GEORGE WASHINGTON MEMORIAL PARKWAY

CHESAPEAKE BAY TMDL ACTION PLAN

Prepared in compliance with General Permit No. VAR040100
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Photo credit: National Park Service

Prepared by National Park Service staff with assistance from

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CERTIFICATION

"I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations."

Name	Title	Date
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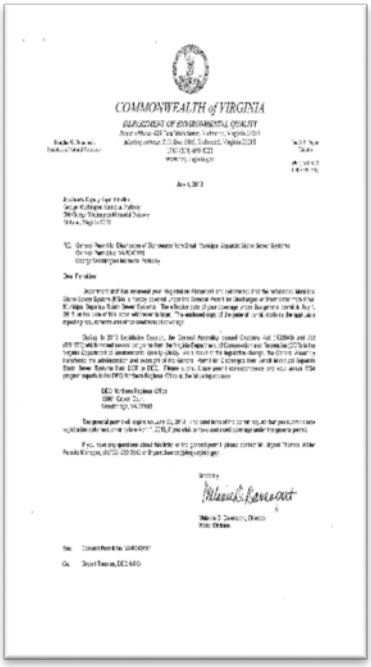
Acronyms

BMP	Best Management Practice
CSN	Chesapeake Stormwater Network
DEQ	Department of Environmental Quality
EPA	Environmental Protection Agency
GWMP	George Washington Memorial Parkway
IDDE	Illicit Discharge Detection and Elimination
MCM	Minimum Control Measure
MEP	Maximum Extent Practicable
MS4	Municipal Separate Storm Sewer System
NPS	National Park Service
PEPC	Planning, Environment, and Public Comment
POC	Pollutants of Concern
TN	Total Nitrogen
TP	Total Phosphorus
TMDL	Total Maximum Daily Loads
TSS	Total Suspended Solids
VPDES	Virginia Pollutant Discharge Elimination System
VSMP	Virginia Stormwater Management Program
WIP	Watershed Implementation Plan

WLA Waste Load Allocation

1 Introduction and Background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DEPARTMENT OF ENVIRONMENTAL QUALITY

This Chesapeake Bay Total Maximum Daily Loads (TMDL) Action Plan documents how the National Park Service (NPS) intends to meet the "Special Condition for Chesapeake Bay TMDL" in Section I, Part C of the George Washington Memorial Parkway's (GWMP's) General Permit for Discharges of Stormwater from Small Municipal Separate Storm Sewer Systems (MS4s). The GWMP's most recent permit (VAR040100) was issued by the Virginia Department of Environmental Quality (DEQ) effective July 1, 2013 and will expire June 30, 2018.

The GWMP's MS4 permit requires the development and implementation of action plans for impaired streams where a TMDL has been established. The GWMP has been assigned a waste load allocation (WLA) as part of the TMDL that has been approved by the State Water Control Board. A TMDL establishes the maximum amount of a pollutant that can enter a water body without violating water quality standards.

A TMDL for the Chesapeake Bay was established by the U.S. Environmental Protection Agency (EPA) in 2010. Pollutants of concern (POCs) identified for the Chesapeake Bay include total nitrogen (TN), total phosphorus (TP), and total suspended solids (TSS). Virginia subsequently developed and adopted a Watershed Implementation Plan (WIP) that establishes the basic framework for meeting the Chesapeake Bay TMDL. The Virginia WIP commits MS4 permit holders to a phased approach for meeting required load reductions over three five-year permit cycles in accordance with the following: 5% of required reductions by the end of the first permit cycle (June 30, 2018); a total of 40% of required reductions by the end of the second permit cycle; and, 100% of required reductions by the end of the third permit cycle.

This Chesapeake Bay TMDL Action Plan calculates the 5% reduction target and establishes the means and methods for achieving the reduction target in accordance with the MS4 permit and the final Chesapeake Bay TMDL Special Condition Guidance developed by DEQ (Guidance Memo No 15-2005) dated May 18, 2015. Reductions in excess of 5% will be applied to the second permit cycle requirements.

1.1 Current Program and Legal Authority

The NPS will participate in the early and candid evaluation of proposals by other governmental or private entities to avoid adverse environmental impacts to NPS park units or other park or recreation resources subject to the provisions of Federal law. This is an essential element of effective NPS stewardship. When participating in the environmental impact analysis processes of other entities, the Associate Director for Natural Resource Stewardship and Science will ensure

that the NPS's responsibilities for commenting are clearly defined and that the Service and its personnel work with federal, tribal, state, and local governments in identifying and evaluating potential impacts to resources under NPS jurisdiction or within areas of NPS expertise. Examples include, but are not limited to:

- Consultation under provisions of Section 4(f) of the Department of Transportation Act;
- Evaluation of noise, visual, or other impacts to national park system resources resulting from external activities;
- Hydropower re-licensing projects through Federal Energy Regulatory Commission procedures;
- Impacts of proposed projects on non-NPS areas that have benefited from NPS-administered partnership programs (e.g., Land and Water Conservation Fund, Rivers and Trails, National Natural Landmarks, National Register Properties, etc.);
- Analysis of cumulative ecosystem or other impacts upon the integrity of NPS administered resources; and
- The impacts of any federal activity on other park resources.

Additionally, the National Park Service is subject to the National Environmental Policy Act of 1969 (NEPA). NEPA is landmark environmental legislation establishing as a goal for Federal decision-making a balance between use and preservation of natural and cultural resources. NEPA requires all Federal agencies to (1) prepare in-depth studies of the impacts of and alternatives to proposed "major Federal actions" prior to making decisions; (2) use the information contained in such studies in deciding whether to proceed with the actions; and (3) diligently attempt to involve the interested and affected public before any decision affecting the environment is made.

