9 acres) is considered part of the Arlington National Cemetery survey group and was therefore not identified. Soils data were obtained from the Natural Resource Conservation Service (NRCS) Web Soil Survey (WSS) (USDA NCRS, 2013). The county-wide soils layer obtained from the WSS was clipped to the installation boundary to create a shapefile specific for JBM-HH. The shapefiles are attributed with soil type and Hydrologic Soil Group (HSG). Figure 3-2 and Table 3-2 summarize JBM-HH soil groups.

FIGURE 3-2 – HYDROLOGIC SOIL GROUPS

TABLE 3-2 SOIL GROUP DISTRIBUTION

HSG	Total Area (AC)	Percentage of Installation Area
B	260.05	97%
N/A	8.9	3%

3.3 STORMWATER BEST MANAGEMENT PRACTICES (BMPS)

BMPs were inventoried and inspected annually during the first permit cycle. Drainage areas were established using the final as-built drawings or design plans. For BMPs where plans were not available, drainage areas were delineated using Light Detection and Ranging (LiDAR) data, Digital Elevation Modeling (DEM), topographic contours, and 2009 aerials (TMDL Action Plan baseline year). BMPs were delineated to include all stormwater conveyed to them through existing infrastructure. Figure 3-3 shows the location of existing BMPs at the time of the original study.

3.4 STORMWATER INFRASTRUCTURE

The stormwater layers used for this investigation were provided by the installation. Separate shapefiles were created for stormwater lines and BMPs. All GIS data created for this project and analyses have previously been submitted to DEQ.

FIGURE 3-3 EXISTING BMPS AT TIME OF FIRST PERMIT CYCLE STUDY

4 FIELD INVESTIGATION

A field assessment was performed in August 2011 to confirm land use and installation boundaries, and to inventory and assess stormwater BMPs. Project members traveled to JBM-HH and coordinated with installation points of contact to locate BMP facilities and inspect structural features.

4.1 STORMWATER BMP INVENTORY AND INSPECTION

During initial BMP evaluations in 2011, data were compiled for each stormwater BMP. A field team documented the type of BMP installed (i.e. ponds, infiltration, filtration, manufactured/underground), and the geographic location, using Global Positioning System (GPS) technology. A visual assessment of the condition of the BMP was performed and documented using The Virginia Stormwater Management Handbook (DCR, 1999). Digital photographs were also taken to document the location and condition of each BMP at the time of the inventory and assessment. Aboveground and underground BMPs at JBM-HH were then inspected by USACE in April and August of 2018 and again in September 2019. The 2019 inspections included the five recently-installed BMPs constructed on base to meet the first permit cycle reduction goals.

The end product of the stormwater BMP inventory and inspections is the BMP database, which is discussed in Section 4-2. An overall rating was assigned to each BMP; for the BMPs constructed prior to 2011, the rating was based on field evaluations. All BMPs with a contract awarded in 2016 and 2017 were inspected and rated during the 2018 inspections. A description of the ratings is provided in Table 4-1 Stormwater BMP Rating Description. These ratings will assist the installation in prioritizing maintenance and improvement activities for each facility.

TABLE 4-1 STORMWATER BMP RATING DESCRIPTION

Rating	Description
A	The BMP is functioning as designed with no problem conditions identified. No signs of impending deterioration.
B	Minor problems are observed; however, BMP is functioning as designed with no problem conditions in critical parameters.
C	Minor problems are observed; however, BMP is functioning as designed with no problem conditions in critical parameters, but BMP performance is being compromised.
D	Major problems are observed, and BMP is not functioning as designed with problem conditions in several critical parameters. Conditions have compromised the BMP performance.
E	Major problems are observed, and BMP is not functioning as designed with problem conditions in several critical parameters. Conditions have compromised the BMP performance. BMP shows signs of impending failure.

All stormwater BMPs were assigned a Permanent ID that includes an abbreviation for the type of stormwater BMP (i.e. “P” for pond or “I” infiltration), and then an identification number.

Twelve stormwater BMPs were identified for the initial TMDL Action Plan submittal in 2016. The BMPs were inventoried by the USACE field crew in 2011. Inspections were again conducted in 2018, where an additional 11 BMPs were added to the inventory for a total of 23 BMPs. Table 4-2 shows the BMP Inventory Results and Table 4-3 shows the inspection results based on condition ratings. The location and type of BMPs are recorded for the BMPs in the BMP Access Database, which is discussed in Section 4.2.

TABLE 4-2 BMP INVENTORY RESULTS

BMP type	Number
Filtration	7
Infiltration	1
Manufactured	6
Miscellaneous	3
Ponds	6

TABLE 4-3 BMP INSPECTION RESULTS

Rating	Number
A	7
B	9
C	2
D	4
E	0

4.2 STORMWATER BMP DATABASE

The data collected from the field assessments was used to create the BMP Database. The BMP database serves as a tracking and record keeping tool and can also be used to determine the pollutant reductions provided by implementing various BMPs. The BMP Database can be used to create a map of all BMP locations within the installation, by exporting a GIS shapefile. The database is in Microsoft Access format, with forms containing all the inspection results and a digital photograph of each BMP. Should the installation implement any additional stormwater BMPs, the database can be expanded so installation staff can use it to manage their stormwater program. In 2021, this Access database was transferred to an online GIS-based platform. Additionally, all historical BMPs have been reported to DEQ.

