APPENDIX A

City of Portsmouth MS4 Program: Task 2.4 Outfall Service Area Delineation

City of Portsmouth MS4 Program
Task 2.4 Outfall Service Area Delineation

PREPARED FOR:	Thomas Quattlebaum, City of Portsmouth
PREPARED BY:	CH2M
DATE:	March 28, 2018
REVISION NO.:	3

The City of Portsmouth (City) is required by their MS4 Permit to map their municipal separate storm sewer system (MS4) service area and each MS4 outfall. The required information for each MS4 outfall is described in the MS4 Permit Part I.B.2.h)3) and includes:

- Individual identification (ID) number
- Local watershed name
- Sixth order Hydrologic Unit Code (HUC) and receiving water
- Latitude and longitude in decimal degrees

When new outfalls are constructed, they must be included on the City's MS4 map and the outfall information must be included in the City's outfall database. The MS4 service area map including outfall locations and outfall information are required to be submitted to the Virginia Department of Environmental Quality (DEQ) in electronic format by December 30, 2017.

Background

Storm sewer outfall service areas, or drainage areas, are used to define the principal boundary of the MS4 service area submitted to DEQ. Initial storm sewer system geographic information system (GIS) data was collected by the City in the early 1990s and updates have been made to the storm sewer system information in the GIS in the following years. Not all of the City's storm sewer system is mapped in their GIS.

The initial GIS drainage area layer was developed approximately 20 years ago and was recently updated using Light Detection and Ranging (LiDAR) data. LiDAR data allows for better topographic resolution, which aids in drainage area delineation. The LiDAR and GIS data were organized using the ESRI ArcGIS Local Government Information Model (LGIM) and provided to CH2M HILL, Inc. (CH2M) in 2017 to use for the outfall service area delineation.

Outfall Service Area Delineation Process

An ESRI-automated ArcGIS software tool, ArcHydro, was used to update the outfall drainage area delineations. CH2M developed a digital elevation model (DEM), based on the latest LiDAR data, for use with ArcHydro. The most recent LGIM GIS data including the street centerlines, storm sewer network, outfall locations, preliminary MS4 boundary, and previous drainage areas were used to build the DEM. The sinks, which are raster cells considered to be an area of internal drainage, were processed using the Portsmouth DEM.

After the original drainage area file was processed, the City's storm sewer network was embedded into the DEM to create an artificial linear depression. The linear depression served to isolate the flow captured by the storm sewer network and enabled ArcHydro to assess the surface drainage flow patterns independently. The DEM was further manipulated to build up the roads to create simulated drainage area "walls," where the DEM topology was inaccurate. After the DEM manipulation was complete, the drainage areas were delineated resulting in approximately 29,000 small drainage areas.

The drainage areas were categorized to help optimize the outfall service area analysis. Each drainage area was identified as being located within or outside the preliminary MS4 service area boundary. If the drainage area was located outside the boundary, it was removed from the analysis. If the drainage area was located within the preliminary MS4 service boundary, it was designated as flowing or not flowing to an outfall. Drainage areas that were determined as flowing to an outfall were given a downstream outfall ID as provided in the LGIM. When drainage area runoff flowed directly into a stream it was noted in the Outfall ID attribute field. Small drainage areas assigned to the same outfall ID were merged to create a larger total service area for each designated outfall. The outfall designations are described in Table 1.

Table 1. Outfall Service Area Designations from Initial Delineation

Category	Explanation	Designations
Outfall	Category used to determine if the drainage area is located in the preliminary MS4 service area boundary and, if so, does the drainage area flow to an MS4 outfall	Y – Yes (flows to an MS4 outfall) N – No (does not flow to an MS4 outfall) OOB – Outside of MS4 service area boundary
Outfall ID	Outfall service area is assigned the downstream outfall ID that it flows to or not assigned an outfall ID if it does not flow to an outfall	Outfall ID Number No Outfall Outside of MS4 Boundary Stream
Verification	Category used to identify outfall service areas that need field investigation or further verification due to lack of GIS information	VN – Verification needed Null – No verification needed

After the initial delineation, 544 outfall service areas were created and reviewed to determine if additional information was needed to complete the delineation. A verification attribute field was created to identify the outfall service areas that needed further field investigation to determine the correct outfall ID. After review, 43 outfall service areas were determined to need verification.

CH2M performed desktop and field verification of the outfall service areas that could not be confirmed from the initial analysis using the ArcHydro processing. Field investigation was performed to try to identify the storm sewer connectivity and outfalls for the unconfirmed service areas. During the field verification, CH2M staff located and recorded critical pipes and ditches not included in the City's GIS data. The information from the field investigation resulted in modifications to the 43 outfall service areas and many additional adjacent outfall service areas. The modifications included combining drainage areas, reducing sheet flow areas, adding or reducing drainage area based on field verified topography, adding and relocating outfalls.

Some drainage area boundaries could not be verified in the field and will require further investigation by the City. For example, the storm sewer pipe connectivity could not be verified in some locations because a storm sewer manhole or inlet at a critical junction could not be accessed. Another example is when a pipe appeared to connect the storm sewer system to two separate MS4 outfalls and the flow direction could not be determined. At some Virginia Department of Transportation (VDOT) roadways such as the Martin Luther King Freeway, it was too hazardous to investigate the storm sewer on foot so the system connectivity could not be conclusively determined.

The outer boundary of the MS4 service area was verified and some of the outfall service areas have internal drainage boundaries that could not be verified. The VDOT and Navy properties were excluded from the City's MS4 service area and the MS4 interconnection points were identified, if possible.

Some of the MS4 outfalls identified in the initial delineation were removed because the MS4 system extended downstream and the upstream service areas could be combined. This situation occurred typically where a MS4 ditch outfall was located in the field. The pipes that discharge to City lakes and ponds identified as stormwater best management practices (BMPs) in the City's GIS data were not designated as MS4 outfalls.

New MS4 outfalls were added for storm sewer outfall pipes or ditches found in the field and not included in the City's GIS data. New MS4 outfalls were also added for streets that do not have a pipe or ditch outfall. For street drainage systems that consist of curb and gutter, a MS4 outfall was added in the GIS at the street centerline where the street gutters end and the runoff discharges by sheet flow to surface waters. For streets that do not have curb and gutter, a MS4 outfall point was added at the low point of the street where the runoff would sheet flows to surface waters. The outfall information required by the MS4 Permit including watershed name, sixth order HUC, and latitude and longitude was added to the GIS data for submittal to DEQ.

Summary and Recommendations

The total MS4 service area is approximately 13,842 acres and there are 560 MS4 outfalls. The MS4 service area boundary and the MS4 outfalls are shown on Figure 1. The individual service areas are shown on Figure 2.

For future MS4 service area delineation coordination, the City should work with VDOT, the Navy and CSX Railroad to clarify the drainage pathways and internal MS4 connection points.

Future field investigation should be performed for those areas where the internal boundaries between service areas could not be determined. These areas include storm sewer manholes or inlets at critical junctions that could not be accessed or where dye testing may be needed to verify the system connectivity and direction of flow. The service areas requiring further field verification are listed in Table 2.

CH2M will provide the City with the field data showing the locations of structures, pipes, and ditches found during the field verification and this information may help the City in ongoing storm sewer system inventory updates.

Table 2. MS4 Outfall Service Areas Requiring Further Investigation

Outfall ID	Reason for Further Investigation
33	The outfall from this BMP could not be field verified.
376	Internal drainage area boundary needs to be verified.
4177	Could not determine if the storm sewer system (outfall ID 4177) is interconnected with storm sewer system to the west (outfall ID 4178); could not access MH ID 4235 in the field and upstream pipes in the field did not match the GIS data.
6161	The outfall location could not be field verified.
12557	The drainage area to the stormwater BMP with outlet pipes FacilityIDs 14279, 14280, 14281, 14282 could not be verified; the drainage area to the BMP may be part of the Outfall ID 12557 service area.
20030	Could not verify if the ditch network south of Early Drive drains to the pond to the north.
20122	Internal drainage area boundary needs to be verified.
20127	CH2M could not verify the location of this pipe outfall.
20149	This service area likely has eastern and western drainage areas that can be split; a drainage divide could not be located in the field.
20164	Streets with curb and gutter and no pipe network; internal drainage area boundary needs to be verified.
20165	Streets with curb and gutter and no pipe network; internal drainage area boundary needs to be verified.
NO OUTFALL ID_2	Storm drain gravity main (FacilityID 1100) connectivity could not be verified; designated as City MS4 service area but no outfall ID was assigned.

Figures

0 2,500 5,000 10,000 15,000 Feet

Legend

- OUTFALL LOCATION
- PORTSMOUTH MS4 SERVICE AREA BOUNDARY

THE CITY OF PORTSMOUTH

N

FIGURE 1
MS4 Service Area Boundary
Portsmouth MS4 Permit and Program

ch2m:

0 2,500 5,000 10,000 15,000 Feet

Legend

- OUTFALL LOCATION
- PORTSMOUTH MS4 SERVICE AREA
- PORTSMOUTH MS4 SERVICE AREA BOUNDARY

THE CITY OF PORTSMOUTH

N

FIGURE 2
MS4 Service Areas
Portsmouth MS4 Permit and Program

ch2m:

APPENDIX B

City of Portsmouth MS4 Program: Task 4.2 Setting the Baseline

City of Portsmouth MS4 Program Task 4.2: Setting the Baseline

PREPARED FOR:	Thomas Quattlebaum, City of Portsmouth
PREPARED BY:	Juliana Cammarata, EIT, CH2M
DATE:	May 9, 2018
REVISION NO.:	2
APPROVED BY:	Shelly Frie, PE, CH2M

The City of Portsmouth (City), Virginia must meet the requirements of the Chesapeake Bay Total Maximum Daily Load (TMDL), in accordance with their Virginia Stormwater Management Program (VSMP) Municipal Separate Storm Sewer System (MS4) Permit No. VA0088668. The VPDES MS4 permit Special Condition for the Chesapeake Bay TMDL requires the City to prepare a Chesapeake Bay TMDL Action Plan and submit it to the Virginia Department of Environmental Quality (DEQ) by June 30, 2018, for review and acceptance. To assess the City's pollutant load reductions, a baseline pollutant load level for the MS4 must be established from the 2009 land cover conditions. The Chesapeake Bay TMDL Action Plan Guidance Revision (Virginia DEQ Guidance; 2015) encourages permittees to use geographic information system (GIS) resources to assess the 2009 land cover conditions of their MS4 and asks that they include a summary of their methodology in their action plan. This technical memorandum describes the methodology used to estimate the 2009 baseline pollutant load for the City's Chesapeake Bay TMDL Action Plan.

Estimated Existing Source Loads and Calculated Total Pollutant of Concern Required Reductions

An estimate of the June 30, 2009 annual pollutant of concern (POC) loads from existing sources within the City's MS4 was calculated to serve as a baseline loading value for the TMDL Action Plan. The POCs include nitrogen, phosphorus, and total suspended solids. The size and extent of the City's MS4 was established in the Portsmouth MS4 Outfall Delineation Technical Memorandum (CH2M, 2017), and revised in March 2018. The City's MS4 drains to the James River Basin, and the City's 2009 edge of stream (EOS) loading rates for regulated urban impervious and pervious sources are listed in Table 1 in the VPDES MS4 permit (2016).

The MS4 land cover conditions for 2009 were determined using 2013 land cover data in conjunction with construction data from between the years of 2009 and 2013. The procedures for determining the 2009 land cover and calculating the 2009 POC existing loads are described in the following paragraphs.

Establishing 2009 Land Cover Conditions

The urban impervious and pervious surfaces served by the MS4 as of June 30, 2009, were determined using GIS land cover data acquired from the Virginia Information Technologies Agency (VITA), and construction data provided by the City. The digital geospatial land cover data was not available for the year 2009; therefore, land cover data from the year 2013 was used and modified to account for land cover changes between 2009 and 2013.

Land cover polygons for categories of shrubland, grasslands/herbaceous, and pasture/hay were evaluated shape-by-shape by overlaying the 2013 land cover data with the 2009 digital orthophoto. Land cover categories that may qualify for exclusion under the Chesapeake Bay TMDL Special Condition guidance are: lands regulated under any general or individual VPDES permit that addresses industrial stormwater; lands regulated under any general or individual VSMP permit for MS4s; forested land, agricultural lands, wetlands, and open waters.