1.2 Cultural and Historic Landscapes and TMDL Applicability

A cultural landscape is defined as "a geographic area, including both cultural and natural resources and the wildlife or domestic animals therein, associated with a historic event, activity, or person or exhibiting other cultural or aesthetic values." There are four general types of cultural landscapes, not mutually exclusive: historic sites, historic designed landscapes, historic vernacular landscapes, and ethnographic landscapes.

Historic landscapes include residential gardens and community parks, scenic parkways like George Washington Memorial Parkway, rural communities, institutional grounds, cemeteries, battlefields and zoological gardens. They are composed of a number of character-defining features which, individually or collectively contribute to the landscape's physical appearance as they have evolved over time. In addition to vegetation and topography, cultural landscapes may include water features, such as ponds, streams, and fountains; circulation features, such as roads, paths, steps, and walls; buildings; and furnishings, including fences, benches, lights and sculptural objects.

Prior to undertaking work on a landscape, a treatment plan or similar document is developed. The four primary treatments identified in *The Secretary of the Interior's Standards for the Treatment of Historic Properties*, are:

- Preservation is defined as the act or process of applying measures necessary to sustain the existing form, integrity, and materials of an historic property. Work, including preliminary measures to protect and stabilize the property, generally focuses upon the ongoing maintenance and repair of historic materials and features rather than extensive replacement and new construction. New additions are not within the scope of this treatment; however, the limited and sensitive upgrading of mechanical, electrical and plumbing systems and other code-required work to make properties functional is appropriate within a preservation project.
- Rehabilitation is defined as the act or process of making possible a compatible use for a property through repair, alterations, and additions while preserving those portions or features which convey its historical or cultural values.
- Restoration is defined as the act or process of accurately depicting the form, features, and character of a property as it appeared at a particular period of time by means of the removal of features from other periods in its history and reconstruction of missing features from the restoration period. The limited and sensitive upgrading of mechanical, electrical and plumbing systems and other code-required work to make properties functional is appropriate within a restoration project.
- Reconstruction is defined as the act or process of depicting, by means of new construction, the form, features, and detailing of a non-surviving site, landscape, building, structure, or object for the purpose of replicating its appearance at a specific period of time and in its historic location.

Stormwater BMPs are implemented to control stormwater runoff and reduce pollutant loads. Many MS4 permit holders implement stormwater BMPs to address pollutant load reduction expectations stemming from TMDLs. These BMPs can include both structural BMPs, which are built structures that are specifically designed to capture and treat stormwater; as well as non-structural BMPs, which typically consist of activities, practices and programs (as opposed to built structures) that help to control stormwater. Examples of structural BMPs include regional stormwater control ponds and small scale environmental site design practices like bioretention cells or bioswales. Non-structural BMPs include educating the public about stormwater pollution so as to change their behavior and reduce pollution; or pollution prevention programs that help reduce the probability that pollutants will enter the stormwater system.

The GWMP is a historic district listed in the National Register of Historic Places and features many cultural landscapes, including: Arlington House; Arlington Ridge Park; Clara Barton Parkway; Fort Hunt Park; Fort Marcy; GWMP-North; Glen Echo Park/Clara Barton House; Great Falls Park; Lady

Bird Johnson Park; Lyndon B. Johnson Memorial Grove; Memorial Avenue Corridor; Mount Vernon Memorial Highway; Patowmack Canal/Matildaville; Spout Run Parkway; Theodore Roosevelt Island; and US Marine Corps War Memorial. In addition to cultural landscapes, the GWMP also features historic properties (those cultural resources listed in the National Register of Historic Places), historic structures, memorials, and archeological sites. Integrity is the authenticity of a property's historic identity or the extent to which a property evokes its appearance during a particular historic period. The National Register identifies seven aspects of integrity: location, design, setting, materials, workmanship, feeling and association. Retention of these qualities is essential for a property to convey its significance. In order to meet requirements under the TMDL Action Plan in the future, the GWMP may require improvements to these areas in the form of structural BMPs. It is important for the Virginia Department of Environmental Quality to understand that improvements in the form of structural BMPs to these areas are very difficult because of the historical and cultural aspects of these facilities. Before further modifications are made to the landscape, changes will have to be carefully evaluated for their impact on the character-defining features and for their adherence to the historical and cultural aspects.

2 MS4 Service Area Delineation

The MS4 permit requires the GWMP to define the size and extent of the existing impervious and pervious area within the MS4 service area. Areas of the GWMP that sheet flow directly to waters of the state, or otherwise drain to waters of the state through means other than a regulated outfall, are not considered part of the MS4 service area. Properties within the jurisdictional boundary that are regulated under a separate Virginia Pollutant Discharge Elimination System (VPDES) stormwater permit, forested areas, wetlands, and open waters are also not considered part of the MS4 service area.

The first step in the analysis involved distinguishing between regulated and unregulated land areas to define the MS4 service area. To perform this analysis, the GWMP utilized local ArcGIS data and tools, a review of other state stormwater permits under the VPDES program, and discussions with NPS staff and regulating agencies.

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

2.1 Estimated Existing Source Loads and Summary of Required Reductions

In accordance with the MS4 permit, the GWMP must calculate reductions required from existing sources as of June 30, 2009 (Section 4) and then calculate offsets to account for increases in pollutant loads due to new sources initiating construction between July 1, 2009 and June 30,

2014 (Section 6) and grandfathered projects beginning construction after July 1, 2014 (Section 7). The GWMP must then identify the means and methods to achieve the required POC reductions accordingly.

The GWMP must estimate the total existing source loads for total nitrogen, total phosphorus, and total suspended solids as of June 30, 2009 based on the 2009 Chesapeake Bay Model progress run and using 2009 Edge of Stream (EOS) loading rates. Since the GWMP is within the Potomac River watershed, the 2009 EOS loading rates from Table 2b of the MS4 permit must be utilized.