5 ESTABLISHMENT OF BASELINE POLLUTANT LOADS

Knowledge of baseline (existing) loading conditions for TN, TP and TSS is needed to guide the facilities in their management and implementation of stormwater BMPs to meet the overall Chesapeake Bay TMDL pollution reduction requirements. The Chesapeake Bay Program Watershed Model (CBPWM) is at a macro-scale and typically does not have the level of detail in land use and installation boundary data as was collected in this study. Therefore, independent calculations of baseline pollutant loads, using the best data available, is needed to better understand the actual baseline pollutant contribution from these facilities and what level of improvements, if any, are needed to meet overall Chesapeake Bay TMDL goals.

5.1 METHODOLOGY

Tables provided in the Virginia TMDL Guidance were used to calculate pollutant load rates from JBM-HH (DEQ, 2014). This approach uses tables with established “Edge of Stream” (EOS) loading rates for pervious and impervious land uses in each of the four regional river basins within the Chesapeake Bay watershed – James River, Potomac River, Rappahannock River, and York River. The total existing acreage for each site is then input into the appropriate table and multiplied by the 2009 EOS loading rate to determine the estimated baseline loads.

5.2 RESULTS

JBM-HH is located within the Potomac River watershed. Baseline load rates from the 2009 CBPWM; acres served by JBM-HH’s MS4 permit, which excludes the 5.92 acres on JBM-HH within industrial permit areas; and the estimated pollutant loads for JBM-HH based on the 2009 progress run rates are shown in Table 2-b: Calculation Sheet for Estimating Existing Source Loads for the Potomac River (Based on Chesapeake Bay Program Watershed Model Phase 5.3.2) (DEQ, 2015).

TABLE 5-1 BASELINE POLLUTANT LOADS

Regulated Urban Land Use Type	Pollutant	Total Existing Acres Served by MS4 (06/30/09)	2009 EOS Rate (lbs/acre)	Estimated Total POC Load (lbs) Based on 2009 Progress Run
Impervious	Nitrogen	127.27	16.86	2,145.77
Pervious		111.88	10.07	1,126.63
Impervious	Phosphorus	127.27	1.62	206.18
Pervious		111.88	0.41	45.87
Impervious	Suspended Solids	127.27	1,171.32	149,073.90
Pervious		111.88	175.80	19,668.50

6 ESTIMATED POLLUTANT LOAD REDUCTIONS

By 2028, JBM-HH is prepared to meet their targeted pollutant load reduction. Table 6-1 summarizes the percent pollution reduction requirements for impervious and pervious land use L2 scoping run reductions, presented in the Phase II WIP and enforced through the MS4 permit equate to a reduction of 9 percent of TN loads, 16 percent of TP loads, and 20 percent of TSS loads from impervious regulated acres, and 6 percent of TN loads, 7.25 percent of TP loads and 8.75 percent TSS loads beyond 2009 progress loads for pervious regulated acreage by the end of the third permit cycle. Virginia (VA) TMDL Guidance provides flexibility in the implementation of specific management technologies employed to meet the required reductions, while stipulating standards and/or objectives. MS4 operators will be able to adjust the levels of reduction between pervious and impervious land uses within their service area, provided the total load reduction for each pollutant is met.

TABLE 6-1 POLLUTION REDUCTION REQUIREMENTS

Pollutant	Regulated Acreage % Load Reduction Target	
	Impervious	Pervious
TN	9%	6%
TP	16%	7.25%
TSS	20%	8.75%

Best Management Practices accepted as methods of reducing pollutant loads for TMDL requirements include: street sweeping, urban stream restoration, shoreline restoration, land use change, structural BMPs, urban nutrient management, and nutrient trade. Street Sweeping is credited based on the number of sweeping events per year, number of curb lane miles swept per event, and the type of street sweeper used. Permittees may receive credit for urban stream restoration, based on linear footage of restoration completed. The methodology under review is based on linear footage of shoreline restored and was used to calculate reductions in this report (Drescher, 2014). Conversion of land use from impervious to pervious or forest land may also receive POC reductions credits based on the acreage changed and type of change. Urban nutrient management plans developed for unregulated, public land smaller than one acre where nutrients are applied may be considered for credit, but have not yet been developed at JBM-HH. Permittees may also offset pollutant loads trading non-point source nutrients in accordance with Virginia Code (DEQ, 2015).

VA TMDL Guidance provided a table of CBP BMP load reduction efficiencies, which were used to calculate BMP pollutant removal rates.

2009 progress run estimated pollutant loads were applied to the load reduction targets to calculate pollutant load reductions required for each of the three permit cycles at JBM-HH, shown in Table 6-2.

TABLE 6-2 POLLUTANT REDUCTIONS REQUIRED FOR JBM-HH, BY PERMIT CYCLE

Pollutant	First Permit Cycle Reductions (lbs) 5% by 2018	Second Permit Cycle Reductions (lbs) 40% by 2023	Third Permit Cycle Reductions (lbs) 100% by 2028
TN	13.54	104.29	260.72
TP	1.38	14.53	36.31
TSS	1,576.48	12,614.31	31,535.77

Table 6-3 shows the "Calculation Sheet for Determining Total POC Reductions Required during the Permit Cycle for the Potomac River Basin" provided in the VA TMDL Guidance completed with total existing acres served by JBM-HH's MS4 permit for regulated urban impervious and pervious land uses and the resulting reduction required by applying the reduction loading rate provided in the fourth column (DEQ, 2015). Permit cycle 1 goals were met; total POC reductions are seen in Table 6.3.