Land Cover Exclusions

The Virginia DEQ guidance (2015) on calculating the existing POC annual loads allows for excluding the following land categories from the regulated land used in the calculation:

- Lands regulated under separate VSMP MS4 and VPDES industrial stormwater permits
- Forested lands
- Agricultural lands
- Wetlands
- Open water

Each exclusion category and how the area was evaluated are described in the subsequent sections.

Lands Regulated Under VSMP and VPDES Permits
Properties with active individual and general VSMP and VPDES permits in 2017 were removed from the MS4 service boundary submitted to the Virginia DEQ in December 2017 and were not changed in the March 2018 boundary revision. These areas include properties owned by the Navy, Wheelabrator, Third Capital Inc., P-Town Recycling, Chesapeake, and the Virginia Department of Transportation.

Forested Lands
The categories of deciduous and evergreen forest were combined into one shapefile, which was vetted both for correlation with the 2009 imagery, and for areas of forest qualifying under the Virginia DEQ Guidance (2015) as being excluded from the regulated lands calculations. To qualify for exclusion from the regulated lands calculations, wooded areas need to be a minimum of 30 meters by 30 meters (900 square meters) contiguous tree cover, with a density meeting the requirements discussed in Appendix V.H. of the Virginia DEQ Guidance (2015).

The forested land cover GIS layer polygons were evaluated to determine if the areas qualified under the minimum size and density requirements. The forested land cover polygons were first sorted by size. Only the forest areas meeting the minimum contiguous tree cover area were considered for exclusion. From here, the MS4 aerial was considered in sections. Wooded areas with 'holes', or with loose, spiraling forms within residential areas (see Figure 1) were interpreted as not meeting the area and density requirements of qualifying forest; therefore, they were not included in the exclusion area.

Figure 1. Example of Area with Non-Qualifying Forest

The resulting qualifying forest layer has 78 GIS polygons with a combined area of 208.08 acres of forested land deemed large enough and dense enough to qualify for exclusion from the regulated land.

Agricultural Lands

The City has no agricultural lands located within its boundary, according to both the City's zoning maps and the VITA 2013 GIS land cover data. Therefore, no agriculture lands were excluded from the regulated land.

Wetlands and Open Water

The United States Fish and Wildlife Service National Wetlands Inventory (NWI) for Virginia was used to identify the wetland locations in the City. The wetlands data is dated 2017, and was vetted for accuracy to 2009 conditions by comparing it to 2009 VITA imagery in GIS. The NWI data is organized by waterbody type, which includes Estuarine and Marine Deepwater, Estuarine and Marine Wetland, Freshwater Forested/Shrub Wetland, Freshwater Pond, Riverine, and Freshwater Emergent Wetland. Polygons identified as freshwater ponds were assumed to represent open waters that qualify for exclusion from regulated lands.

All stormwater best management practices (BMPs) from 2009 that could be classified as open water were identified and excluded from the regulated lands. To confirm that all open waters were identified, the open water land cover from the 2013 orthophotography was compared to the wetlands data. The 2009 VITA imagery was then reviewed for any open water that may have been missed or misidentified in the data. The City's golf course ponds are one example of areas missing classification as open water land cover. Open water found in this way were individually added to the wetland GIS layer to create one GIS layer of all excluded wetlands and open water. Polygons representing open water we later sorted into their own GIS layer.

The NWI shapefile data were reviewed for areas that were not wetlands in 2009, specifically the City's stormwater ditch network, which often fell under the riverine category in the NWI dataset, but cannot be excluded from the MS4 regulated land as wetland. The NWI data were compared to the City's stormwater ditch network and, in areas where the NWI data clearly overlapped the City's stormwater ditch network, the polygons representing ditches were removed from the NWI GIS layer. In areas where the NWI wetland polygons overlapped with

forest land cover polygons from the 2013 VITA geospatial land cover data, the area was classified only as forest as forested areas were more easily confirmed using the 2009 aerial imagery. As both land cover categories are exclusions, this classification does not affect the final POC loading calculation.

Areas of open water that are not urban stormwater BMPs maintained by the City were removed from the MS4 service area submitted to Virginia DEQ in December 2017, and were not changed in the March 2018 revision. Therefore, they were not included in the open waters and wetland calculations.

Calculating Regulated Pervious and Impervious Cover

After the 2013 VITA land cover data were adjusted for 2009 land cover conditions, the total area for each land cover category was calculated. Land cover categories in the VITA data identified as pervious were deciduous and evergreen forest not counted as exclusions, shrubland, grasslands/herbaceous, pasture/hay, woody wetlands, and selected areas of bare rock/sand/clay. Land cover categories in the VITA data identified as impervious were low-intensity residential, high-intensity residential, and selected areas of bare rock/sand/clay.

Regulated Pervious Cover

The 2013 VITA land cover categories of shrubland, grasslands/herbaceous, bare rock/sand/clay, and pasture/hay were evaluated polygon-by-polygon against the 2009 aerial imagery, to determine 2009 pervious cover. Polygons were added, removed, or adjusted according to the 2009 imagery, as needed. Some areas of bare rock/sand/clay were identified as impervious and included in the regulated impervious cover calculation. The pervious areas were summed to determine the total 2009 regulated pervious area and, excluding forested lands, wetlands, and open water, the total pervious area is 6989.73 acres.

Regulated Impervious Cover

Assessing the City's 2009 regulated impervious cover required data collection using GIS sources and the City's recordkeeping and tracking software program called Tidemark. The City's 2013 impervious area was calculated using the VITA data. All polygons in the low- and high-intensity residential categories were found to be impervious, as well as some polygons in the bare rock/sand/clay category. All areas of impervious cover were summed to determine the 2013 regulated impervious land cover area for the City, which was found to be 6457.37 acres.

To determine the 2009 regulated impervious land cover, the impervious area from construction activities that occurred between July 1, 2009 through the 2013 orthophotography was subtracted from the 2013 regulated impervious land cover area. Orthophotography of the region was gathered throughout the Spring of 2013, so the date of March 30, 2013 was used for the period end date. The City provided a list of all construction projects occurring between July 1, 2009 and March 30, 2013 from Tidemark.

The City's construction data were first evaluated for duplicate entries with the BMP data from the same time period. Addresses were sorted, and those addresses associated with a BMP installed during the study period were removed and only the impervious area listed on the BMP construction plans was used for the change in impervious cover. The change in impervious cover from construction projects completed between July 1, 2009 and March 30, 2013 that included BMPs was estimated to be 42.71 acres.

The remaining construction sites from the City's list were grouped into sites with Agreements in Lieu of a Stormwater Management Plan, Plans with Landcover Data, and Plans with no Landcover Data.

Development Sites with Agreements in Lieu of a Stormwater Management Plan
After discussion with City staff, it was determined that the single family residential (SFR) development with Agreements in Lieu of a Stormwater Management Plan (Agreements in Lieu of), for which there is no impervious or pervious landcover data, would be assigned an impervious cover of 0.043 acre (1 Equivalent Residential Unit, or ERU), in accordance with the City's stormwater utility billing policy. There were 218 SFR and two multifamily residential development properties granted Agreements in Lieu of, during the study period. The impervious cover for the two multifamily residential properties was calculated by estimating the number of ERUs for these properties. The total change in impervious cover from Agreements in Lieu of development properties was estimated to be 9.71 acres.

Development Sites with Land Cover Data
For many of the developed properties without BMPs installed between July 1, 2009 and March 30, 2013, the impervious area added or removed during construction was provided by Tidemark. The proposed impervious areas and impervious area reductions provided by Tidemark were used to calculate the change in total impervious area from 2009 to 2013. The change in impervious area from 2009 to 2013 for development sites without BMPs and with available land cover data is 56.55 acres.

Development Sites with No Land Cover Data
Land cover data was not available for 43 sites developed during the study period. These sites were treated as if they had Agreements in Lieu of. The number of ERUs for each of these sites was estimated and the total change in impervious cover was calculated to be 2.90 acres.

2009 Land Cover Conditions

The impervious land cover for all development occurring between 2009 and 2013 was 111.87 acres. This value represents the change in impervious cover from 2009 to 2013, and was subtracted from the total impervious land cover value determined from the 2013 land cover VITA data (6,457.37 acres). The total 2009 impervious land cover area is 6,345.51 acres.

The final values calculated for regulated urban impervious and regulated urban pervious area with forested land, wetlands, and open water excluded from the total regulated areas are provided in Table 1.

Table 1. MS4 Regulated Urban Impervious and Pervious Area as of June 30, 2009

Area Description	Area (acres)
Portsmouth MS4 Regulated Area	13,841.96
Portsmouth MS4 Regulated Area Excluding Forested Land, Wetlands, and Open Water Area	13,335.24
MS4 Regulated Impervious Area	6,345.51
MS4 Regulated Pervious Area	7,496.45
Forested Land, Wetlands and Open Water Area	506.73
MS4 Regulated Pervious Area Excluding Forested Land, Wetlands, and Open Water Area	6,989.73

Estimated 2009 Existing Pollutant Source Loads

An estimate of the annual POC loads from existing sources as of June 30, 2009, and the total required pollutant load reductions were calculated according to the VPDES MS4 permit (2016) and Virginia DEQ Guidance (2015) and are provided in Table 2.

Table 2. Existing Source Loads

Area Type	Pollutant	Total Existing Acres Served by MS4 (6/30/09)	2009 EOS Loading Rate (lbs/acre/yr)	Estimated Total POC Load Based on 2009 Progress Run (lbs/yr)	Total Impervious and Pervious POC Load Based on 2009 Progress Run (lbs/yr)
Regulated Urban Impervious	Nitrogen	6,345.51	9.574666034	60,756.12	108,592.16
Regulated Urban Pervious		6,989.73	6.843763814	47,836.04	
Regulated Urban Impervious	Phosphorous	6,345.51	1.786015931	11,333.18	14,802.39
Regulated Urban Pervious		6,989.73	0.496330705	3,469.22	
Regulated Urban Impervious	Total Suspended Solids	6,345.51	703.4240675	4,463,583.07	5,188,862.57
Regulated Urban Pervious		6,989.73	103.763636	725,279.49	

Notes:
EOS = edge of stream
lbs/acre/yr = pounds per acre per year
lbs/yr = pounds per year

Pollutant of Concern Required Reductions

The total Chesapeake Bay TMDL POC required reductions for this permit cycle were calculated using the reduction loading rate values from Table 2 and Part I.D.1.b.1.g of the City's MS4 permit and are provided in Table 3.

Table 3. Total Pollutant of Concern Required Reductions

Area Type	Pollutant	Total Existing Acres Served by MS4 (6/30/09)	First Permit Cycle Required Reduction in Loading Rate (lbs/acre/yr)	Reduction Required for Existing Sources for First Permit Cycle (lbs/yr)	Reduction Required for Existing and New Sources for First Permit Cycle (lbs/yr)	Total Impervious and Pervious Reduction Required First Permit Cycle (lbs/yr)
Regulated Urban Impervious	Nitrogen	6,345.51	0.043085997	273.40	314.41	479.45
Regulated Urban Pervious		6,989.73	0.020531291	143.51	165.03	
Regulated Urban Impervious	Phosphorous	6,345.51	0.014288127	90.67	104.27	118.73
Regulated Urban Pervious		6,989.73	0.001799199	12.58	14.46	
Regulated Urban Impervious	Total Suspended Solids	6,345.51	7.034240675	44,635.83	51,331.21	54,980.27
Regulated Urban Pervious		6,989.73	0.453965907	3,173.10	3,649.06	

References

CH2M HILL, Inc. (CH2M). 2017. *Portsmouth MS4 Outfall Delineation Technical Memorandum.* December.

Chesapeake Bay TMDL Action Plan Guidance Revision. 2015. http://www.deq.virginia.gov/Portals/0/DEQ/Water/Guidance/152005.pdf.

City of Portsmouth MS4 Permit. 2016.

https://www.portsmouthva.gov/DocumentCenter/View/1480.