Table 1 and 2 presents the estimated existing source loads in accordance with the MS4 permit and the Chesapeake Bay TMDL Action Plan Guidance.

The reductions from the estimated existing source loads (loads in existence as of June 30, 2009) in Table 1 and 2 must be calculated using Table 3b of the MS4 permit. Table 3 shows the completed calculations from Table 3b of the permit.

The GWMP calculates that the following reductions must be achieved within this permit cycle from sources that existed as of June 30, 2009: 125.6 pounds for TN; 6.4 pounds for TP; and, 6,140.3 pounds for TSS. The GWMP will achieve the reductions through the means and methods detailed in Section 4 below.

Table 1. GWMP Chesapeake Bay TMDL Impervious and Pervious Surface Summary

Watershed	Watershed Area (Ac)	MS4 Watershed Area (Ac)	Total MS4 Pervious (Ac)	Total MS4 Impervious (Ac)	Impervious Area (Ac)						Impervious Area (% of MS4 Watershed Area)					
					Buildings	Driveway and Parking Lot	Other	Paved Median	Roads	Sidewalks	Buildings	Driveway and Parking Lot	Other	Paved Median	Roads	Sidewalks
Chesapeake Bay	N/A	3681.5	3379.3	302.2	4.90	68.79	0.10	2.65	220.90	4.82	0.1%	2%	0%	0%	6%	0.1%

Table 2. GWMP Estimated Existing Source Loads[1]

Table 2b: Calculation Sheet for Estimating Existing Source Loads for the Potomac River Basin *Based on Chesapeake Bay Program Watershed Model Phase 5.3.2				
Subsource	Pollutant	Total Existing Acres Served by MS4 (6/30/2009)	2009 EOS Loading Rate (lbs/acre)	Estimated Total POC Load Based on 2009 Progress Run (lbs)
Regulated Urban Impervious	Nitrogen	302.16	16.86	5,094.38
Regulated Urban Pervious		3,379.30	10.07	34,029.58
Regulated Urban Impervious	Phosphorus	302.16	1.62	489.50
Regulated Urban Pervious		3,379.30	0.41	1,385.51
Regulated Urban Impervious	Total Suspended Solids	302.16	1171.32	353,923.12
Regulated Urban Pervious		3,379.30	175.8	594,081.51

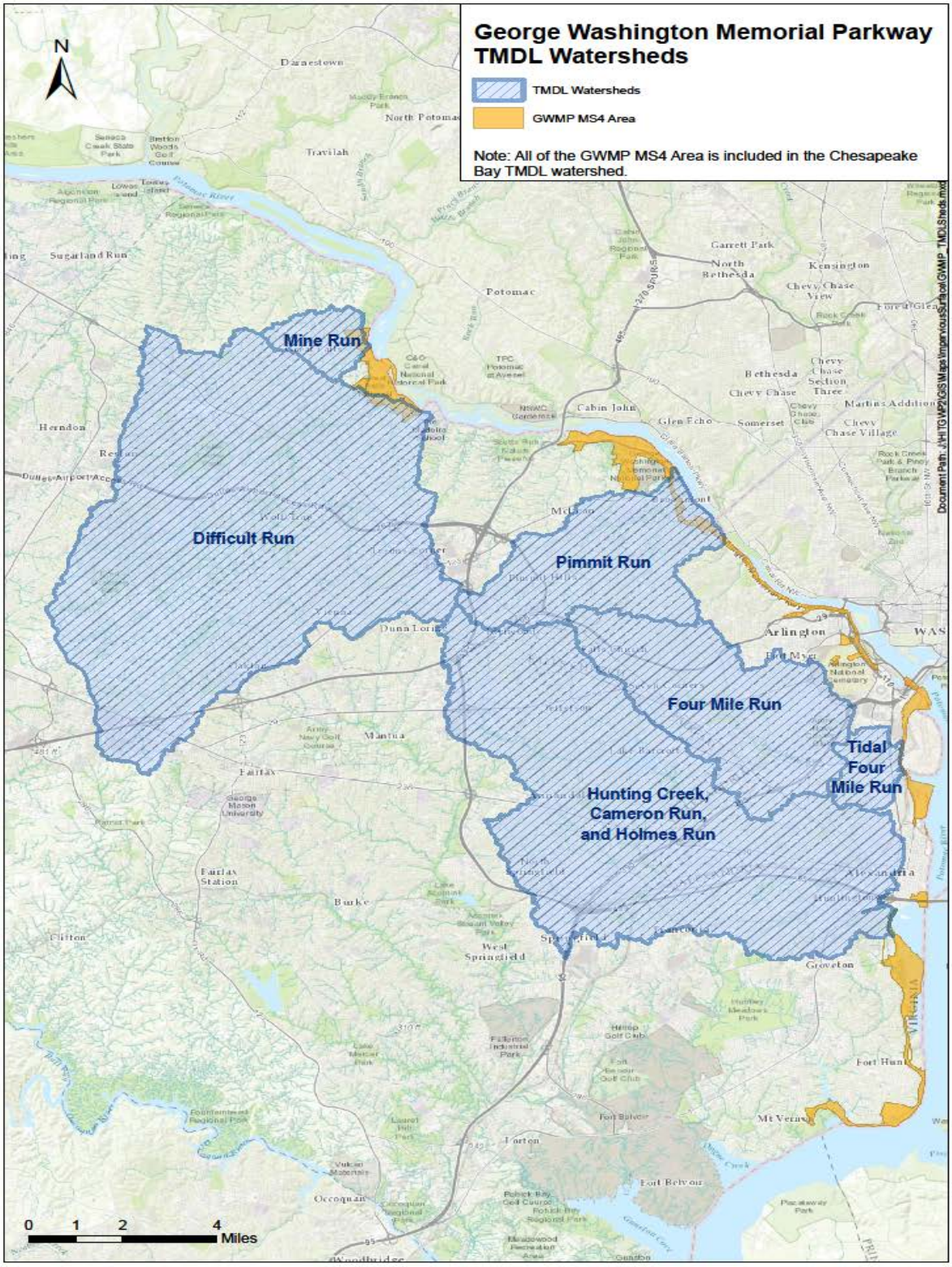
[1] The values in the columns are rounded and result in some of the totals not being the exact value shown.