TABLE 6-3 FIRST PERMIT CYCLE REDUCTIONS

Regulated Urban Land Use Type	Pollutant	Total Existing Acres Served by MS4 (6/30/09)	First Permit Cycle Required Reduction in Loading Rate (lbs/acre/yr)	Total Reduction Required First Permit Cycle (lbs/yr)**	Actual First Permit Cycle Total Achieved (lbs/yr) and % 2028 *
Impervious	Nitrogen	127.27	0.08	10.18	47.20 (17.4%)
Pervious		111.88	0.03	3.36	
Impervious	Phosphorus	127.27	0.01	1.27	6.07 (22.0%)
Pervious		111.88	0.001	0.11	
Impervious	Total Suspended Solids	127.27	11.71	1,490.33	2,650.40 (8.4%)
Pervious		111.88	0.77	86.15	

*BMPs awarded in 2016 and 2017 for construction and 2014 demolition
**Table 3b: Calculation Sheet for Determining Total POC Reductions Required During the Permit Cycle for the Potomac River Basin (*Based on Chesapeake Bay Program Watershed Model Phase 5.3.2)

6.1 FIRST PERMIT CYCLE PROGRESS

First Permit Cycle goals were met by awarding contracts for five new BMPs to be built, as well as demolishing Building 406 in 2014, which converted the area from impervious surface to grass. Reduction totals from permit cycle one can be seen in Table 6-4. Figure 6-1 shows the location of all BMPs implemented to meet the first permit cycle goals. Several of the BMPs were scheduled to be completed prior to July 2018 but experienced delays due to funding difficulties and construction contractor delays; these BMPs were all completely by April 2019. VA TMDL Guidance provided a table of CBP BMP load reduction efficiencies, which were used to calculate BMP pollutant removal rates.

TABLE 6-4 FIRST PERMIT CYCLE ESTIMATED POLLUTANT REDUCTIONS BY BMP

BMP Name	BMP Type	Location	Implementation Date	TN Removal Efficiency/ TN Removed (lbs/yr)	TP Removal Efficiency/ TP Removed (lbs/yr)	TSS Removal Efficiency/ TSS Removed (lbs/yr)
Special Events Area Bio-retention	Bio-retention	38.878002, -77.079534	May 2018	60% 11.61	50% 1.59	70% 657.01
Special Events Area Permeable Pavement	Permeable Pavement	38.877827, -77.079491	May 2018	25% 4.23	25% 0.59	67% 264.39
Building 406 Demolition	Impervious to Pervious Conversion	38.877354, -77.080576	2014	15.07	1.61	747.94
Sheridan Avenue Bio-swale	Bio-swale	38.872978, -77.080705	April 2019	35% 3.94	40% 0.57	67% 269.98
Pershing Drive Permeable Pavers	Permeable Pavers	38.874226, -77.079997	April 2019	25% 2.11	25% 0.30	62% 179.62
Fitness Center Parking Lot Bio-swales	Bio-swales	38.874987, -77.082009	April 2019	35% 2.63	40% 0.38	58% 165.10
East Lot Island Bio-retention	Bio-retention	38.877477, -77.079375	April 2019	60% 8.71	50% 1.19	58% 423.44
Total Pollutant Removal				**48.3**	**6.23**	**2,707.48**
2028 Pollutant Goal (lbs)				**260.72**	**36.31**	**31,535.77**
% 2028 Goal				**18.53%**	**17.16%**	**8.59%**

FIGURE 6-1 FIRST PERMIT CYCLE BMPS

6.2 SECOND PERMIT CYCLE PROGRESS

Second Permit Cycle goals were met by converting an area of impervious tennis courts to grass, awarding contracts for street sweeping twice per week and the construction of 14 tree box filter units (Filterras), and excess pollutant reduction credits generated by BMPs for the Perimeter Security Fence construction project. The following sections describe these BMPs in further detail.

6.2.1 Tennis Court Demolition

From June-August 2023, a 1.31-acre area of paved tennis courts located south of the Wainwright Hall Hotel (318 Jackson Ave Bldg. 50, Fort Myer, VA 22211) was demolished and converted to grass. This impervious to pervious conversion qualifies as a Land Use Change BMP. Table 6-5 below shows the calculation of pollutant reductions based on reduction efficiencies from the Land Use Change Conversion Efficiency Table included in VADEQ's 2021 Chesapeake Bay TMDL Guidance Memorandum.

TABLE 6-5 ANNUAL POLLUTANT LOAD REDUCTION CALCULATION – TENNIS COURT CONVERSION

Pollutant	Pollutant Reduction Efficiencies* (lb/ac/yr)	Area of Land Conversion (acres)	Pollutant Reduction (lbs/yr)
TN	4.27	1.31	5.59
TP	0.00	1.31	0.00
TSS	1240	1.31	1624.40

* Reduction Efficiencies for Impervious to Turf Conversion in the Potomac River Basin

6.2.2 Street Sweeping

JBM-HH DPW has established a contract to conduct street sweeping with a regenerative air street sweeper of at least 50 curb-lane miles of Fort Myer-Henderson Hall twice per week. The contractor is set to begin operations on October 1, 2023.