National Wetlands Inventory. U.S. Fish and Wildlife Service. 2017. https://www.fws.gov/wetlands/Data/State-Downloads.html

Attachment A
Portsmouth TMDL Load Calculations

City of Portsmouth Chesapeake Bay TMDL Action Plan
5/8/2018

James River Basin 2009 Land cover Conditions

Regulated Impervious Area	6345.51 acres
Pervious Area	7496.45 acres
Contiguous Tree Cover Area	208.08 acres
Wetlands Area	43.71 acres
Open Water Area	254.93 acres
Regulated Pervious Area	6989.73 acres

Table 1
Calculation of Existing Source Loads for the James River Basin
Based on the Chesapeake Bay Program Watershed Model Phase 5.3.2

Subsource	Pollutant	Total Existing Acres Served by MS4 (6/30/09)	2009 EOS Loading Rate (lbs/acre/yr)	Estimated Total POC Load Based on 2009 Progress Run (lbs/yr)	Total Impervious and Pervious POC Load Based on 2009 Progress Run (lbs/yr)
Regulated Urban Impervious	Nitrogen	6,345.51	9.574666034	60,756.12	108,592.16
Regulated Urban Pervious		6,989.73	6.843763814	47,836.04	
Regulated Urban Impervious	Phosphorous	6,345.51	1.786015931	11,333.18	14,802.39
Regulated Urban Pervious		6,989.73	0.496330705	3,469.22	
Regulated Urban Impervious	TSS	6,345.51	703.4240675	4,463,583.07	5,188,862.57
Regulated Urban Pervious		6,989.73	103.763636	725,279.49	

Table 2
Calculation Sheet for Determining the POC Reductions Required for Existing Sources During the First Permit Cycle for the James River Basin
Based on the Chesapeake Bay Program Watershed Model Phase 5.3.2

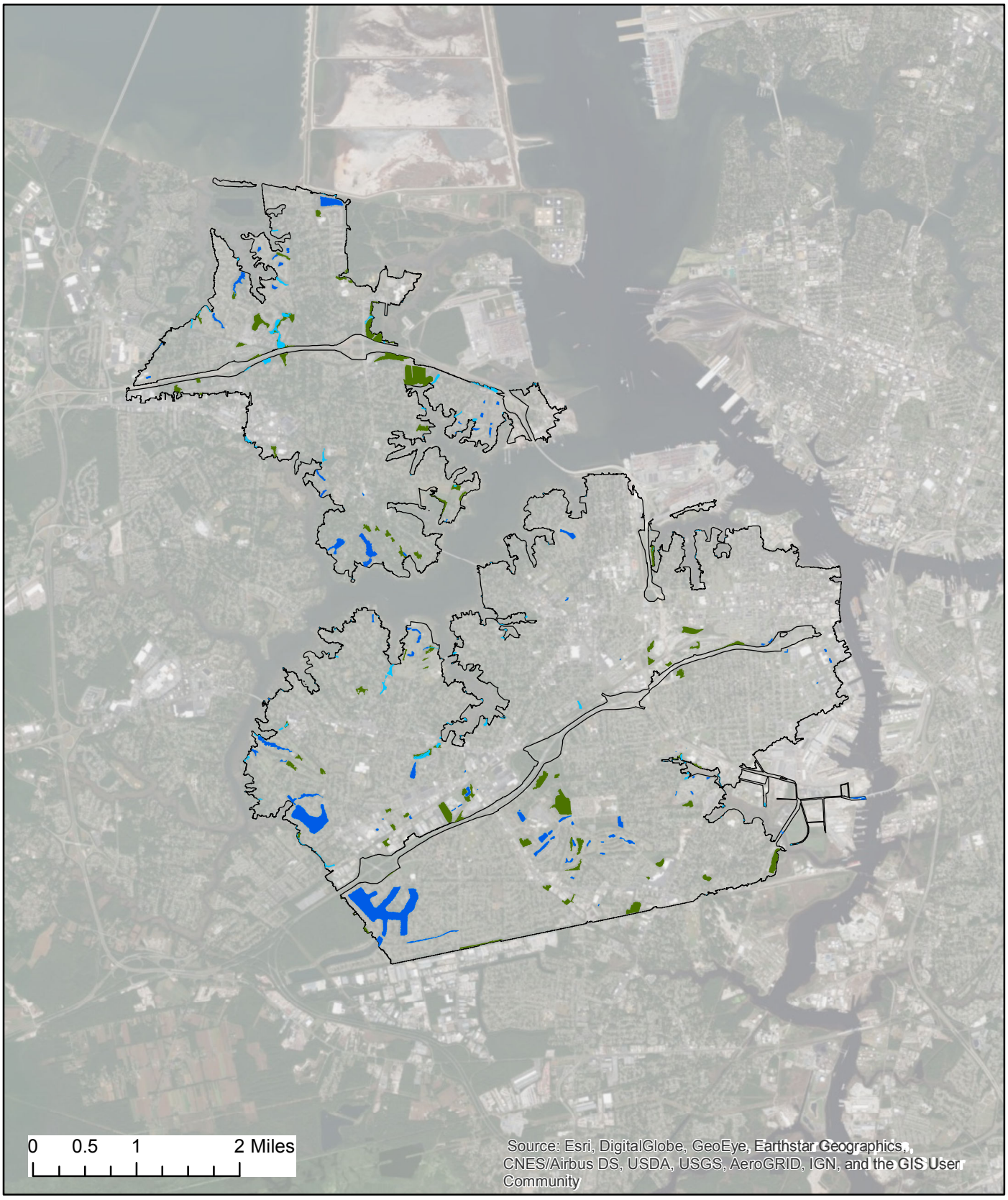
Subsource	Pollutant	Total Existing Acres Served by MS4 (6/30/09)	First Permit Cycle Required Reduction in Loading Rate (lbs/acre/yr)	Reduction Required for Existing Sources for First Permit Cycle by Subsource(lbs/yr)	Total Reduction Required for Existing Sources for First Permit Cycle (lbs/yr)	Estimated Total Reduction Required for Existing Sources by 2025 (lbs/yr)
Regulated Urban Impervious	Nitrogen	6,345.51	0.043085997	273.40	416.91	8,338.21
Regulated Urban Pervious		6,989.73	0.020531291	143.51		
Regulated Urban Impervious	Phosphorous	6,345.51	0.014288127	90.67	103.24	2,064.83
Regulated Urban Pervious		6,989.73	0.001799199	12.58		
Regulated Urban Impervious	TSS	6,345.51	7.034240675	44,635.83	47,808.93	956,178.57
Regulated Urban Pervious		6,989.73	0.453965907	3,173.10		

Table 3

Calculation Sheet for Determining the POC Reductions Required for Existing and New Sources During the First Permit Cycle for the James River Basin Based on the Chesapeake Bay Program Watershed Model Phase 5.3.2

Subsource	Pollutant	Total Existing Acres Served by MS4 (6/30/09)	Reduction Required for Existing Sources for First Permit Cycle by Subsource(lbs/yr)	Reduction Required for Existing and New Sources with Additional 15% Reduction for First Permit Cycle by Subsource (lbs/yr)	Total Reduction Required for Existing and New Sources for First Permit Cycle (lbs/yr)
Regulated Urban Impervious	Nitrogen	6,345.51	273.40	314.41	479.45
Regulated Urban Pervious		6,989.73	143.51	165.03	
Regulated Urban Impervious	Phosphorous	6,345.51	90.67	104.27	118.73
Regulated Urban Pervious		6,989.73	12.58	14.46	
Regulated Urban Impervious	TSS	6,345.51	44635.83	51,331.21	54,980.27
Regulated Urban Pervious		6,989.73	3173.10	3,649.06	

Attachment B
Land Cover Exclusions



LEGEND

- Open Waters
- Wetlands
- Forest Qualifying for Exclusion
- MS4 Boundary

N

FIGURE 2
Land Cover Exclusions
Areas excluded from POC base load calculations.
City of Portsmouth, VA MS4 Permit and Program

APPENDIX C

City of Portsmouth MS4 Program: Pollutant Reductions from Historical and Redevelopment Stormwater Best Management Practices

City of Portsmouth MS4 Program Pollutant Reductions from Historical and Redevelopment Stormwater Best Management Practices

PREPARED FOR:	Thomas Quattlebaum, City of Portsmouth
PREPARED BY:	Juliana Cammarata, EIT, CH2M
DATE:	May 9, 2018
REVISION NO.:	3
APPROVED BY:	Shelly Frie, PE, CH2M

This technical memorandum summarizes the assessment of the City of Portsmouth's (City's) Best Management Practices (BMPs) installed between January 1999 and January 2018, for pollutant load reduction credits to meet the City's Chesapeake Bay Total Maximum Daily Load (TMDL) requirements.

The City is required to meet the requirements of the Chesapeake Bay TMDL as described in their municipal separate storm sewer system (MS4) permit Part 1.D., and in the Chesapeake Bay TMDL Special Condition Guidance (the Guidance) Part IV.2. Part I.D.1.c.2.d. of the City's MS4 permit states that the City, to the maximum extent practicable, should implement means and measures sufficient to reduce their required pollutants of concern (POC) loads by 5 percent by the end of the first permit term.

Permittees were encouraged to submit historical data for water quality BMPs installed before June 30, 2013, to meet this requirement. Permittees will receive full credit for BMPs installed between January 1, 2006 and June 30, 2009 that were constructed with the express purpose of addressing water quality. BMPs installed before 2006 can generate load reduction credits if they were retrofitted or enhanced to meet the Virginia Stormwater Management Program (VSMP) water quality design criteria requirements for development on prior developed lands (9VAC25-870-63). BMPs installed after 2009 may generate additional load reduction credits if they were constructed to exceed existing load reduction regulations (Guidance Part III.3). Additionally, Part III.3.1. of the Guidance states that permittees may claim credits for pollutant reductions resulting from redevelopment projects completed after July 1, 2009. The City's BMPs were reviewed to determine if they qualified for pollutant load reduction credits under any of these provisions, and POC reductions were calculated.

Estimating Nutrient Pollutant Reductions from Best Management Practices

Part II.2. of the Guidance instructs that to assess the City's pollutant load reductions, a baseline pollutant load level for the MS4 must be established from the June 30, 2009 land cover conditions. The baseline pollutant load level is then used to estimate pollutant reductions

attributable to installed BMPs. This process is further discussed in the document, *Task 4.2 Setting the Baseline* (CH2M, 2018). After the 2009 baseline pollutant load was established, CH2M HILL, Inc. (CH2M) reviewed the City's construction records between 2004 and January 2018 to identify BMPs eligible for pollutant load reduction credits and to determine redevelopment status. The BMPs were sorted by type and grouped by installation date.

Historical Best Management Practices

The City submitted a list of historical BMPs to the Virginia Department of Environmental Quality (DEQ) by September 1, 2015, per the instructions in the Guidance. A list of historical BMPs was provided to CH2M by City staff in October 2017, but City staff were not certain if it was the exact list submitted to Virginia DEQ. A list of the submitted BMPs was requested from the Virginia DEQ and received, but the Virginia DEQ BMP list had no information about the BMP locations and therefore could not be correlated with BMP data from the City's development recordkeeping and tracking software program called Tidemark. The list received from the DEQ has 62 sites with BMPs installed between 2006 and 2009. A new list of historical BMPs was assembled using the City's Tidemark data with the assumption that any BMPs determined to qualify as historical BMPs would have been included on the City's original list. The new list has 30 BMPs installed between 2006 and 2009.

The BMP type, impervious area in the BMP drainage area, and the pervious area in the BMP drainage area were obtained from the City's Tidemark database and from the site development plans for BMPs installed between 2006 and 2009, when available. Each BMP was evaluated for pollutant reduction capacity using the techniques outlined in the Guidance, Appendix V.A. The Chesapeake Bay Program (CBP) efficiencies were applied to this set of BMPs as the current Virginia Stormwater BMP Clearinghouse (Clearinghouse) design criteria were not implemented until 2015.

BMPs installed between 1999 and 2006 qualify for credits only if they were retrofitted after 2006 to meet the new water quality regulations. Historical construction data from 1999 to 2003 was incomplete so BMP water quality retrofits could not be determined; however, any of the BMPs installed before January 1, 2006 qualifying under this provision would have been part of a redevelopment project between 2006 and 2018. Sites with redevelopment activities and BMPs installed between 2006 and 2018 were reviewed in depth for historical and redevelopment BMP credits. During this process, a water quantity BMP located at 3204 Tyre Neck Road was modified to have increased storage volume. No pollutant load reduction credits can be claimed for this BMP since the retrofit does not address water quality.

BMPs installed between 2009 and 2013 qualify to receive reduction credits if they were oversized for their required treatment volume. CH2M could not determine if any of the BMPs were oversized for water quality treatment because there was not adequate historical design calculation data.

The results of the historical BMP assessment are summarized in Table 1 and the TMDL pollutant reduction information for historical BMPs is provided in Attachment 1.