Table 3. GWMP Estimated Total POC Reduction Required During this Permit Cycle[2]

Table 3b: Calculation Sheet for Determining Total POC Reductions Required During this Permit Cycle for the Potomac River Basin *Based on Chesapeake Bay Program Watershed Model Phase 5.3.2					
Subsource	Pollutant	Total Existing Acres Served by MS4 (6/30/2009)	First Permit Cycle Required Reduction in Loading Rate (lbs/acre)	Total Reduction Required First Permit Cycle (lbs/year)	
Regulated Urban Impervious	Nitrogen	302.16	0.08	24.17	125.6
Regulated Urban Pervious		3,379.30	0.03	101.38	
Regulated Urban Impervious	Phosphorus	302.16	0.01	3.03	6.4
Regulated Urban Pervious		3,379.30	0.001	3.38	
Regulated Urban Impervious	Total Suspended Solids	302.16	11.71	3,538.29	6,140.4
Regulated Urban Pervious		3,379.30	0.77	2,602.06	

[2] The values in the columns are rounded and result in some of the totals not being the exact value shown.

Figure 1. GWMP TMDL Watersheds and MS4 Area



3 Maximum Extent Practicable Reduction Strategy

To achieve the required water quality goals, the permit requires the GWMP to control the discharge of pollutants to the maximum extent practicable (MEP) by addressing the following six minimum control measures (MCMs). The six minimum control measures will be used to create stormwater management best management practices (BMPs).

1. Public Education and Outreach on Stormwater Impacts	**4.** Construction Site Stormwater Runoff Control
2. Public Involvement / Participation	**5.** Post-Construction Stormwater Management
3. Illicit Discharge Detection and Elimination	**6.** Pollution Prevention/Good Housekeeping for Municipal Operations

The NPS understands the need for environmental stewardship and the regulatory requirements to address TMDLs stemming from its MS4 permit. Indeed, the NPS is a pre-eminent federal advocate for the preservation of natural places in the United States. But the NPS is also charged with preserving historic cultural landscapes, and, in the case of the GWMP, with operating and maintaining a highly-trafficked roadway, with all of the safety and land-use restrictions that come with that responsibility.

In short, the NPS must balance multiple requirements that sometimes are difficult to achieve. Therefore, the NPS has developed a Chesapeake Bay TMDL Action Plan that makes use of activities, practices, and programs that are already underway in the GWMP. Many of these are non-structural BMPs that focus on public education and involvement in reducing stormwater loads from GWMP property. Simultaneously, the NPS will look for opportunities to add structural stormwater treatment BMPs while also meeting cultural landscape requirements. Implementation of additional stormwater management – particularly capital projects - will be subject to the NPS budgeting process as well as the National Environmental Policy Act and Section 106 of the National Historic Preservation Act processes.

4 Means and Methods to Meet Required Reductions and Schedule

This section describes the means and methods by which the GMWP will achieve the 5% reductions required for source loads in existence as of June 30, 2009 as calculated in Section 2. The GWMP's first permit reductions will be achieved through a combination of street sweeping and leaf removal (Section 4.2); educational outreach (Section 4.1); and purchased credits. Finally, the GWMP reserves the right to take credit for additional means and methods that may be implemented during the current permit cycle in accordance with DEQ's Chesapeake Bay TMDL Special Conditions Guidance (Section 4.4 – Future Projects under Consideration).

4.1 BMPs for Chesapeake Bay TMDL Compliance for this Permit Cycle

Chesapeake Bay TMDL BMP #1 – Chesapeake Bay TMDL Action Plan Revision and Reporting

- ***Measurable Goal***: In permit year 4 (PY4), post approved Chesapeake Bay TMDL Action Plan on GWMP website and report on implementation of Chesapeake Bay TMDL Action Plan in the MS4 Annual Report. In permit year 5 (PY5), the Chesapeake TMDL Action Plan shall be reviewed and revised, as needed, for the MS4 reapplication package due to VADEQ at least 90 days before the expiration date of the existing permit.
- ***Reporting and Recordkeeping:*** In the annual report, provide a narrative on the progress of implementation.

Chesapeake Bay TMDL BMP #2 – Chesapeake Bay Nutrient Management Education

- ***Measurable Goal:*** The urban landscape has the potential to impact stormwater runoff that is transported through the MS4 to local waters, the Potomac River, and the Chesapeake Bay through over-application and misapplication of fertilizer. The purpose of this BMP is to provide education and outreach to employees, contractors, and visitors on proper use and application of fertilizers to reduce and minimize the impact of nutrients. Starting in permit year 4, annually include a message on social media about the proper use and application of fertilizer. During permit year 5, the GWMP will create include information on the current website accessible to the public related to the proper application and use of fertilizers to protect water quality, and include a link to the www.onlyrain.org website.
- ***Reporting and Recordkeeping:*** In the annual report, provide a narrative on the progress of implementation. Fertilizer use over time will also be quantified to achieve required reductions. These reductions will be quantified and reported.