Street sweeping estimates for TN, TP, and TSS are based on the removal rates and calculation methods detailed 2016 "Recommendations of the Expert Panel to Define Removal Rates for Street and Storm Drain Cleaning Practices" approved by the Chesapeake Bay Expert Panel (Chesapeake Stormwater Network et al., 2016). Lane miles were calculated using GIS mapping of the facility. Calculations of areas to be swept totaled 64.5 curb lane miles; this amount was decreased to 50 curb lane miles for the purposes of pollutant reduction credit calculations to incorporate a margin of error and prevent shortfalls in meeting requirements.

The street sweeping contract includes requirements to use a regenerative air street sweeper twice per week, which corresponds with Street Sweeping Practice 1 described in the Expert Panel Report (SCP-1). Table 6-6 below shows the calculation of pollutant reductions that would be removed per year with the implementation of the street sweeping contract program at JBM-HH. The annual loads for the Potomac River Basin (Table 3b of the 2018 MS4 Permit), as well as pollutant removal rates associated with SCP-1, are included in Table 6-5 (Chesapeake Stormwater Network et al., 2016).

TABLE 6-6 ANNUAL POLLUTANT LOAD REDUCTION CALCULATION – STREET SWEEPING

Pollutant	Loading Rate (lbs/ac/yr)	x	Acres Swept	=	Annual Load/Year (lbs)	x	Removal Rates (%)*	=	Pollutant Load Removed/Year (lbs)
TN	16.86	x	50	=	843	x	4	=	33.72
TP	1.62	x	50	=	81	x	10	=	8.1
TSS	1,300	x	50	=	65,000	x	21	=	13,650

*Based on SCP-1 in Table 17 of the 2016 Expert Panel Report

6.2.3 Tree Box Filter Units

JBM-HH has awarded a contract for the construction of 14 Filterra units located within three parking lots at Fort Myer-Henderson Hall. The Filterra units were scheduled to be completed prior to October 2023; however, several issues resulted in project schedule delays including difficulties in obtaining the funding for the project, staffing and resource shortages due to the COVID-19 pandemic, and necessary changes in the scope due to the limited available space for stormwater BMPs on base. VADEQ was notified of this delay in December 2022. At this time, the project is underway and is anticipated to be completed by the end of May 2024.

Calculation of the pollutant reductions for the Filterra units were conducted based on the following VADEQ-approved pollutant removal efficiencies for the proprietary units: 34% for TN, 62% for TP, and 85% for TSS. Table 6-7 below lists the pollutant reductions calculated for each unit:

TABLE 6-7 POLLUTANT REDUCTIONS BY FILTERRA UNIT

BMP Name	Location	Pollutant Removal Efficiencies/ Amount Removed (lbs/yr)		
		TN	TP	TSS
Commissary Lot Filterra - Inlet #700	38.870403, -77.077071	3.09	0.46	431.06
Commissary Lot Filterra - Inlet #701	38.870313, -77.077532	1.76	0.29	276.00
Commissary Lot Filterra - Inlet #702	38.870383, -77.077646	2.77	0.45	439.01
Commissary Lot Filterra - Inlet #703	38.869999, -77.077134	1.32	0.21	199.88
Commissary Lot Filterra - Inlet #704	38.869757, -77.076895	2.03	0.33	322.79
Commissary Lot Filterra - Inlet #706	38.869583, -77.077808	1.71	0.27	263.09
Commissary Lot Filterra - Inlet #707A	38.869709, -77.077953	1.76	0.29	281.92
Commissary Lot Filterra - Inlet #707B	38.86987, -77.078141	1.34	0.22	211.36
Commissary Lot Filterra - Inlet #708A	38.870177, -77.078315	2.96	0.38	337.37
Commissary Lot Filterra - Inlet #708B	38.87013, -77.078261	2.96	0.38	337.37
Radar Clinic Lot Filterra - Inlet 746	38.869232, -77.075717	1.69	0.26	253.62
Radar Clinic Lot Filterra - Inlet 747	38.869359, -77.075508	1.72	0.28	268.65
Building 416 Lot Filterra - Inlet 545	38.876281, -77.082295	1.02	0.15	137.71
Building 416 Lot Filterra - Inlet 542	38.876317, -77.082006	1.16	0.17	153.81
Total Pollutant Removal		**47.20**	**6.07**	**2,650.40**
2028 Pollutant Goal (lbs)		**270.80**	**27.60**	**31,529.60**
% 2028 Goal		**17.4%**	**22.0%**	**8.4%**

6.2.4 Perimeter Security Fence BMPs

In 2020, the perimeter security fence around JBM-HH was replaced and upgraded. The project also included adding a parking lot on the Henderson Hall side. Based on the amount of land disturbance involved with the project, stormwater management requirements applied and the following stormwater BMPs were installed:

- Three bioswales in the medians of the new Henderson Hall parking lot
- Permeable pavement jogging paths along McNair Road and the Arlington National Cemetery boundary wall
- Permeable pavers in the parking lot in front of the Old Post Chapel

The stormwater BMPs exceeded the required reductions for the construction project, providing available pollutant reduction credits to be applied to the JBM-HH's TMDL goals.