The 2009 baseload POC is discussed in the document, *Task 4.2: Setting the Baseline* (CH2M, 2018). Table 1 presents the 2009 POC loads, the first permit cycle required reductions, credits from historical BMPs, and the percent of first permit cycle required reduction achieved.

Table 1. Pollutants of Concern Reductions from Historical Best Management Practices

	TN	TP	TSS
2009 POC LOADS (LBS)	108,592.16	14,802.39	5,188,862.57
REQUIRED REDUCTION FROM NEW AND EXISTING SOURCES (LBS)	479.45	118.73	54,980.27
REDUCTION FROM HISTORICAL BMPS (LBS)	117.89	34.01	19,335.59
PERCENT OF FIRST PERMIT CYCLE REQUIRED REDUCTION ACHIEVED	24.6%	28.6%	35.2%

Notes:

LBS = pounds

TN = Total Nitrogen

TP = Total Phosphorous

TSS = Total Suspended Solids

Redevelopment Pollutant Reduction Credits

Part III.3.1. of the Guidance states that permittees may claim credits for pollutant reductions resulting from redevelopment projects completed after July 1, 2009. The City considers 'redevelopment' as construction on prior developed lands. Properties that have had demolition activity but were not developed within 5 years of that activity are considered new development. All redevelopment activities for which a BMP was installed result in a reduction in POC loads, so all BMPs installed for redevelopment after July 1, 2009 are included in the pollutant reduction calculations.

A list was compiled of all BMPs installed in the City after July 1, 2009. This list was checked against all construction in the City between 2004 and 2018, for construction activities at the same site address to determine if the demolition occurred within 5 years of the BMP construction. Construction activities with the same site address were reviewed for redevelopment activities using data from Tidemark, aerial imagery, and site plan sets when available. Sites with both new construction and redevelopment were noted so that only the BMP serving the redevelopment area was included in the pollutant load reduction calculations.

After the redevelopment sites were identified, data was collected for the POC loading calculations for the BMP drainage areas. Data to complete pollutant load reductions was gathered from Tidemark and site plans (when available), and supplemented with GIS BMP data and aerial photography when necessary. Each site was considered individually for impervious cover within the BMP drainage area and BMP type. BMP type was then correlated with a practice from the CBP or Clearinghouse to assign a reduction efficiency. Efficiencies from both the CBP and Clearinghouse were compared and either the CBP or Clearinghouse efficiency was applied based on available data, and which efficiency provided the highest nutrient removal. BMPs installed before the implementation of the current Clearinghouse types in 2015 were assessed using only CBP efficiencies. The Clearinghouse does not provide TN removal efficiencies for proprietary BMPs, nor TSS efficiencies for any BMPs, so CBP efficiencies were

used in these cases. The results of this analysis are provided in Table 2 and in the TMDL Pollutant Reduction Calculations in Attachment 2.

Table 2. Pollutants of Concern Reductions from Best Management Practices Installed for Redevelopment

	TN	TP	TSS
2009 POC LOADS (LBS)	108,592.16	14,802.39	5,188,862.57
REQUIRED REDUCTION FROM NEW AND EXISTING SOURCES (LBS)	479.45	118.73	54,980.27
REDUCTION FROM REDEVELOPMENT BMPS (LBS)	169.69	45.88	22,416.54
PERCENT OF FIRST PERMIT CYCLE REQUIRED REDUCTIONS ACHIEVED	35.4%	38.6%	40.8%

Summary of Pollutant Reductions from Best Management Practices

The total combined pollutant reductions from historical and redevelopment BMPs are provided in Table 3.

Table 3. Pollutants of Concern Reductions from Historical and Redevelopment Best Management Practices

	TN	TP	TSS
2009 POC LOADS (LBS)	108,592.16	14,802.39	5,188,862.57
REQUIRED REDUCTION FROM NEW AND EXISTING SOURCES (LBS)	479.45	118.73	54,980.27
TOTAL REDUCTION FROM HISTORICAL AND REDEVELOPMENT BMPS (LBS)	287.58	79.89	41,752.13
PERCENT OF REQUIRED REDUCTION REDUCED BY HISTORICAL AND REDEVELOPMENT BMPS	60.0%	67.3%	75.9%
PERCENT OF REQUIRED REDUCTION REMAINING	40.0%	32.7%	24.1%

References

CH2M HILL, Inc. (CH2M). 2018. *Task 4.2 Setting the Baseline* Technical Memorandum. March.

Chesapeake Bay TMDL Action Plan Guidance Revision. 2015. http://www.deq.virginia.gov/Portals/0/DEQ/Water/Guidance/152005.pdf.

City of Portsmouth MS4 Permit. 2016. https://www.portsmouthva.gov/DocumentCenter/View/1480.

Attachment 1
Historical Best Management Practices

City of Portsmouth Chesapeake Bay TMDL Action Plan
Pollutant Reduction from Structural BMPs Installed After 2009
Use method described in Appendixes V.C from VDEQ Chesapeake Bay TMDL Action Plan Guidance Memo No. 15-2005.
Drainage impervious and pervious area are from the Williamsburg historial BMP reporting spreadsheet.
Use BMP removal efficiency values from Chesapeake Bay Program BMP Efficiencies.

Totals

TN	TP	TSS	acres
117.89	34.01	19335.59	66.39

No.	Address	BMP ID	Lat.	Long.	HUC12	BMP Type (including Clearinghouse)	Chesapeake Bay Program BMP	Drainage Area (acres)	Impervious Drainage Area (acres)	Impervious TN Loading Rate (lbs/ac/yr)	Impervious TP Loading Rate (lbs/ac/yr)	Impervious TSS Loading Rate (lbs/ac/yr)	Pervious Drainage Area (acres)	Pervious TN Loading Rate (lbs/ac/yr)	Pervious TP Loading Rate (lbs/ac/yr)	Pervious TSS Loading Rate (lbs/ac/yr)	Impervious and Pervious TN (lbs/yr)	Impervious and Pervious TP (lbs/yr)	Impervious and Pervious TSS (lbs/yr)	TN Removal Eff.	TP Removal Eff.	TSS Removal Eff.	TN Reduction (lbs/yr)	TP Reduction (lbs/yr)	TSS Reduction (lbs/yr)
1	2219 FREDERICK BLVD	SIT2004-00045_1	36.822569	-76.33068	0202802080203	Wetpond	Wet Ponds and Wetlands	0.62	0.45	9.574666034	1.786015931	703.4240675	0.17	6.843763814	0.496330705	103.763636	5.47	0.89	334.18	20%	45%	60%	1.09	0.40	200.51
2	2503 WOODROW ST	SIT2004-00056_1	36.844732	-76.332897	0202802080206	Bioretention	Bioretention C/D soils, underdrain	0.52	0.34	9.574666034	1.786015931	703.4240675	0.18	6.843763814	0.496330705	103.763636	4.50	0.70	259.76	25%	45%	55%	1.12	0.32	142.87
3	4900 W HIGH ST	SIT2005-00042_1	36.852591	-76.377014	0202802080205	Dry Pond	Dry Detention Ponds	1.45	1.00	9.574666034	1.786015931	703.4240675	0.45	6.843763814	0.496330705	103.763636	12.65	2.01	750.12	5%	10%	10%	0.63	0.20	75.01
4	4900 W HIGH ST	SIT2005-00042_2	36.851403	-76.376783	0202802080205	Dry Pond	Dry Detention Ponds	0.55	0.42	9.574666034	1.786015931	703.4240675	0.13	6.843763814	0.496330705	103.763636	4.91	0.81	308.93	5%	10%	10%	0.25	0.08	30.89
5	TALLWOOD DR (1070 University Blvd Portsmouth)	SIT2006-00003_1	36.869181	-76.415899	020802080301	Wetpond	Wet Ponds and Wetlands	16.25	3.40	9.574666034	1.786015931	703.4240675	12.85	6.843763814	0.496330705	103.763636	120.50	12.45	3725.00	20%	45%	60%	24.10	5.60	2235.00
6	4005 VICTORY BLVD	SIT2006-00011_1	36.810301	-76.360035	0202802080205	Wetpond	Wet Ponds and Wetlands	2.63	1.81	9.574666034	1.786015931	703.4240675	0.82	6.843763814	0.496330705	103.763636	22.94	3.64	1358.28	20%	45%	60%	4.59	1.64	814.97
7	2917 QUEEN ST	SIT2006-00017_1	36.834983	-76.337152	0202802080205	Extended dry detention	Dry Extended Detention Ponds	0.47	0.25	9.574666034	1.786015931	703.4240675	0.22	6.843763814	0.496330705	103.763636	3.90	0.56	198.68	20%	20%	60%	0.78	0.11	119.21
8	3708 ADAMS ST (Adams St plan)	SIT2006-00027_1	36.860436	-76.352457	0202802080205	Filterra	Filtering Practices	0.64	0.44	9.574666034	1.786015931	703.4240675	0.20	6.843763814	0.496330705	103.763636	5.57	0.88	327.38	40%	60%	80%	2.23	0.53	261.90
9	3708 ADAMS ST (Adams St plan)	SIT2006-00027_2	36.860627	-76.352047	0202802080205	Grass Swale	Vegetated Open Channels C/D soils, no underdrain	0.29	0.20	9.574666034	1.786015931	703.4240675	0.09	6.843763814	0.496330705	103.763636	2.52	0.40	148.34	10%	10%	50%	0.25	0.04	74.17
10	3708 ADAMS ST (Adams St plan)	SIT2006-00027_3	36.860661	-76.351944	0202802080205	Grass Swale	Vegetated Open Channels C/D soils, no underdrain	0.17	0.12	9.574666034	1.786015931	703.4240675	0.05	6.843763814	0.496330705	103.763636	1.49	0.24	89.60	10%	10%	50%	0.15	0.02	44.80
11	3505 TYRE NECK RD	SIT2006-00029_1	36.865066	-76.394401	0202802080205	Bioretention	Bioretention C/D soils, underdrain	0.09	0.04	9.574666034	1.786015931	703.4240675	0.05	6.843763814	0.496330705	103.763636	0.71	0.09	30.93	25%	45%	55%	0.18	0.04	17.01
12	3505 TYRE NECK RD	SIT2006-00029_2	36.865066	-76.394401	0202802080205	Bioretention	Bioretention C/D soils, underdrain	0.14	0.09	9.574666034	1.786015931	703.4240675	0.05	6.843763814	0.496330705	103.763636	1.21	0.19	70.30	25%	45%	55%	0.30	0.09	38.66
13	3300 AIRLINE BLVD	SIT2006-00033_1	36.807493	-76.3786355	0202802080205	Wetpond	Wet Ponds and Wetlands	3.36	2.79	9.574666034	1.786015931	703.4240675	0.57	6.843763814	0.496330705	103.763636	30.61	5.26	2020.98	20%	45%	60%	6.12	2.37	1212.59
14	260 ELM AVE	SIT2006-00035_1	36.838699	-76.314162	0202802080206	Extended dry detention	Dry Extended Detention Ponds	7.18	7.18	9.574666034	1.786015931	703.4240675	0.00	6.843763814	0.496330705	103.763636	68.75	12.82	5050.58	20%	20%	60%	13.75	2.56	3030.35
15	3325 FREDERICK BLVD	SIT2006-00036_1	36.813615	-76.31807	0202802080205	Extended dry detention	Dry Extended Detention Ponds	2.45	2.31	9.574666034	1.786015931	703.4240675	0.14	6.843763814	0.496330705	103.763636	22.17	3.77	1639.44	20%	20%	60%	4.43	0.75	983.66
16	2401 TURNPIKE RD	SIT2006-00039_1	36.831164	-76.329258	0202802080206	Dry Pond	Dry Detention Ponds	1.23	1.11	9.574666034	1.786015931	703.4240675	0.12	6.843763814	0.496330705	103.763636	11.45	2.04	793.25	5%	10%	10%	0.57	0.20	79.33
17	500 LINCOLN ST	SIT2007-00007_1	36.825987	-76.301892	0202802080203	Extended dry detention	Dry Extended Detention Ponds	1.03	1.03	9.574666034	1.786015931	703.4240675	0.00	6.843763814	0.496330705	103.763636	9.86	1.84	724.53	20%	20%	60%	1.97	0.37	434.72
18	700 PORTCENTRE PKWY	SIT2007-00008_1	36.8255	-76.298212	0202802080203	Infiltration	Infiltration Practices w/o Sand, Veg.	1.15	0.91	9.574666034	1.786015931	703.4240675	0.24	6.843763814	0.496330705	103.763636	10.35	1.74	664.12	80%	85%	95%	8.28	1.48	630.91
19	700 PORTCENTRE PKWY	SIT2007-00008_2	36.824927	-76.297982	0202802080203	Grass Swale	Vegetated Open Channels C/D soils, no underdrain	0.23	0.18	9.574666034	1.786015931	703.4240675	0.05	6.843763814	0.496330705	103.763636	2.07	0.35	132.82	10%	10%	50%	0.21	0.03	66.41
20	3120 TYRE NECK RD	SIT2007-00011_1	36.859498	-76.397519	0202802080205	Bioretention	Bioretention C/D soils, underdrain	0.22	0.12	9.574666034	1.786015931	703.4240675	0.10	6.843763814	0.496330705	103.763636	1.84	0.27	95.39	25%	45%	55%	0.46	0.12	52.46
21	361 EFFINGHAM ST	SIT2007-00027_1	36.837813	-76.306622	020802080206	Bioretention	Bioretention C/D soils, underdrain	0.52	0.36	9.574666034	1.786015931	703.4240675	0.16	6.843763814	0.496330705	103.763636	4.54	0.72	269.83	25%	45%	55%	1.14	0.33	148.41
22	4934 W HIGH ST	SIT2007-00030_1	36.85202	-76.378768	0202802080205	Wetpond	Wet Ponds and Wetlands	1.85	1.39	9.574666034	1.786015931	703.4240675	0.46	6.843763814	0.496330705	103.763636	16.46	2.71	1025.49	20%	45%	60%	3.29	1.22	615.29
23	2306 AIRLINE BLVD	SIT2007-00038_1	36.818515	-76.353929	0202802080205	Enhanced Detention	Dry Extended Detention Ponds	0.62	0.50	9.574666034	1.786015931	703.4240675	0.12	6.843763814	0.496330705	103.763636	5.61	0.95	364.16	20%	20%	60%	1.12	0.19	218.50
24	ALABAMA AVE (develpoment @ west end of street)	SIT2007-00045_1	36.809727	-76.322031	0202802080203	Wetpond	Wet Ponds and Wetlands	2.94	2.26	9.574666034	1.786015931	703.4240675	0.68	6.843763814	0.496330705	103.763636	26.30	4.38	1662.70	20%	45%	60%	5.26	1.97	997.62
25	ALABAMA AVE (develpoment @ west end of street)	SIT2007-00045_2	36.809727	-76.322031	0202802080203	Wetpond	Wet Ponds and Wetlands	5.53	4.26	9.574666034	1.786015931	703.4240675	1.27	6.843763814	0.496330705	103.763636	49.48	8.24	3128.37	20%	45%	60%	9.90	3.71	1877.02
26	ALABAMA AVE (develpoment @ west end of street)	SIT2007-00045_3	36.809727	-76.322031	0202802080203	Wetpond	Wet Ponds and Wetlands	4.00	3.08	9.574666034	1.786015931	703.4240675	0.92	6.843763814	0.496330705	103.763636	35.79	5.96	2262.01	20%	45%	60%	7.16	2.68	1357.21
27	3959 GARWOOD AVE	SIT2007-00046_1	36.801814	-76.381417	0202802080205	Extended dry detention	Dry Extended Detention Ponds	0.77	0.27	9.574666034	1.786015931	703.4240675	0.50	6.843763814	0.496330705	103.763636	6.01	0.73	241.51	20%	20%	60%	1.20	0.15	144.90
28	2716 AIRLINE BLVD	SIT2007-00051_1	36.811631	-76.363763	0202802080205	Filterra	Filtering Practices	0.13	0.13	9.574666034	1.786015931	703.4240675	0.00	6.843763814	0.496330705	103.763636	1.24	0.23	91.45	40%	60%	80%	0.50	0.14	73.16
29	HOWARD ST (109-134 Howard St plan)	SIT2008-00003_1	36.82811	-76.334541	0202802080205	Wetpond	Wet Ponds and Wetlands	9.18	7.71	9.574666034	1.786015931	703.4240675	1.47	6.843763814	0.496330705	103.763636	83.88	14.50	5576.65	20%	45%	60%	16.78	6.53	3345.99
30	1445 CENTRE AVE	SIT2008-00023_1	36.816201	-76.315751	0202802080203	Other (storm filter)	Dry Detention Ponds and Hydrodynamic Structures	0.18	0.17	9.574666034	1.786015931	703.4240675	0.01	6.843763814	0.496330705	103.763636	1.70	0.31	120.62	5%	45%	10%	0.08	0.14	12.06