Chesapeake Bay TMDL BMP #3 – General Public Education and Outreach

- ***Measurable Goal***: The goal of this BMP is to continue to provide general stormwater quality education and outreach to a diverse range of audiences by engaging students, civic groups, and residents through presentations, discussions and distribution of materials by participating in numerous events. Distributing general education brochures and participating in education outreach efforts increases individual and household knowledge about the steps that can be taken to reduce stormwater pollution and increases understanding of the legal implications of the improper disposal of waste. The GWMP will continue to distribute brochures and other educational materials at events and present education materials to school and civic groups.
- ***Reporting and Recordkeeping:*** The GWMP will document efforts to engage and educate citizens, students, and other groups and report these efforts in the annual report. This will include the number of events attended and an estimate of the number

of individuals reached.

Chesapeake Bay TMDL BMP #4 – Promote and Support Local Activities

- ***Measurable Goal***: The goal is to increase overall stormwater quality awareness and education, strengthen private environmental stewardship efforts, and provide citizens with a broad range of environmentally-related volunteer and engagement opportunities. The GWMP will continue to promote local water quality events and volunteer opportunities which may include stream cleanup.
- ***Reporting and Recordkeeping:*** The GWMP will document its sponsorship, participation, and promotion of local events in the annual report and provide information on efforts.

Chesapeake Bay TMDL BMP #5 – Pollution Prevention and Good Housekeeping Training

- ***Measurable Goal***: GWMP staff engages in daily activities that have the potential to adversely impact water quality. The likelihood of these impacts occurring may be minimized or avoided by providing staff training on pollution prevention and good housekeeping. Permit Section II.B.6.d requires training for specific categories, including staff working in and around recreational, public works and maintenance facilities, and staff performing road, street and parking lot maintenance. The GMWP will provide annual training to staff in these specific categories. Training tools may include, but are not limited to, videos, presentations, manuals, desktop exercises and field exercises, as appropriate.
- ***Reporting and Recordkeeping:*** A list of training events held, the date, number of staff attending and the objective of the training will be provided in each associated annual report. Sign-in sheets and materials will be retained for a minimum of three years. Documentation of emergency spill response training will be included in each annual report.

Chesapeake Bay TMDL BMP #6 – Contractor Oversight

- ***Measurable Goal***: Contractors performing work on behalf of the GWMP must use the appropriate control measures and standard procedures to control impacts to the MS4 from stormwater discharges. Contractors must follow the appropriate laws and regulations, and secure applicable permits as required. The GWMP will continue to ensure that contractors follow proper procedures and employ required control measures.
- ***Reporting and Recordkeeping:*** The GWMP will document in the annual summary on the types of tools used to ensure compliance with contractor oversight.

Chesapeake Bay TMDL BMP #7 – Stormwater BMP Inventory Tracking Database

- ***Measurable Goal***: The purpose of this BMP is to continue to maintain a database for tracking required information for BMPs installed in the GWMP. This information enables a better understanding of areas being treated by BMPs and is used for Chesapeake Bay TMDL Action Plan reporting purposes. The GWMP will ensure that required information for all new BMPs is entered into the GWMP's tracking database. The current permit contains a new requirement for the breakdown of impervious and pervious area draining

to each BMP. The GWMP will ensure that all future and current BMPs are tracked and recorded by this breakdown.

- ***Reporting and Recordkeeping:*** The GWMP will document and provide a spreadsheet of all future and current BMPs brought online during the reporting period. The database information will include the project number/unique identifier, type of BMP, location, impaired water body where the GWMP discharges, description of how the GMWP will maintain the BMP, date of installation, and a breakdown of impervious and pervious drainage area.

4.2 Street Sweeping and Leaf Removal

Removing trash, debris, organic material, and sediment from roadways ensures that these materials do not enter the storm sewer system and later get deposited in local waterways, the Potomac River, and the Chesapeake Bay. Removing leaves from properties within the GWMP keeps this organic material out of the storm sewer system, and removes possible sources of nutrients and impacts on Biological and Chemical Oxygen Demand in surface waters.

The GWMP previously conducted street sweeping activities but not to the frequency that is able to be credited according to the DEQ's Chesapeake Bay TMDL Special Conditions Guidance. The GWMP will take credit for its street sweeping program starting in Permit Year 4 and 5 (2017 and 2018) to meet required POC reduction. In future permitting years, the GWMP will maintain this level of effort and refine documentation of the amount of debris collected. DEQ's Chesapeake Bay TMDL Special Conditions Guidance provides the specific steps required for determining credit for street sweeping programs as well as efficiencies for reducing TN, TP, and TSS. The "qualifying street lane method" was used to determine the credit for the street sweeping program. Both methods only apply to streets that are swept biweekly (26 times per year) or more frequently. Table 4 summarizes the estimated annual reduction achieved through the GWMP's street sweeping program for Permit Years 4 and 5.

The GWMP will track and certify the following data to ensure that it is able to take credit for street sweeping activities. A summary of the records will include:

1. Actual sweeper routes (and type of road).
2. Total curb miles swept on each route.
3. Sweeper technology used.
4. Number of sweeping passes per year on each qualifying route.

The GWMP has 23.6 miles of qualifying lanes that will be swept on both sides of the street (1.3 miles of the GWMP is in the District of Columbia). This will account for 57.2 of impervious acres. For the reduction calculation, it is assumed the GWMP will use a Regenerative/Vacuum technology on the qualifying lanes.