Based on the Virginia Runoff Reduction Method (VRRM) calculations conducted for the project, 2.28 lbs of TP were required to be removed. The above listed BMPs removed a total of 2.9 lbs of TP, exceeding the requirement by 0.62 lb. In accordance with the calculation methods identified in Appendix V.E of VADEQ's Chesapeake Bay TMDL Special Condition Guidance Memo No. 20-2003, the proportion of reduction is 0.66 (0.62 TP credit / 0.94 TP total removed). Using the Clearinghouse efficiency for TN, the corresponding amount of TN credit available for the TMDL goals is 25.17 lbs (38.14 x 0.66). Based on the Chesapeake Bay Program V.B curve, the corresponding TSS credit is 1,656.26 lbs (2509.48 x 0.66).

To summarize, the credits available to apply toward JBM-HH's TMDL goals are 25.17 lbs TN, 0.62 lb TP, and 1,656.26 lbs TSS.

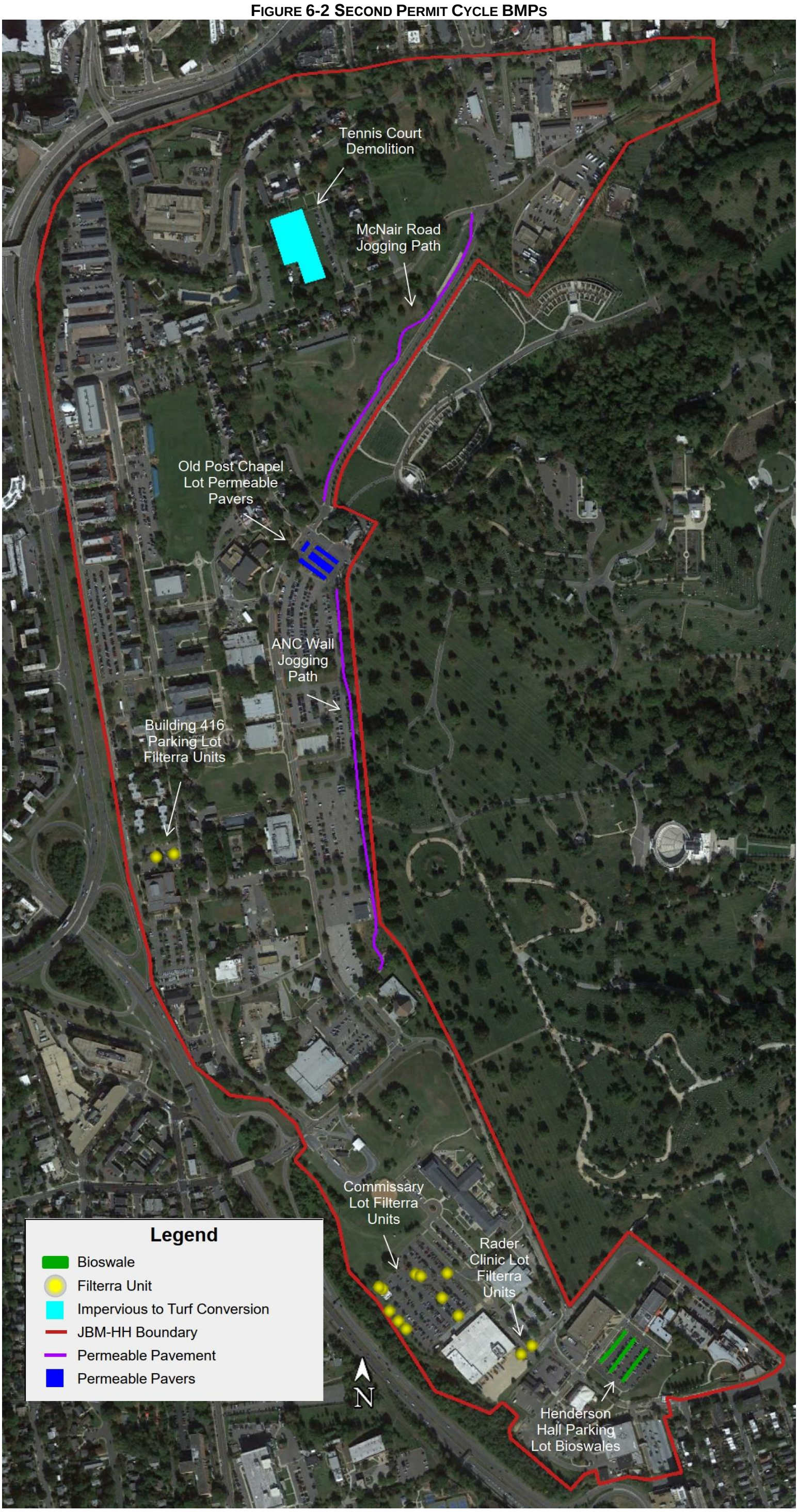
6.2.5 Second Permit Cycle Summary

Reduction totals for the second permit cycle are listed below in Table 6-8. Figure 6-2 shows the location of all BMPs implemented to meet the second permit cycle goals.