Attachment 2
Redevelopment Best Management Practices

City of Portsmouth Chesapeake Bay TMDL Action Plan
Pollutant Reduction from Structural BMPs Installed During Redevelopment After 2009
Use method described in Appendixes V.C from VDEQ Chesapeake Bay TMDL Action Plan Guidance Memo No. 15-2005.
Drainage impervious and pervious area are from Portsmouth's Tidemark database and plan sets.
Use BMP removal efficiency values from Chesapeake Bay Program BMP and Virginia Stormwater BMP Clearinghouse.

Totals

TN	TP	TSS	acres
169.69	45.88	22416.54	89.01

No.	Address	BMP ID	Lat.	Long.	HUC12	BMP Type (including Clearinghouse)	Chesapeake Bay Program BMP	Drainage Area (acres)	Impervious Drainage Area (acres)	Impervious TN Loading Rate (lbs/ac/yr)	Impervious TP Loading Rate (lbs/ac/yr)	Impervious TSS Loading Rate (lbs/ac/yr)	Pervious Drainage Area (acres)	Pervious TN Loading Rate (lbs/ac/yr)	Pervious TP Loading Rate (lbs/ac/yr)	Pervious TSS Loading Rate (lbs/ac/yr)	Impervious and Pervious TN (lbs/yr)	Impervious and Pervious TP (lbs/yr)	Impervious and Pervious TSS (lbs/yr)	TN Removal Eff.	Source of TN Removal Eff.	TP Removal Eff.	Source of TP Removal Eff.	TSS Removal Eff. (Bay Prog)	TN Reduction (lbs/yr)	TP Reduction (lbs/yr)	TSS Reduction (lbs/yr)
54	1 HIGH ST	SIT2015-00029_1	36.834413	-76.296757	20802080203	Filterra	Filtering Practices	0.13	0.13	9.574666034	1.786015931	703.4240675	0.00	6.843763814	0.496330705	103.763636	1.24	0.23	91.45	40%	Bay Prog.	60%	Bay Prog.	80%	0.50	0.14	73.16
35	1009 VICTORY BLVD	SIT2015-00037_1	36.798234	-76.306802	20802080203	Rainwater Harvesting	Dry Detention Ponds and Hydrodynamic Structures	0.04	0.04	9.574666034	1.786015931	703.4240675	0.00	6.843763814	0.496330705	103.763636	0.38	0.07	28.14	50%	Clearinghouse	50%	Clearinghouse	10%	0.19	0.04	2.81
36	1009 VICTORY BLVD	SIT2015-00037_2	36.798234	-76.306802	20802080203	Bioretention 1	Bioretention C/D soils, underdrain	0.18	0.04	9.574666034	1.786015931	703.4240675	0.14	6.843763814	0.496330705	103.763636	1.34	0.14	42.66	64%	Clearinghouse	55%	Clearinghouse	55%	0.86	0.08	23.47
37	1009 VICTORY BLVD	SIT2015-00037_3	36.798234	-76.306802	20802080203	Permeable Pavement 1	Permeable Pavement w/o Sand, Veg. - C/D soils, underdrain	0.52	0.52	9.574666034	1.786015931	703.4240675	0.00	6.843763814	0.496330705	103.763636	4.98	0.93	365.78	59%	Clearinghouse	59%	Clearinghouse	55%	2.94	0.55	201.18
49	1098 FREDERICK BLVD	SIT2017-00004_1	36.829264	-76.340431	20802080205	Filterra	Filtering Practices	0.25	0.23	9.574666034	1.786015931	703.4240675	0.02	6.843763814	0.496330705	103.763636	2.34	0.42	163.86	40%	Bay Prog.	60%	Bay Prog.	80%	0.94	0.25	131.09
12	1100 PORTSMOUTH BLVD	SIT2015-00002_1	36.820704	-76.310871	20802080203	Grass Channel A/B soils	Vegetated Open Channels A/B soils, no underdrain	2.95	0.00	9.574666034	1.786015931	703.4240675	2.95	6.843763814	0.496330705	103.763636	20.19	1.46	306.10	45%	Bay Prog.	45%	Bay Prog.	70%	9.09	0.66	214.27
50	1116 COUNTY ST	SIT2007-00032_1	36.834024	-76.311365	20802080203	Storm Filter	Dry Detention Ponds and Hydrodynamic Structures	1.02	0.96	9.574666034	1.786015931	703.4240675	0.06	6.843763814	0.496330705	103.763636	9.60	1.74	681.51	5%	Bay Prog.	45%	Clearinghouse	10%	0.48	0.78	68.15
68	1140 LONDON BLVD	SIT2013-00004_1	36.837807	-76.312036	20802080206	Filterra	Filtering Practices	0.25	0.25	9.574666034	1.786015931	703.4240675	0.00	6.843763814	0.496330705	103.763636	2.39	0.45	175.86	40%	Bay Prog.	60%	Bay Prog.	80%	0.96	0.27	140.68
69	1140 LONDON BLVD	SIT2013-00004_2	36.837565	-76.312264	20802080206	Filterra	Filtering Practices	0.07	0.07	9.574666034	1.786015931	703.4240675	0.00	6.843763814	0.496330705	103.763636	0.67	0.13	49.24	40%	Bay Prog.	60%	Bay Prog.	80%	0.27	0.08	39.39
39	115 CAVALIER BLVD	SIT2005-00001_1	36.814364	-76.345496	20802080203	Bioretention	Bioretention C/D soils, underdrain	0.02	0.02	9.574666034	1.786015931	703.4240675	0.00	6.843763814	0.496330705	103.763636	0.14	0.03	10.55	25%	Bay Prog.	45%	Bay Prog.	55%	0.04	0.01	5.80
40	115 CAVALIER BLVD	SIT2005-00001_2	36.81439	-76.344759	20802080203	Bioretention	Bioretention C/D soils, underdrain	0.01	0.01	9.574666034	1.786015931	703.4240675	0.00	6.843763814	0.496330705	103.763636	0.09	0.02	6.33	25%	Bay Prog.	45%	Bay Prog.	55%	0.02	0.01	3.48
94	1200 FREDERICK BLVD	SIT2014-00009	36.828152	-76.339555	020802080205	Other (unknown)	Dry Detention Ponds and Hydrodynamic Structures	0.46	0.391	9.574666034	1.786015931	703.4240675	0.07	6.843763814	0.496330705	103.763636	4.22	0.73	282.20	5%	Bay Prog.	10%	Bay Prog.	10%	0.21	0.07	28.22
5	1201 FREDERICK BLVD	SIT2014-00025_1	36.829109	-76.338339	20802080205	Vegetated Filter/Channel impervious Disconnection	Vegetated Open Channels C/D soils, no underdrain	0.30	0.30	9.574666034	1.786015931	703.4240675	0.00	6.843763814	0.496330705	103.763636	2.84	0.53	208.92	10%	Bay Prog.	10%	Bay Prog.	50%	0.28	0.05	104.46
55	132 BYERS AVE	SIT2009-00008_1	36.827186	-76.36641	20802080205	Bioretention	Bioretention C/D soils, underdrain	1.05	0.66	9.574666034	1.786015931	703.4240675	0.39	6.843763814	0.496330705	103.763636	8.99	1.37	504.73	25%	Bay Prog.	45%	Bay Prog.	55%	2.25	0.62	277.60
56	132 BYERS AVE	SIT2009-00008_2	36.826604	-76.367157	20802080205	Bioretention	Bioretention C/D soils, underdrain	0.39	0.25	9.574666034	1.786015931	703.4240675	0.14	6.843763814	0.496330705	103.763636	3.35	0.52	190.38	25%	Bay Prog.	45%	Bay Prog.	55%	0.84	0.23	104.71
57	132 BYERS AVE	SIT2009-00008_3	36.826381	-76.367306	20802080205	Bioretention	Bioretention C/D soils, underdrain	0.23	0.08	9.574666034	1.786015931	703.4240675	0.15	6.843763814	0.496330705	103.763636	1.79	0.22	71.84	25%	Bay Prog.	45%	Bay Prog.	55%	0.45	0.10	39.51
58	132 BYERS AVE	SIT2009-00008_4	36.826018	-76.366841	20802080205	Bioretention	Bioretention C/D soils, underdrain	0.24	0.08	9.574666034	1.786015931	703.4240675	0.16	6.843763814	0.496330705	103.763636	1.86	0.22	72.88	25%	Bay Prog.	45%	Bay Prog.	55%	0.47	0.10	40.08
59	132 BYERS AVE	SIT2009-00008_5	36.826172	-76.366718	20802080205	Bioretention	Bioretention C/D soils, underdrain	0.38	0.17	9.574666034	1.786015931	703.4240675	0.21	6.843763814	0.496330705	103.763636	3.06	0.41	141.37	25%	Bay Prog.	45%	Bay Prog.	55%	0.77	0.18	77.75
60	132 BYERS AVE	SIT2009-00008_6	36.826134	-76.366326	20802080205	Stormceptor	Dry Detention Ponds and Hydrodynamic Structures	8.70	0.03	9.574666034	1.786015931	703.4240675	8.67	6.843763814	0.496330705	103.763636	59.62	4.36	920.73	5%	Bay Prog.	20%	Clearinghouse	10%	2.98	0.87	92.07
61	132 BYERS AVE	SIT2009-00008_7	36.826728	-76.366418	20802080205	Vegetated Roof 1	Vegetated Open Channels A/B soils, no underdrain	0.67	0.67	9.574666034	1.786015931	703.4240675	0.00	6.843763814	0.496330705	103.763636	6.42	1.20	471.29	45%	Clearinghouse	45%	Clearinghouse	70%	2.89	0.54	329.91
62	132 BYERS AVE	SIT2009-00008_8	36.827186	-76.36641	20802080205	Porous Pavers	Permeable Pavement w/o Sand, Veg. - A/B soils, underdrain	0.72	0.72	9.574666034	1.786015931	703.4240675	0.00	6.843763814	0.496330705	103.763636	6.89	1.29	506.47	45%	Bay Prog.	50%	Bay Prog.	70%	3.10	0.64	354.53
110	1401 CRAWFORD PKWY	SIT2008-00027	36.840866	-76.315395	020802080206	Enhanced Detention	Dry Extended Detention Ponds	3.11	2.94	9.574666034	1.786015931	703.4240675	0.17	6.843763814	0.496330705	103.763636	29.31	5.34	2085.71	20%	Bay Prog.	20%	Bay Prog.	60%	5.86	1.07	1251.42
112	1503 LONDON BLVD	SIT2009-00026	36.836711	-76.317995	020802080206	Dry Pond	Dry Detention Ponds	4.1	3.895	9.574666034	1.786015931	703.4240675	0.21	6.843763814	0.496330705	103.763636	38.70	7.06	2761.11	5%	Bay Prog.	10%	Bay Prog.	10%	1.93	0.71	276.11
114	1600 SOUTH ST	SIT2009-00010_1	36.829535	-76.317553	20802080203	Porous Pavers	Permeable Pavement w/o Sand, Veg. - A/B soils, underdrain	1.95	0.5655	9.574666034	1.786015931	703.4240675	1.38	6.843763814	0.496330705	103.763636	14.89	1.70	541.45	45%	Bay Prog.	50%	Bay Prog.	70%	6.70	0.85	379.01
41	18 DAHLGREN AVE	SIT2009-00022_1	36.798096	-76.320903	20802080203	Bioretention	Bioretention C/D soils, underdrain	0.55	0.55	9.574666034	1.786015931	703.4240675	0.00	6.843763814	0.496330705	103.763636	5.27	0.98	386.88	25%	Bay Prog.	45%	Bay Prog.	55%	1.32	0.44	212.79