Table 4 – Summary of Reductions from Street Sweeping Applicable to Permit Years 4 and 5

Pollutant	Pre-sweeping annual nutrient load (lbs./year)[3]	Removal Efficiency	Pollutant Reduction (lbs./year)
Total Nitrogen	880.9	0.05	44.0
Total Phosphorus	114.4	0.06	6.9
Total Suspended Solids	74,360*	0.25	18,590

*Assume annual load from impervious cover of 1,300 lbs./ac/year (sediment) from Chesapeake Stormwater Network (CSN) TECHNICAL BULLETIN No. 9

4.3 Urban Nutrient Management

The most cost effective nutrient reduction strategy is to reduce or eliminate fertilization on urban turf. The areas that are eligible for nutrient reduction are areas within the MS4 service area that are one contiguous acre or less. When less fertilizer is applied to turf, it translates to lower nutrient loads washing off pervious areas in stormwater (and less need for downstream retrofits to capture and treat the polluted stormwater). As noted in Section 5.3.9 of *CSN TECHNICAL BULLETIN No. 9*, the total nutrient reduction achieved through urban fertilizer management can be impressive. A 17% reduction for nitrogen for certified acres that shift from fertilized to non-fertilized can be used to define fertilizer management credits; or half that rate can be used for certified acres where fertilizers shift to lower impact fertilization methods. Because the risk level is unknown for the parcels, the blended removal efficiency located in Table V.K.1 of the *Chesapeake Bay TMDL Action Plan Guidance Memo* will be used.

In Permit Year 5, the GWMP will identify additional acres that will shift to lower impact fertilization methods. In Permit Year 5, these lower impact fertilization methods will be implemented. Table 5 summarizes estimated reductions achieved through the GWMP's urban nutrient management program in Permit Year 5.

Table 5 – Summary of Reductions from Urban Nutrient Management for Permit Year 5

Pollutant	Pre-urban nutrient management annual nutrient load (lbs./year)*	Removal Efficiency	Pollutant Reduction (lbs./year)
Total Nitrogen	503.5	0.090	45.3
Total Phosphorus	20.5	0.045	0.92

*Assume annual load from pervious cover of 10.07 lbs. /ac/yr. (nitrogen) and 0.41 lbs. /ac/yr. (phosphorus)

[3] Calculated using Appendix V.G of the Guidance vs using the 2009 EOS loading rate (from Table 2 in this doc)

4.4 Additional TN Reduction Actions

Because of March 1, 2017 comments received from DEQ, that street sweeping reductions "are not cumulative, but instead can only be applied based on the pollutant reduction achieved in each year," GWMP has been instructed by DEQ to develop additional measures to account for the remaining 36.3 lbs/year of TN reductions to achieve the TN reduction target. At this time GWMP plans to purchase TN credits on an annual basis in exchange for the additional pounds of TN reduction required.

GWMP has an active invasive species removal and native plant restoration program for NPS lands. The program is supported by one full-time employee, with additional support provided by seasonal staff, the GWMP Tree Crew, and volunteers. We are working to quantify our activities to date, and to develop a tracking and reporting system that will satisfy DEQ requirements for restoration. Additionally, we have two larger scale restoration projects that will have funding available and are planned for this permit cycle. The details of these two restorations, referred to as Roaches Run and Four Mile Run, are still being finalized and the action plan will be updated accordingly to account for these reductions prior to purchasing credits.

4.5 Summary of Required Reductions and Means and Methods to Achieve Required Reductions for Current Permit Cycle

Tables 6A through 6C demonstrate how the GWMP will meet the required reductions from Section 2 for each POC with the means and methods described in Sections 4.1 through 4.3.

Table 6A – Compliance Demonstration for Total Nitrogen

Total Required Reductions – lbs/year. (Table 3)	Total Reductions Achieved – lbs/year. (Table 4 and Table 5)	Total Reductions Remaining (lbs./year)	Percentage Target Achieved
125.6	44 (PY4) + 45.3 + 36.3 (purchased credits) = 125.6 lbs/year	- 0	100%

Table 6B – Compliance Demonstration for Total Phosphorus

Total Required Reductions – lbs/year. (Table 3)	Total Reductions Achieved – lbs/year. (Table 4 and Table 5)	Total Reductions Remaining (lbs./year)	Percentage Target Achieved
6.4	6.9 (PY4) + 0.92 = 7.82	-1.42	122.2%

Table 6C – Compliance Demonstration for Total Suspended Solids

Total Required Reductions – lbs/year. (Table 3)	Total Reductions Achieved – lbs/year. (Table 4 and Table 5)	Total Reductions Remaining (lbs./year)	Percentage Target Achieved
6,140.4	18,590 (PY4)	-12,449.6	302.7%

5 Estimated Cost of Compliance for First Permit Cycle

Table 7 provides a summary of the estimated cost to implement projects in Section 4. These projects exceed the POC reduction requirements of this permit cycle.

Table 7 – Estimated Cost of Compliance

Strategy	Cost Explanation	Estimated Cost
Street Sweeping	Annual budgeted cost of street sweeping based on adopted FY15 budget. This does not include additional street sweeping efforts that will be required under this action plan. This is the current budgeted amount.	$10,000
Urban Nutrient Management	The cost is an estimate based on switching to other products for nutrient and turf management. This is **not** a current budgeted amount.	$15,000
Purchased TN credits	The cost is an estimate based on current market prices of purchasing 36.3 lbs of TN credit per year (years 4 and 5).	$3,510
TOTAL COST		$28,510

6 Future Projects under Consideration

Buildings and locations of the Parkway that are considered non-contributing to the National

Register of Historic Places listing for the GWMP, such as the maintenance yard, will be evaluated for potential rainwater harvesting activities to reduce the volume of runoff entering the MS4 system. Rain barrels are a simple, low cost, and non-intrusive way to capture rainwater from disconnected roof drains. This water can be used to water native plantings and other landscaped areas. Another possibility is that visible BMPs such as rain gardens could be installed at visitor centers to educate the public about stormwater management activities within the GWMP, while also managing rooftop or parking lot runoff. NPS will also consider certain BMPs that are completely underground and not visible to manage rooftop runoff from buildings or runoff from parking areas or roads. For example, cisterns can be constructed underground and store large volumes of water from disconnected roof drains for later use. Projects of this magnitude are subject to certain constraints like budget and approval, project management availability, and archaeology.