TABLE 6-8 SECOND PERMIT CYCLE ESTIMATED POLLUTANT REDUCTIONS SUMMARY

BMP Name	BMP Type	Implementation Date	Pollutant Removal Efficiencies/ Amount Removed (lbs/yr)		
			TN	TP	TSS
Tennis Court Demolition	Impervious to Grass Conversion	August 2023	5.59	0.00	1,624.40
Street Sweeping Twice per Week	Street sweeping with regenerative sweeper	October 1, 2023	33.72	8.1	13,650
Commissary Lot Filterras (10 Units)	Precast Tree Box Filter Unit	Completion by Spring 2024	21.72	3.28	3,099.86
Radar Clinic Lot Filterras (2 Units)	Precast Tree Box Filter Unit	Completion by Spring 2024	3.40	0.54	522.27
Building 416 Lot Filterras (2 Units)	Precast Tree Box Filter Unit	Completion by Spring 2024	2.18	0.31	291.52
Perimeter Security Fence Project	Bioswales, Permeable Pavement, and Permeable Pavers	June 26, 2020	25.17	0.62	1,656.26
Total Pollutant Removal for Second Permit Cycle			**95.16**	**13.67**	**22,209.31**
First Permit Cycle Reductions			48.3	6.23	2,707.48
Total Reductions Achieved (Permit Cycle 1 and 2)			**143.46**	**19.9**	**24,916.79**
2023 Pollutant Goal (lbs)			**104.29**	**14.53**	**12,614.31**
% 2023 Goal			138%	137%	198%

FIGURE 6-2 SECOND PERMIT CYCLE BMPS



7 PLAN FOR REMAINING 2028 POLLUTANT LOAD GOALS

In addition to structural BMPs, permittees may receive credit for street sweeping, land use change, urban nutrient management, nutrient trading, and urban stream restoration. Any conversion of land use from urban impervious to pervious or to forest can receive credit for pollutant removal, as explained in the VA TMDL Guidance (DEQ, 2015). Urban nutrient management plans developed for unregulated, public land smaller than one acre where nutrients are applied may be considered for credit. Permittees may offset pollutant loads trading non-point source nutrients in accordance with Virginia Code. Permittees may also receive credit for urban stream restoration, based on the reduction of nutrients entering streams as a result of the restoration. This section presents recommended BMPs to meet the remaining 2028 load reductions.

7.1 ADDITIONAL PLANNED BMPS

7.1.1 Lower Paddock Conversion to Meadow

As part of the Installation's mission, a stables facility with associated paddocks is operated on base. The Lower Paddock is a fenced in area along the northwestern property boundary of JBM-HH, adjacent to Route 50. This paddock has become severely compacted over time by its use for pasturing horses and no longer allows water to freely infiltrate the ground. The stables staff have ceased using the paddock for horses and there are plans in place to convert 0.65 acre of the former paddock into mixed open land in 2024.

Based on conversations with the VADEQ Construction Division, the compacted paddock is considered impervious surface based on its condition. Converting the area to a meadow would therefore qualify as a Land Use Change BMP with the conversion of impervious to mixed open.

According to VADEQ's 2021 Chesapeake Bay TMDL Special Condition Guidance Memorandum, the removal efficiencies for this BMP in the Potomac River Basin are 9.55 lbs/ac/yr of TN, 0.48 lbs/ac/yr of TP, and 877 lbs/ac/yr of TSS. Based on the size of the area that would be converted (0.65 acre), this conversion would result in pollutant reductions of 6.21 lbs/yr TN, 0.31 lbs/yr TP, and 570.05 lbs/yr TSS.

TABLE 7-1 PLANNED BMP REDUCTIONS

	TN (lb/yr)	TP (lb/yr)	TSS (lb/yr)
Lower Paddock Conversion to Meadow (Impervious to Mixed Open)	6.21	0.31	570.05
First and Second Permit Cycle BMPs	143.46	19.9	24,916.79
Total	**149.67**	**20.21**	**25487**
% 2028	**57.41%**	**55.66%**	**80.82%**

7.1.2 Credit Purchasing

Federal agencies are currently prohibited from purchasing water quality credits to meet pollutant reduction goals. Congress must amend the CWA to allow federal agencies to develop policy and participate in a Water Quality Trading program and purchase credits. The DoD CWA Steering Committee and DoD's Army Environmental Command (AEC) are currently engaged in efforts to advance amendments to the CWA to allow for credit purchasing. If these amendments are implemented, JBM-HH plans to purchase credits to satisfy the remaining gap to the 2028 pollutant reduction goals.

7.2 ADDITIONAL POTENTIAL PROPOSED BMPS

In the event credit purchasing does not become an option to meet 2028 reduction goals, the following BMPs are being evaluated as options to achieve the required reductions for 2028.

Millennium Vault Retrofit

The existing Millennium Stormwater Detention Vault is used primarily to provide volume control with some water quality control provided by a hydrodynamic separator. The Millennium Vault is a good candidate for water quality retrofit. The proposed plan would be to incorporate proprietary filter cartridges either upstream or in the actual vault to pre-treat the first flush stormwater. The vault could also include a rainwater harvesting component to maximize water quality credits. Table 7-2 shows the removal estimate with and without rainwater harvesting and Figure 7-2 shows the location of the vault and associated drainage area.

Summerall Field Rainwater Harvesting

The proposed BMP for Summerall Field is a relatively new take on rainwater harvesting. The field will be filled with sand that has a 29% void space. The profile will maintain a 4-inch -5-inch depth that is completely saturated in the bottom. Stormwater will be diverted to the sand bed profile and distributed through a 6-inch -8-inch diameter PVC "header" with dozens of 2-inch-diameter pipe connections that extend into Environmental Passive Integrated Chambers (EPIC chambers), followed by a 2-inch diameter pipe section to another EPIC chamber. The stormwater will be evenly distributed across the entire parade field. Underground detention vaults will be placed upstream of Summerall Field and will retain peak flow to maintain a slow release into the sand bed profile. Once the water enters the parade field it can only: 1) evaporate, 2) transpire through the growth of grass, or 3) discharge (after being filtered from moving through the sand bed) into an overflow pipe that will be connected to an existing storm drain pipe/system.