42	18 DAHLGREN AVE	SIT2009-00022_2	36.798418	-76.320345	20802080203	Bioretention	Bioretention C/D soils, underdrain	1.01	1.01	9.574666034	1.786015931	703.4240675	0.00	6.843763814	0.496330705	103.763636	9.67	1.80	710.46	25%	Bay Prog.	45%	Bay Prog.	55%	2.42	0.81	390.75
43	18 DAHLGREN AVE	SIT2009-00022_3	36.798788	-76.319936	20802080203	Bioretention	Bioretention C/D soils, underdrain	0.99	0.99	9.574666034	1.786015931	703.4240675	0.00	6.843763814	0.496330705	103.763636	9.48	1.77	696.39	25%	Bay Prog.	45%	Bay Prog.	55%	2.37	0.80	383.01
44	18 DAHLGREN AVE	SIT2009-00022_4	36.798374	-76.319532	20802080203	Bioretention	Bioretention C/D soils, underdrain	0.25	0.25	9.574666034	1.786015931	703.4240675	0.00	6.843763814	0.496330705	103.763636	2.39	0.45	175.86	25%	Bay Prog.	45%	Bay Prog.	55%	0.60	0.20	96.72
45	18 DAHLGREN AVE	SIT2009-00022_5	36.7986	-76.319365	20802080203	Bioretention	Bioretention C/D soils, underdrain	0.14	0.14	9.574666034	1.786015931	703.4240675	0.00	6.843763814	0.496330705	103.763636	1.34	0.25	98.48	25%	Bay Prog.	45%	Bay Prog.	55%	0.34	0.11	54.16
46	18 DAHLGREN AVE	SIT2009-00022_6	36.798402	-76.319022	20802080203	Bioretention	Bioretention C/D soils, underdrain	0.62	0.62	9.574666034	1.786015931	703.4240675	0.00	6.843763814	0.496330705	103.763636	5.94	1.11	436.12	25%	Bay Prog.	45%	Bay Prog.	55%	1.48	0.50	239.87
71	1800 FREDERICK BLVD	SIT2010-00016_1	36.824388	-76.339155	020802080205	Storm Filter	Dry Detention Ponds and Hydrodynamic Structures	1.12	0.83	9.574666034	1.786015931	703.4240675	0.29	6.843763814	0.496330705	103.763636	9.93	1.62	613.21	5%	Bay Prog.	45%	Clearinghouse	10%	0.50	0.73	61.32
14	1800 FREDERICK BLVD	SIT2010-00016_2	36.824331	-76.339707	20802080205	Storm Filter	Dry Detention Ponds and Hydrodynamic Structures	0.46	0.45	9.574666034	1.786015931	703.4240675	0.01	6.843763814	0.496330705	103.763636	4.37	0.80	315.30	5%	Bay Prog.	45%	Clearinghouse	10%	0.22	0.36	31.53
15	1800 FREDERICK BLVD	SIT2010-00016_3	36.824331	-76.339707	20802080205	Storm Filter	Dry Detention Ponds and Hydrodynamic Structures	0.28	0.25	9.574666034	1.786015931	703.4240675	0.03	6.843763814	0.496330705	103.763636	2.60	0.46	178.49	5%	Bay Prog.	45%	Clearinghouse	10%	0.13	0.21	17.85
16	1800 FREDERICK BLVD	SIT2010-00016_4	36.824331	-76.339707	20802080205	Storm Filter	Dry Detention Ponds and Hydrodynamic Structures	0.13	0.11	9.574666034	1.786015931	703.4240675	0.02	6.843763814	0.496330705	103.763636	1.20	0.21	81.31	5%	Bay Prog.	45%	Clearinghouse	10%	0.06	0.09	8.13
2	1811 EFFINGHAM ST	SIT2015-00001_1	36.825334	-76.305044	20802080203	Bioretention	Bioretention C/D soils, underdrain	0.32	0.17	9.574666034	1.786015931	703.4240675	0.15	6.843763814	0.496330705	103.763636	2.65	0.38	135.15	25%	Bay Prog.	45%	Bay Prog.	55%	0.66	0.17	74.33
95	1811 EFFINGHAM ST	SIT2015-00001_1	36.825028	-76.305819	020802080203	Bioretention	Bioretention C/D soils, underdrain	0.32	0.17	9.574666034	1.786015931	703.4240675	0.15	6.843763814	0.496330705	103.763636	2.65	0.38	135.15	25%	Bay Prog.	45%	Bay Prog.	55%	0.66	0.17	74.33
3	1811 EFFINGHAM ST	SIT2015-00001_2	36.824795	-76.306113	20802080203	Bioretention	Bioretention C/D soils, underdrain	0.64	0.42	9.574666034	1.786015931	703.4240675	0.22	6.843763814	0.496330705	103.763636	5.53	0.86	318.27	25%	Bay Prog.	45%	Bay Prog.	55%	1.38	0.39	175.05
96	1811 EFFINGHAM ST	SIT2015-00001_2	36.825028	-76.305819	020802080203	Bioretention	Bioretention C/D soils, underdrain	0.64	0.42	9.574666034	1.786015931	703.4240675	0.22	6.843763814	0.496330705	103.763636	5.53	0.86	318.27	25%	Bay Prog.	45%	Bay Prog.	55%	1.38	0.39	175.05
10	1811 KING ST	SIT2013-00007_1	36.833464	-76.321157	20802080206	Bioretention	Bioretention C/D soils, underdrain	1.27	0.91	9.574666034	1.786015931	703.4240675	0.36	6.843763814	0.496330705	103.763636	11.19	1.81	679.50	25%	Bay Prog.	45%	Bay Prog.	55%	2.80	0.81	373.72
11	1811 KING ST	SIT2013-00007_2	36.833911	-76.322337	20802080206	Bioretention	Bioretention C/D soils, underdrain	0.41	0.27	9.574666034	1.786015931	703.4240675	0.14	6.843763814	0.496330705	103.763636	3.56	0.56	207.13	25%	Bay Prog.	45%	Bay Prog.	55%	0.89	0.25	113.92
53	2001 FREDERICK BLVD	SIT2015-00022_1	36.824429	-76.331662	20802080203	Bioretention	Bioretention C/D soils, underdrain	0.06	0.06	9.574666034	1.786015931	703.4240675	0.00	6.843763814	0.496330705	103.763636	0.61	0.11	45.02	25%	Bay Prog.	45%	Bay Prog.	55%	0.15	0.05	24.76
17	2210 PORTSMOUTH BLVD	SIT2016-00016_1	36.817134	-76.327524	20802080203	Manufactured Treatment Device-Filtering	Dry Detention Ponds and Hydrodynamic Structures	0.30	0.27	9.574666034	1.786015931	703.4240675	0.03	6.843763814	0.496330705	103.763636	2.79	0.50	193.04	5%	Bay Prog.	10%	Bay Prog.	10%	0.14	0.05	19.30
18	2210 PORTSMOUTH BLVD	SIT2016-00016_2	36.816995	-76.327594	20802080203	Manufactured Treatment Device-Generic	Dry Detention Ponds and Hydrodynamic Structures	0.27	0.20	9.574666034	1.786015931	703.4240675	0.07	6.843763814	0.496330705	103.763636	2.39	0.39	147.95	5%	Bay Prog.	10%	Bay Prog.	10%	0.12	0.04	14.79
63	23 MOHAWK DR	SIT2016-00020_1	36.813418	-76.362764	20802080205	Bioretention 2	Bioretention C/D soils, underdrain	0.11	0.03	9.574666034	1.786015931	703.4240675	0.08	6.843763814	0.496330705	103.763636	0.84	0.10	32.01	90%	Clearinghouse	90%	Clearinghouse	55%	0.76	0.09	17.61
64	23 MOHAWK DR	SIT2016-00020_2	36.81327	-76.362794	20802080205	Bioretention 2	Bioretention C/D soils, underdrain	0.11	0.03	9.574666034	1.786015931	703.4240675	0.07	6.843763814	0.496330705	103.763636	0.84	0.10	31.93	90%	Clearinghouse	90%	Clearinghouse	55%	0.75	0.09	17.56
65	23 MOHAWK DR	SIT2016-00020_3	36.813159	-76.362809	20802080205	Bioretention 2	Bioretention C/D soils, underdrain	0.11	0.03	9.574666034	1.786015931	703.4240675	0.07	6.843763814	0.496330705	103.763636	0.84	0.10	31.91	90%	Clearinghouse	90%	Clearinghouse	55%	0.75	0.09	17.55
66	23 MOHAWK DR	SIT2016-00020_4	36.813335	-76.362605	20802080205	Bioretention 2	Bioretention C/D soils, underdrain	0.10	0.03	9.574666034	1.786015931	703.4240675	0.07	6.843763814	0.496330705	103.763636	0.75	0.08	26.59	90%	Clearinghouse	90%	Clearinghouse	55%	0.68	0.08	14.63
67	23 MOHAWK DR	SIT2016-00020_5	36.813335	-76.362605	20802080205	Bioretention 2	Bioretention C/D soils, underdrain	0.08	0.03	9.574666034	1.786015931	703.4240675	0.06	6.843763814	0.496330705	103.763636	0.65	0.08	25.02	90%	Clearinghouse	90%	Clearinghouse	55%	0.58	0.07	13.76
113	2602 AIRLINE BLVD	SIT2008-00044	36.814868	-76.361571	020802080205	Other (Pavers)	Permeable Pavement w/o Sand, Veg. - C/D soils, underdrain	0.057	0.004	9.574666034	1.786015931	703.4240675	0.05	6.843763814	0.496330705	103.763636	0.40	0.03	8.31	10%	Bay Prog.	20%	Bay Prog.	55%	0.04	0.01	4.57
6	3010 HIGH ST	SIT2014-00030_1	36.834781	-76.338438	20802080205	Filterra	Filtering Practices	0.24	0.23	9.574666034	1.786015931	703.4240675	0.01	6.843763814	0.496330705	103.763636	2.27	0.42	162.83	40%	Bay Prog.	60%	Bay Prog.	80%	0.91	0.25	130.26
7	3011 HIGH ST	SIT2014-00030_2	36.834781	-76.338438	20802080205	Filterra	Filtering Practices	0.12	0.11	9.574666034	1.786015931	703.4240675	0.01	6.843763814	0.496330705	103.763636	1.12	0.20	78.41	40%	Bay Prog.	60%	Bay Prog.	80%	0.45	0.12	62.73
8	3012 HIGH ST	SIT2014-00030_3	36.834781	-76.338438	20802080205	Filterra	Filtering Practices	0.07	0.06	9.574666034	1.786015931	703.4240675	0.01	6.843763814	0.496330705	103.763636	0.62	0.11	42.83	40%	Bay Prog.	60%	Bay Prog.	80%	0.25	0.07	34.26
9	3013 HIGH ST	SIT2014-00030_4	36.834781	-76.338438	20802080205	Filterra	Filtering Practices	0.17	0.17	9.574666034	1.786015931	703.4240675	0.00	6.843763814	0.496330705	103.763636	1.63	0.30	119.58	40%	Bay Prog.	60%	Bay Prog.	80%	0.65	0.18	95.67
52	3116 SOUTH ST	SIT2011-00037_1	36.831772	-76.340409	20802080205	Filterra	Filtering Practices	0.11	0.10	9.574666034	1.786015931	703.4240675	0.01	6.843763814	0.496330705	103.763636	1.01	0.18	68.98	40%	Bay Prog.	60%	Bay Prog.	80%	0.41	0.11	55.19
1	3119 RIVEREDGE DR	SIT2010-00011_1	36.847176	-76.362772	20802080205	Mulch Bed	Filtering Practices	0.03	0.03	9.574666034	1.786015931	703.4240675	0.00	6.843763814	0.496330705	103.763636	0.29	0.05	21.10	40%	Bay Prog.	60%	Bay Prog.	80%	0.11	0.03	16.88