Marinas provide an opportunity for a few unique BMPs to be implemented. Storm drains near marinas can be stenciled with messages to discourage dumping of pollutants. Composting programs for fish waste and other organic materials can provide a source of fertilizer and reduce usage of chemical fertilizer. NPS can also encourage concessioners who operate marinas within the GWMP to pursue certification through the Virginia Clean Marina program (http://www.virginiacleanmarina.com/), which outlines structural and nonstructural BMPs that can be implemented in marinas.

NPS will continue its current activities that prevent, reduce, or mitigate pollutant loads from roadways and parking lots, including catch basin cleaning, storm sewer inspection and cleaning, street sweeping, and using absorbent pans to catch oil spills. The policy of no noticeable accumulation of debris in the GWMP will be maintained. When parking lots need routine repaving, NPS will consider installing permeable pavements as a way to manage runoff from these surfaces. Permeable pavement tends to have higher installation costs than traditional pavement, at $10-12 per square foot compared to about $5 per square foot for traditional pavement (King and Hagan, 2011). Maintenance needs of permeable pavement differ from traditional pavements, as permeable pavement needs periodic sweeping or vacuuming to prevent clogging by debris. However, the annual maintenance costs of permeable pavement tend to be lower than those of traditional pavement, and when considering the combined construction and maintenance costs over a 25 year lifespan, permeable pavement may actually be less expensive (Terhell, et. al., 2015). However, NPS will have to evaluate the capital costs and ongoing maintenance considerations for permeable pavement before committing to this potential BMP.

New developments on GWMP land will have erosion and sediment control requirements during construction and water quality requirements post-construction. New developments adjacent to the GWMP are also monitored for erosion and sediment control activities during construction. As part of the Chesapeake Bay TMDL Action Plan, stormwater management BMPs will be

required for any new development within the GWMP.

6.1 Site Specific BMP Recommendations

Throughout the GWMP, there are several sites that pose opportunities for new BMPs to be implemented. These include Great Falls Park, Turkey Run Park, Fort Marcy, interchanges along the north Parkway, Arlington Ridge Park, Lady Bird Johnson Park, Gravelly Point, Daingerfield Island, Jones Point Park, Dyke Marsh, Belle Haven Marina, and Fort Hunt Park. Although many of these sites are protected as part of the cultural landscape or have archeological resources, there are potential opportunities for BMPs in parking lots and discrete areas. There are also future improvements planned for some of these areas that can incorporate BMPs, and opportunities to enhance the existing education/outreach programs.

Great Falls Park, the northernmost site identified, is a part of the cultural landscape and historic district. It is also a large archeological site that will pose a unique opportunity for having visible BMPs. However, with its high number of visitors, educational programming and demonstrations of stormwater management would be highly impactful. Visible BMPs, such as raingardens, bioswales, and native plantings, may be able to be implemented at the visitor's center and parking lot to provide functional and educational value, but will be difficult to install due to this being a cultural landscape and historic district. Similar BMPs will be more easily installed at park maintenance facilities and US Park Police facilities within Great Falls Park and will also be evaluated for installation. Rainwater harvesting, utilizing rain barrels or cisterns, could be implemented at these buildings as well. When routine repaving of parking lots occurs, NPS will consider installing permeable pavements. NPS is also planning a large erosion control project within Great Falls Park at Lock 2, which will help to reduce sediment pollution loading from this area.

Turkey Run Park, which contains GWMP Headquarters and the US Park Police station, is an important component of the North Parkway's cultural landscape with its old-age forests and diverse vegetation. However, NPS will explore the potential for BMPs such as bioswales or bioretention in the parking lot medians and comfort stations throughout the park as appropriate. These proposed features would be evaluated through the required National Historic Preservation Act (Section 106) and NEPA compliance processes and implemented as appropriate. There are mowed grassy areas near the driveway entrance of Turkey Run Park that are being considered as potential BMP sites under the North Parkway Rehabilitation project. This planning project is currently moving through the NEPA and Section 106 compliance process and is anticipated to be completed in 2018. Trails within the park have issues with erosion, and although these areas have to remain undeveloped, the eroding areas can be targeted with native plantings for stabilization as appropriate, which will reduce sediment loading and help meet Chesapeake Bay TMDL goals. NPS will also consider posting signage encouraging pet waste cleanup in parking areas and at trailheads as funding and compliance allows.

Fort Marcy, an important site used in the defense of Washington, D.C. during the Civil War, is also a significant component of the cultural landscape. There are substantial archeological resources within the Fort Marcy area. BMPs similar to those recommended for the parking lots at Turkey Run Park could also be implemented at Fort Marcy without impacting the historical integrity of the site. NPS will explore these options.

In conjunction with an ongoing environmental assessment and rehabilitation of the North Parkway, NPS will explore opportunities for BMPs at GWMP interchanges in the cloverleafs and medians, and adjacent to the roadway. Specific sites of interest are the intersections of the GWMP with Chain Bridge Road and Spout Run, and the ramps leading to the Central Intelligence Agency (CIA) headquarters. NPS will also explore the potential for discreet BMPs that are compatible with and sympathetic to the design of the parkway to be implemented in cloverleafs near the airport. These options will be pursued only if they do not conflict with the GWMP's 1959 and 1962 historical planting plans and do not impact archeological resources.

Arlington Ridge Park contains two memorials that define its landscape: the U.S. Marine Corps War Memorial and the Netherlands Carillon. Given the layout of Arlington Ridge Park, structural BMPs would be highly noticeable and potentially visually disruptive. Therefore, such BMPs are not being considered at this location. Although structural BMPs are not an option in this cultural site, there are a few nonstructural BMPs that could be implemented. Since Arlington Ridge Park serves much of the immediate surrounding community, there is an opportunity to encourage dog-walkers to clean up after their pets. NPS will explore signage options in the parking lot, approaching the Arlington Ridge Park entrance, or in other locations that will not interfere with the cultural landscape. NPS will also determine if fertilizer is being used, and whether or not the fertilizer can be switched to a lower phosphorus option. These BMPs would reduce bacteria and sediment loads.