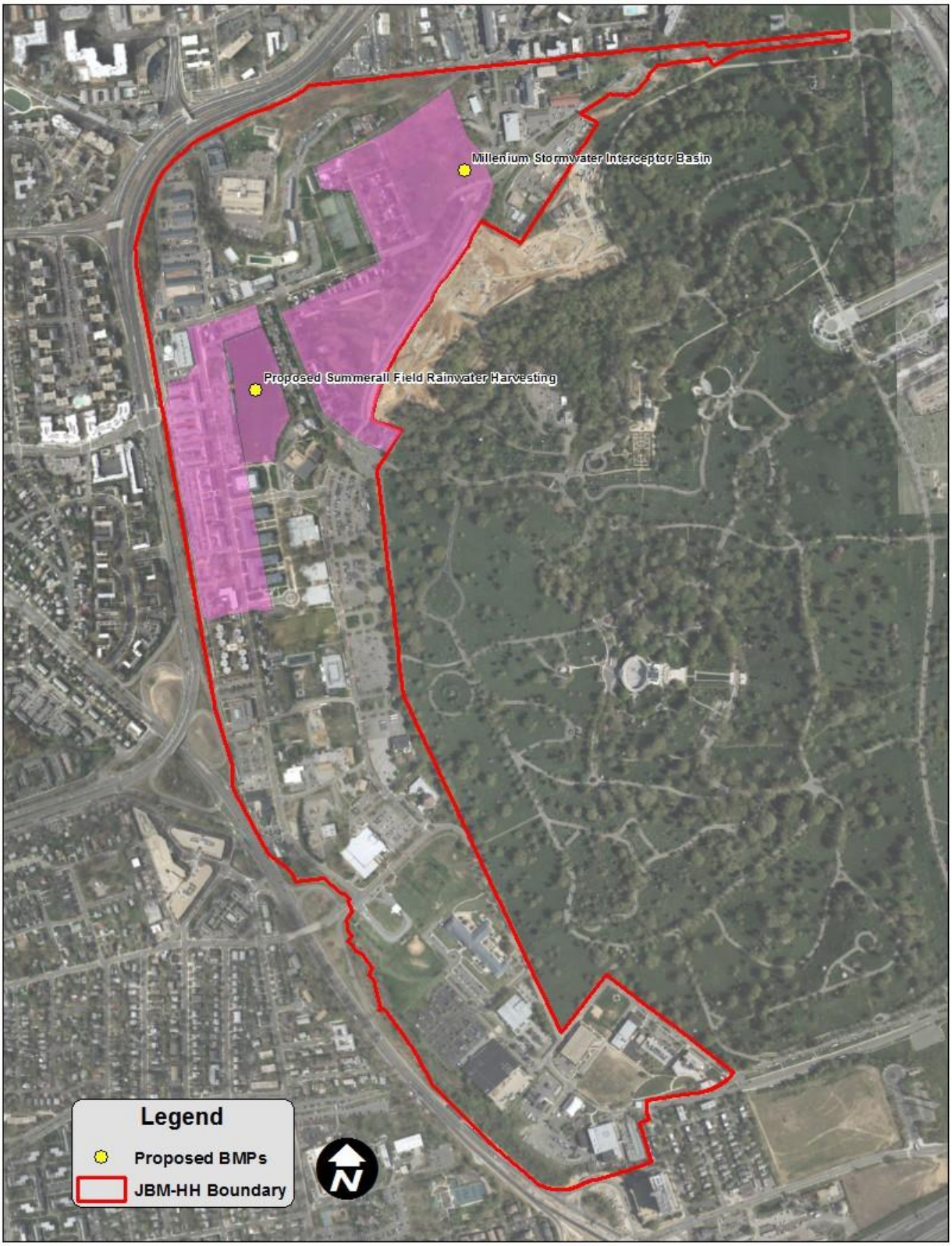
Table 7-2 shows the removal estimates for the proposed Summerall Field Rainwater Harvesting BMP and Figure 7-1 shows the location of the proposed BMP and associated drainage area.

TABLE 7-2 PROPOSED BMP REDUCTIONS

	TN (lb/yr)	TP (lb/yr)	TSS (lb/yr)
Millennium Vault Retrofit without Rainwater Harvesting (Filter Cartridges only)	50.70	10.42	5,155.00
% 2028*	**19.45%**	**28.70%**	**16.35%**
Millennium Vault Retrofit with Rainwater Harvesting	80.00	12.00	7,500.00
% 2028*	**30.68%**	**33.05%**	**23.78%**
Summerall Field Rainwater Harvesting	293.10	28.16	20,362.70
% 2028*	**112.42%**	**77.55%**	**64.57%**

*Percentage of total 2028 goals without first and second permit cycle BMPs factored in.

FIGURE 7-1 PROPOSED BMPS



7.3 SUMMARY

The proposed BMPs outlined in this section are summarized in Table 7-4. If credit trading does not become an option to meet the 2028 reduction goals, a combination of these BMPs could satisfy the final 2028 TMDL Action Plan reduction goal.