38	3201 HIGH ST	SIT2015-00018_1	36.834197	-76.341056	20802080205	Filterra	Filtering Practices	0.82	0.61	9.574666034	1.786015931	703.4240675	0.21	6.843763814	0.496330705	103.763636	7.28	1.19	450.88	40%	Bay Prog.	60%	Bay Prog.	80%	2.91	0.72	360.70
107	3201 HIGH ST	SIT2015-00018_1	36.83405	-76.341073	020802080205	FMD (Contech Jellyfish)	Dry Detention Ponds and Hydrodynamic Structures	0.79	0.12	9.574666034	1.786015931	703.4240675	0.67	6.843763814	0.496330705	103.763636	5.73	0.55	153.93	5%	Bay Prog.	45%	Clearinghouse	10%	0.29	0.25	15.39
47	3245 PORTSMOUTH BLVD	SIT2008-00014_1	36.815312	-76.340876	20802080203	Infiltration	Infiltration Practices w/o Sand, Veg.	0.14	0.09	9.574666034	1.786015931	703.4240675	0.05	6.843763814	0.496330705	103.763636	1.20	0.19	68.50	80%	Bay Prog.	85%	Bay Prog.	95%	0.96	0.16	65.07
4	3340 WEST NORFOLK RD	SIT2008-00021_1	36.86213	-76.344329	20802080205	Vegetated Swale	Vegetated Open Channels C/D soils, no underdrain	0.90	0.90	9.574666034	1.786015931	703.4240675	0.00	6.843763814	0.496330705	103.763636	8.62	1.61	633.08	10%	Bay Prog.	10%	Bay Prog.	50%	0.86	0.16	316.54
19	3340 WEST NORFOLK RD	SIT2009-00003_1	36.863824	-76.343927	20802080206	Bioretention	Bioretention C/D soils, underdrain	1.36	1.36	9.574666034	1.786015931	703.4240675	0.00	6.843763814	0.496330705	103.763636	13.03	2.43	957.36	25%	Bay Prog.	45%	Bay Prog.	55%	3.26	1.09	526.55
20	3400 WESTERN BRANCH BLVD	SIT2007-00058_1	36.867253	-76.413947	20802080205	Grass Swale	Vegetated Open Channels C/D soils, no underdrain	1.68	1.50	9.574666034	1.786015931	703.4240675	0.18	6.843763814	0.496330705	103.763636	15.59	2.77	1073.81	10%	Bay Prog.	10%	Bay Prog.	50%	1.56	0.28	536.91
27	3400 WESTERN BRANCH BLVD	SIT2007-00058_F10	36.866818	-76.415806	20802080301	Filterra	Filtering Practices	0.50	0.50	9.574666034	1.786015931	703.4240675	0.00	6.843763814	0.496330705	103.763636	4.79	0.89	351.71	40%	Bay Prog.	60%	Bay Prog.	80%	1.91	0.54	281.37
28	3400 WESTERN BRANCH BLVD	SIT2007-00058_F11	36.867892	-76.414396	20802080301	Filterra	Filtering Practices	0.12	0.12	9.574666034	1.786015931	703.4240675	0.00	6.843763814	0.496330705	103.763636	1.15	0.21	84.41	40%	Bay Prog.	60%	Bay Prog.	80%	0.46	0.13	67.53
29	3400 WESTERN BRANCH BLVD	SIT2007-00058_F12	36.867846	-76.414798	20802080301	Filterra	Filtering Practices	0.41	0.41	9.574666034	1.786015931	703.4240675	0.00	6.843763814	0.496330705	103.763636	3.93	0.73	288.40	40%	Bay Prog.	60%	Bay Prog.	80%	1.57	0.44	230.72
30	3400 WESTERN BRANCH BLVD	SIT2007-00058_F13	36.867846	-76.414798	20802080301	Filterra	Filtering Practices	0.50	0.50	9.574666034	1.786015931	703.4240675	0.00	6.843763814	0.496330705	103.763636	4.79	0.89	351.71	40%	Bay Prog.	60%	Bay Prog.	80%	1.91	0.54	281.37
31	3400 WESTERN BRANCH BLVD	SIT2007-00058_F14	36.867794	-76.415282	20802080301	Filterra	Filtering Practices	0.17	0.17	9.574666034	1.786015931	703.4240675	0.00	6.843763814	0.496330705	103.763636	1.63	0.30	119.58	40%	Bay Prog.	60%	Bay Prog.	80%	0.65	0.18	95.67
32	3400 WESTERN BRANCH BLVD	SIT2007-00058_F15	36.867746	-76.415715	20802080301	Filterra	Filtering Practices	0.17	0.17	9.574666034	1.786015931	703.4240675	0.00	6.843763814	0.496330705	103.763636	1.63	0.30	119.58	40%	Bay Prog.	60%	Bay Prog.	80%	0.65	0.18	95.67
33	3400 WESTERN BRANCH BLVD	SIT2007-00058_F16	36.867707	-76.416065	20802080301	Filterra	Filtering Practices	0.50	0.50	9.574666034	1.786015931	703.4240675	0.00	6.843763814	0.496330705	103.763636	4.79	0.89	351.71	40%	Bay Prog.	60%	Bay Prog.	80%	1.91	0.54	281.37
34	3400 WESTERN BRANCH BLVD	SIT2007-00058_F17	36.867651	-76.416371	20802080301	Filterra	Filtering Practices	0.45	0.45	9.574666034	1.786015931	703.4240675	0.00	6.843763814	0.496330705	103.763636	4.31	0.80	316.54	40%	Bay Prog.	60%	Bay Prog.	80%	1.72	0.48	253.23
21	3400 WESTERN BRANCH BLVD	SIT2007-00058_F3	36.866331	-76.414622	20802080205	Filterra	Filtering Practices	0.08	0.08	9.574666034	1.786015931	703.4240675	0.00	6.843763814	0.496330705	103.763636	0.72	0.13	52.76	40%	Bay Prog.	60%	Bay Prog.	80%	0.29	0.08	42.21
22	3400 WESTERN BRANCH BLVD	SIT2007-00058_F5	36.867404	-76.414868	20802080301	Filterra	Filtering Practices	0.45	0.45	9.574666034	1.786015931	703.4240675	0.00	6.843763814	0.496330705	103.763636	4.31	0.80	316.54	40%	Bay Prog.	60%	Bay Prog.	80%	1.72	0.48	253.23
23	3400 WESTERN BRANCH BLVD	SIT2007-00058_F6	36.867404	-76.414868	20802080301	Filterra	Filtering Practices	0.32	0.32	9.574666034	1.786015931	703.4240675	0.00	6.843763814	0.496330705	103.763636	3.06	0.57	225.10	40%	Bay Prog.	60%	Bay Prog.	80%	1.23	0.34	180.08
24	3400 WESTERN BRANCH BLVD	SIT2007-00058_F7	36.867651	-76.416371	20802080301	Filterra	Filtering Practices	0.34	0.34	9.574666034	1.786015931	703.4240675	0.00	6.843763814	0.496330705	103.763636	3.26	0.61	239.16	40%	Bay Prog.	60%	Bay Prog.	80%	1.30	0.36	191.33
25	3400 WESTERN BRANCH BLVD	SIT2007-00058_F8	36.866818	-76.415806	20802080301	Filterra	Filtering Practices	0.50	0.50	9.574666034	1.786015931	703.4240675	0.00	6.843763814	0.496330705	103.763636	4.79	0.89	351.71	40%	Bay Prog.	60%	Bay Prog.	80%	1.91	0.54	281.37
26	3400 WESTERN BRANCH BLVD	SIT2007-00058_F9	36.867257	-76.416431	20802080301	Filterra	Filtering Practices	0.44	0.44	9.574666034	1.786015931	703.4240675	0.00	6.843763814	0.496330705	103.763636	4.21	0.79	309.51	40%	Bay Prog.	60%	Bay Prog.	80%	1.69	0.47	247.61
70	3401 TURNPIKE RD	SIT2008-00043	36.821213	-76.343381	020802080205	Wetpond	Wet Ponds and Wetlands	7.93	4.60	9.574666034	1.786015931	703.4240675	3.33	6.843763814	0.496330705	103.763636	66.83	9.87	3580.92	20%	Bay Prog.	45%	Bay Prog.	60%	13.37	4.44	2148.55
83	3406 JACKSON ST	SIT2010-00041	36.865195	-76.349971	020802080205	Bioretention	Bioretention C/D soils, underdrain	0.22	0.136	9.574666034	1.786015931	703.4240675	0.08	6.843763814	0.496330705	103.763636	1.88	0.28	104.38	25%	Bay Prog.	45%	Bay Prog.	55%	0.47	0.13	57.41
104	3410 GEORGE WASHINGTON HWY	SIT2009-00041_1	36.812357	-76.316431	020802080203	Extended Dry Detention	Dry Extended Detention Ponds	0.85	0.578	9.574666034	1.786015931	703.4240675	0.27	6.843763814	0.496330705	103.763636	7.40	1.17	434.80	20%	Bay Prog.	20%	Bay Prog.	60%	1.48	0.23	260.88
105	3410 GEORGE WASHINGTON HWY	SIT2009-00041_2	36.812357	-76.316431	020802080203	Extended Dry Detention	Dry Extended Detention Ponds	0.73	0.4964	9.574666034	1.786015931	703.4240675	0.23	6.843763814	0.496330705	103.763636	6.35	1.00	373.42	20%	Bay Prog.	20%	Bay Prog.	60%	1.27	0.20	224.05
79	3555 AIRLINE BLVD	SIT2011-00017	36.80412	-76.383651	020802080205	Other (Contech Stormfilter)	Dry Detention Ponds and Hydrodynamic Structures	0.3792	0.48	9.574666034	1.786015931	703.4240675	-0.10	6.843763814	0.496330705	103.763636	3.91	0.81	327.18	5%	Bay Prog.	45%	Clearinghouse	10%	0.20	0.36	32.72
88	3601 VICTORY BLVD	SIT2013-00029_1	36.804687	-76.355092	020802080203	Bioretention	Bioretention C/D soils, underdrain	0.42	0.249	9.574666034	1.786015931	703.4240675	0.17	6.843763814	0.496330705	103.763636	3.55	0.53	192.90	25%	Bay Prog.	45%	Bay Prog.	55%	0.89	0.24	106.09
89	3601 VICTORY BLVD	SIT2013-00029_2	36.804687	-76.355092	020802080203	Filterra	Filtering Practices	0.49	0.292	9.574666034	1.786015931	703.4240675	0.20	6.843763814	0.496330705	103.763636	4.15	0.62	225.95	40%	Bay Prog.	60%	Bay Prog.	80%	1.66	0.37	180.76
90	3601 VICTORY BLVD	SIT2013-00029_3	36.804687	-76.355092	020802080203	Filterra	Filtering Practices	0.56	0.423	9.574666034	1.786015931	703.4240675	0.14	6.843763814	0.496330705	103.763636	4.99	0.82	311.76	40%	Bay Prog.	60%	Bay Prog.	80%	2.00	0.49	249.41
106	3636 HIGH ST	SIT2015-00014	36.836515	-76.347935	020802080205	Bioretention	Bioretention C/D soils, underdrain	0.08	0.06	9.574666034	1.786015931	703.4240675	0.02	6.843763814	0.496330705	103.763636	0.71	0.12	44.28	25%	Bay Prog.	45%	Bay Prog.	55%	0.18	0.05	24.35
91	4001 GREENWOOD DR	SIT2014-00028	36.799551	-76.363387	020802080206	Vegetated Swale	Vegetated Open Channels C/D soils, no underdrain	0.14	0.07	9.574666034	1.786015931	703.4240675	0.07	6.843763814	0.496330705	103.763636	1.15	0.16	56.50	10%	Bay Prog.	10%	Bay Prog.	50%	0.11	0.02	28.25