Most of Lady Bird Johnson Park, including the Columbia Island Marina, lies within the boundaries of the District of Columbia, and so is not covered under the Virginia MS4 permit which is the subject of this Chesapeake Bay TMDL Action Plan, but there is a small portion at the entrance to the Lyndon B. Johnson Memorial Grove that is on the Virginia side. This portion contains a landscaped plaza, parking lot, and access to a pedestrian bridge connecting to the island. This area can be targeted with the BMPs related to pet waste cleanup and low phosphorus fertilizer, as well as permeable pavement when the parking lot is re-paved. Bioretention will also be evaluated for implementation in the medians of the parking lot.

Gravelly Point poses opportunities with its parking lot and potential future developments. BMPs such as bioretention, raingardens, bioswales, or permeable pavement could be installed, similarly to parking lots discussed previously. Gravelly Point lies within the cultural landscape of the GWMP, as well as the cultural landscape of the Mount Vernon Memorial Highway (the original stretch of roadway from Mount Vernon to Arlington Memorial Bridge). As such, any structural BMPs would need to be very carefully planned and placed as to not adversely impact

historically planned views. NPS is considering the development of a boathouse at this site in the future, and BMPs can be incorporated into this plan. Goose harassment is already being carried out at this site and at the adjacent Roaches Run Waterfowl Sanctuary for the airport. These programs are likely to reduce the number of animals occupying NPS land, thus also reducing bacteria from goose waste entering the NPS's MS4 system.

Daingerfield Island has a concessioner-run marina in the northern portion. NPS will encourage concessioner to become certified – or if they are already certified, to continue to implement BMPs to reduce stormwater pollution with the Virginia Clean Marina Program and implement marina-specific BMPs. In the central area of Daingerfield Island is a greenhouse where rain barrels or a cistern could be installed for rainwater harvesting. The southern part of Daingerfield Island is used for waste storage. NPS will ensure that sediment control and other good housekeeping measures are being practiced here, and that no hazardous materials or potential pollutants are entering the waterways from this area.

Jones Point Park has some newer developments, such as a community garden, playground, comfort stations, and parking lot; although Jones Point Park are within the boundaries of the GWMP, areas of the park are not considered contributing to the Historic District and provide opportunities for BMPs such as permeable pavement, bioretention, and rainwater harvesting. NPS will also consider ways to promote pet waste cleanup in the park. Additionally, there is a NPS parking lot under the Woodrow Wilson Bridge that may be targeted with permeable pavement, bioretention, and other structural BMPs, depending on available funding There are already planted areas within and alongside the parking lot that are well suited for BMPs.

NPS is proposing to restore Dyke Marsh, one of the few remaining tidal freshwater marshes on the Potomac River and has already completed an Environmental Impact Statement under NEPA. We are currently in the design process and expect to award the contract by the end of FY 2017, with construction beginning in 2018. The project aims to restore wetland functions and processes lost through mining and shoreline erosion and improve ecosystem services that benefit the Potomac River Watershed and the Chesapeake Bay. A major objective of the restoration project is to reduce erosion in the existing marsh and implement erosion control measures in the restored areas, which will reduce sediment loads. The restored marsh area also serves as a buffer for stormwater runoff and provides several other valuable ecosystem services. Restoration of this marshland will help meet Chesapeake Bay TMDL load reductions through filtering of stormwater pollutants.

Belle Haven Marina is operated by a concessioner. NPS will encourage concessioner to become certified – or if they are already certified, to continue to implement BMPs to reduce stormwater pollution as a Clean Marina.

Most of Fort Hunt Park is part of the cultural landscape, but certain areas have non-contributing features. There is a US Park Police facility and parking lot where permeable pavement, bioretention, rainwater harvesting, infiltrations, and other structural BMPs can be evaluated for

implementation. Similar BMPs could be implemented in the other parking lots, the playgrounds, the pavilions, and the maintenance facilities. NPS can also post signage to promote pet waste cleanup.

7 Assessment of Effectiveness

The GWMP will assess the effectiveness of its efforts by reviewing the measures in Section 4 as part of the annual report submitted to DEQ. Additionally, the GWMP will begin to consider future projects to meet required future reductions in the next permitting cycle.

A key obligation contained in the permit is the requirement to submit an Annual Report by October 1st of each year. This Chesapeake Bay TMDL Action Plan identifies the steps that are necessary for the GWMP to maintain compliance with its MS4 General Permit, while the Annual Report documents the status of the TMDL implementation provisions of the Chesapeake Bay TMDL Action Plan for each permit year. In effect, the Chesapeake Bay TMDL Action Plan comprises a road map that must be followed, which requires continuous management efforts and substantial resource commitments on the part of the GWMP.

8 Public Comment on Chesapeake Bay TMDL Action Plan

Planning, Environment, and Public Comment (PEPC) is a web-based system was created for and adopted by the NPS that is used nationwide. This system allows people to gain access to current plans and related documents that are available for review and open for comment. Public comments can be submitted through the PEPC system. The public are also able to access schedules for particular projects as well as specific information about public meetings.

While the PEPC system is the primary vehicle to submit and review comments on planning efforts and projects, the park will continue to accept comments from the public as it always has, by mail, fax, and e-mail.

The GWMP will post a copy of the Chesapeake Bay TMDL Action Plan after the draft has been approved by the Virginia DEQ on the NPS PEPC system for 30 days to allow adequate time for the public to comment on the plan. The NPS will then provide a list of all comments received and any modifications made to the draft Chesapeake Bay TMDL Action Plan as a result of the public comments.