***TABLE 7-3 SUMMARY OF PLANNED & PROPOSED BMPS**

	BMP Pollution Reduction (lb/year)		
AOI	**TN**	**TP**	**TSS**
Lower Paddock Conversion to Meadow (Impervious to Mixed Open)	6.21	0.31	570.05
Percent of 2028 Goal**	**2.38%**	**0.85%**	**1.81%**
Millennium Vault (Filter, no RWH)	50.70	10.42	5,155.00
Percent of 2028 Goal**	**19.45%**	**28.70%**	**16.35%**
Millennium Vault (Filter, with RWH)	80.00	12.00	7,500.00
Percent of 2028 Goal**	**30.68%**	**33.05%**	**23.78%**
Summerall Field	293.10	28.16	20,362.70
Percent of 2028 Goal**	**112.42%**	**77.55%**	**64.57%**

*2028 Reduction Goals are 260.72 for TN, 36.31 for TP, and 31,535.77 for TSS.
**Percentage of total 2028 goals without first and second permit cycle BMPs factored in.

7.4 PUBLIC PARTICIPATION

The Chesapeake Bay TMDL Action Plan was uploaded to JBM-HH's Stormwater Pollution Prevention webpage in May 2019 and made available for public comment. The Action Plan included street sweeping, the Millennium Vault retrofit, and Summerall Field BMPs. No comments were received from the public on the Action Plan. This Plan was updated in October 2019, ahead of the November 1 submission deadline, to address changes in calculation methods for pollutant reductions from street sweeping in order to reflect the guidance provided in the 2016 Expert Panel Report, as suggested by VADEQ. This version of the TMDL Action Plan, which was prepared to comply with the draft 2023 MS4 General Permit, will be uploaded to JBM-HH's website and made available for public comment by the end of October 2023.

8 IMPLEMENTATION SCHEDULE AND COSTS

8.1 SCHEDULE

VA TMDL Guidance provides a timeline for when these pollutant load reductions must be implemented, as described in Table 6-2.

The five BMPs and Building 401 Demolition were completed for the First Permit Cycle goals. For the Second Permit Cycle goals, the Perimeter Security Fence BMPs were completed in June 2020; the tennis court demolition and conversion to grass was completed in August 2023; the street sweeping contract has been awarded and sweeping twice per week will begin the week of October 1, 2023; and the Filterra unit project construction contract has been awarded and is underway, with completion expected by Spring 2024.

JBM-HH is currently working towards meeting the Third Permit Cycle goals through one land conversion project, anticipated to be completed in 2024 and credit purchasing, for which the Army Environmental Command is currently working towards approval. Additionally, JBM-HH is looking into the options of retrofitting the vaults and has contracted with USACE to complete a BMP opportunities assessment to identify additional methods of meeting the 2028 goals over the next five years.

8.2 COST

The total cost to implement BMPs to satisfy the first phase of the permit for JBM-HH was $2,995,239, excluding the cost of the building demolition.

For the second permit cycle, the street sweeping contract (for six months of sweeping twice per week) cost is $197,431, with options for additional six-month increments. The cost for implementation of 14 Filterra units is approximately $2.8M. The tennis court demolition contract cost $392,019.80, and the cost of the BMPs constructed for the Perimeter Security Fence Project is unknown at this time.

Costs for the Millennium Vault retrofit and Summerall field are currently unknown and will be updated once design is initiated.

Several variables to be explored in later phases of the study can greatly affect the cost to implement a BMP, such as utility placement, regional specific permits, and unexploded ordinance surveys, type of contract, acquisition strategy, and real property. With further investigation, these areas of interest can be prioritized based on the cost of logistics to construct the BMPs and divert stormwater to them.

9 CONCLUSIONS

The purpose of this study is to provide technical data pertaining to the Chesapeake Bay TMDL Action Plan for JBM-HH. This was executed by locating, inventorying, and assessing the condition of existing stormwater BMPs, quantifying source loads for TN, TP, and TSS within the installation boundary and identifying opportunities to reduce pollutant loads to the Chesapeake Bay.

The results of this investigation conclude that approximately 3,272.40 lbs of TN, 252.05 lbs of TP and 168,742.40 lbs of TSS are loaded into waterways from JBM-HH per year, based on 2009 land use data. JBM-HH must reduce their nutrient loads by 260.72 lbs of TN, 36.31 lbs of TP and 31,535.77 lbs of TSS by the end of the third MS4 permit cycle in 2028. Permit cycle one successfully met the pollutant reduction goals by implementing five stormwater BMPs and demolition of building and converting to pervious. The conversion of tennis courts to turf, installation of 14 Filterra units, excess credits earned from BMPs constructed for a land disturbing project, and implementation of a rigorous street sweeping program will exceed second permit cycle goals. If credit purchasing, additional impervious surface removal, the Millennium Vault retrofit, and the Summerall Field Rainwater Harvesting are implemented (or some combination of them), JBMHH will exceed their pollutant reduction goals by 2028. The cost to implement the proposed structural BMPs proposed to meet these requirements is unknown and will require a more in-depth engineering and cost analysis.

JBM-HH will release the Action Plan information to the public via JBM-HH's stormwater pollution prevention webpage. It will be available for comment for 30 days. The "public," as defined by JBM-HH's MS4 Program Plan is "the resident and employee population within the fence line of the facility" (JBM-HH, 2013).

A BMP database was created to store and organize data collected from the BMP inventory conducted as a part of this study; it also provides the installation with a tool to track L2 reduction progress and generate annual progress report.