No.	Address	BMP ID	Lat.	Long.	HUC12	BMP Type (including Clearinghouse)	Chesapeake Bay Program BMP	Drainage Area (acres)	Impervious Drainage Area (acres)	Impervious TN Loading Rate (lbs/ac/yr)	Impervious TP Loading Rate (lbs/ac/yr)	Impervious TSS Loading Rate (lbs/ac/yr)	Pervious Drainage Area (acres)	Pervious TN Loading Rate (lbs/ac/yr)	Pervious TP Loading Rate (lbs/ac/yr)	Pervious TSS Loading Rate (lbs/ac/yr)	Impervious and Pervious TN (lbs/yr)	Impervious and Pervious TP (lbs/yr)	Impervious and Pervious TSS (lbs/yr)	TN Removal Eff.	Source of TN Removal Eff.	TP Removal Eff.	Source of TP Removal Eff.	TSS Removal Eff. (Bay Prog)	TN Reduction (lbs/yr)	TP Reduction (lbs/yr)	TSS Reduction (lbs/yr)
101	417 COUNTY ST	SIT2014-00011_1	36.833504	-76.30153	020802080203	Filterra	Filtering Practices	0.08	0.065	9.574666034	1.786015931	703.4240675	0.02	6.843763814	0.496330705	103.763636	0.73	0.12	47.28	40%	Bay Prog.	60%	Bay Prog.	80%	0.29	0.07	37.82
102	417 COUNTY ST	SIT2014-00011_2	36.833179	-76.301758	020802080203	Filterra	Filtering Practices	0.2	0.2	9.574666034	1.786015931	703.4240675	0.00	6.843763814	0.496330705	103.763636	1.91	0.36	140.68	40%	Bay Prog.	60%	Bay Prog.	80%	0.77	0.21	112.55
103	417 COUNTY ST	SIT2014-00011_3	36.833179	-76.301758	020802080203	Filterra	Filtering Practices	0.09	0.083	9.574666034	1.786015931	703.4240675	0.01	6.843763814	0.496330705	103.763636	0.84	0.15	59.11	40%	Bay Prog.	60%	Bay Prog.	80%	0.34	0.09	47.29
92	4211 COUNTY ST	SIT2013-00020_1	36.832006	-76.355024	020802080205	Bioretention	Bioretention C/D soils, underdrain	0.37	0.259	9.574666034	1.786015931	703.4240675	0.11	6.843763814	0.496330705	103.763636	3.24	0.52	193.70	25%	Bay Prog.	45%	Bay Prog.	55%	0.81	0.23	106.54
93	4211 COUNTY ST	SIT2013-00020_2	36.832006	-76.355024	020802080205	Other (Filter Strip)	Filtering Practices	0.82	0.574	9.574666034	1.786015931	703.4240675	0.25	6.843763814	0.496330705	103.763636	7.18	1.15	429.29	40%	Bay Prog.	60%	Bay Prog.	80%	2.87	0.69	343.43
85	4825 PORTSMOUTH BLVD	SIT2014-00002	36.817632	-76.37129	020802080205	Infiltration (Pervious Pavement SPEC 7)	Permeable Pavement w/o Sand, Veg. - C/D soils, underdrain	0.17	0.1661	9.574666034	1.786015931	703.4240675	0.00	6.843763814	0.496330705	103.763636	1.62	0.30	117.24	10%	Bay Prog.	20%	Bay Prog.	55%	0.16	0.06	64.48
108	4916 WEST NORFOLK RD	SIT2008-00020_1	36.869665	-76.37684	020802080205	Detention	Dry Extended Detention Ponds	1.06	0.67	9.574666034	1.786015931	703.4240675	0.39	6.843763814	0.496330705	103.763636	9.08	1.39	511.76	20%	Bay Prog.	20%	Bay Prog.	60%	1.82	0.28	307.06
109	4916 WEST NORFOLK RD	SIT2008-00020_2	36.869665	-76.37684	020802080205	Detention	Dry Extended Detention Ponds	0.58	0.31	9.574666034	1.786015931	703.4240675	0.27	6.843763814	0.496330705	103.763636	4.82	0.69	246.08	20%	Bay Prog.	20%	Bay Prog.	60%	0.96	0.14	147.65
111	5100 DEEP CREEK BLVD	SIT2007-00041	36.793827	-76.336582	020802080203	Other (Dry Wells)	Infiltration Practices w/o Sand, Veg.	0.14	0.119	9.574666034	1.786015931	703.4240675	0.02	6.843763814	0.496330705	103.763636	1.28	0.22	85.89	80%	Bay Prog.	85%	Bay Prog.	95%	1.03	0.19	81.59
80	5515 PORTSMOUTH BLVD	SIT2011-00027	36.819014	-76.378653	020802080205	Infiltration (Perforated pipe wrapped in filter fabric)	Infiltration Practices w/o Sand, Veg.	0.11	0.099	9.574666034	1.786015931	703.4240675	0.01	6.843763814	0.496330705	103.763636	1.02	0.18	70.78	80%	Bay Prog.	85%	Bay Prog.	95%	0.82	0.15	67.24
75	5700 HEDGEROW LN	SIT2010-00012_1	36.889893	-76.38496	020802080301	Filterra	Filtering Practices	0.71	0.71	9.574666034	1.786015931	703.4240675	0.00	6.843763814	0.496330705	103.763636	6.80	1.27	499.43	40%	Bay Prog.	60%	Bay Prog.	80%	2.72	0.76	399.54
76	5700 HEDGEROW LN	SIT2010-00012_2	36.889893	-76.38496	020802080301	Other (Hydrodynamic Separator)	Dry Detention Ponds and Hydrodynamic Structures	0.7	0.7	9.574666034	1.786015931	703.4240675	0.00	6.843763814	0.496330705	103.763636	6.70	1.25	492.40	5%	Bay Prog.	10%	Bay Prog.	10%	0.34	0.13	49.24
77	5700 HEDGEROW LN	SIT2010-00012_3	36.889893	-76.38496	020802080301	Other (Hydrodynamic Separator)	Dry Detention Ponds and Hydrodynamic Structures	0.7	0.7	9.574666034	1.786015931	703.4240675	0.00	6.843763814	0.496330705	103.763636	6.70	1.25	492.40	5%	Bay Prog.	10%	Bay Prog.	10%	0.34	0.13	49.24
78	5700 HEDGEROW LN	SIT2010-00012_4	36.889893	-76.38496	020802080301	Other (Pervious Concrete)	Permeable Pavement w/o Sand, Veg. - C/D soils, underdrain	0.29	0.29	9.574666034	1.786015931	703.4240675	0.00	6.843763814	0.496330705	103.763636	2.78	0.52	203.99	10%	Bay Prog.	20%	Bay Prog.	55%	0.28	0.10	112.20
99	5811 W HIGH ST	SIT2014-00032	36.859667	-76.39454	20802080205	FMD (Contech Storm Filter)	Dry Detention Ponds and Hydrodynamic Structures	1.06	0.92	9.574666034	1.786015931	703.4240675	0.14	6.843763814	0.496330705	103.763636	9.77	1.71	661.68	5%	Bay Prog.	45%	Clearinghouse	10%	0.49	0.77	66.17
84	5829 W HIGH ST	SIT2013-00001	36.860201	-76.394872	020802080205	Filterra	Filtering Practices	0.3	0.2811	9.574666034	1.786015931	703.4240675	0.02	6.843763814	0.496330705	103.763636	2.82	0.51	199.69	40%	Bay Prog.	60%	Bay Prog.	80%	1.13	0.31	159.75
100	600 WASHINGTON ST	SIT2014-00010	36.834313	-76.304245	020802080203	Filterra	Filtering Practices	0.1	0.1	9.574666034	1.786015931	703.4240675	0.00	6.843763814	0.496330705	103.763636	0.96	0.18	70.34	40%	Bay Prog.	60%	Bay Prog.	80%	0.38	0.11	56.27
86	611 SIXTH ST	SIT2012-00018_1	36.825118	-76.302046	020802080203	Filterra	Filtering Practices	0.22	0.1628	9.574666034	1.786015931	703.4240675	0.06	6.843763814	0.496330705	103.763636	1.95	0.32	120.45	40%	Bay Prog.	60%	Bay Prog.	80%	0.78	0.19	96.36
87	611 SIXTH ST	SIT2012-00018_2	36.825118	-76.302046	020802080203	Filterra	Filtering Practices	0.24	0.168	9.574666034	1.786015931	703.4240675	0.07	6.843763814	0.496330705	103.763636	2.10	0.34	125.65	40%	Bay Prog.	60%	Bay Prog.	80%	0.84	0.20	100.52
81	726 SOUTH ST	SIT2010-00025_1	36.832825	-76.306454	020802080203	Infiltration (Pervious Asphalt)	Permeable Pavement w/o Sand, Veg. - C/D soils, underdrain	0.269	0.060525	9.574666034	1.786015931	703.4240675	0.21	6.843763814	0.496330705	103.763636	2.01	0.21	64.21	10%	Bay Prog.	20%	Bay Prog.	55%	0.20	0.04	35.31
82	726 SOUTH ST	SIT2010-00025_2	36.832825	-76.306454	020802080203	Underground Infiltration (Infilatration Chamber)	Bioretention C/D soils, underdrain	0.5	0.2725	9.574666034	1.786015931	703.4240675	0.23	6.843763814	0.496330705	103.763636	4.17	0.60	215.29	25%	Bay Prog.	45%	Bay Prog.	55%	1.04	0.27	118.41
72	ADAMS ST (3504 Shipwright Street)	SIT2010-00021_1	36.860129	-76.348603	020802080205	Extended Dry Detention	Dry Extended Detention Ponds	0.8	0.568	9.574666034	1.786015931	703.4240675	0.23	6.843763814	0.496330705	103.763636	7.03	1.13	423.62	20%	Bay Prog.	20%	Bay Prog.	60%	1.41	0.23	254.17
73	ADAMS ST (3504 Shipwright Street)	SIT2010-00021_2	36.860129	-76.348603	020802080205	Filterra	Filtering Practices	0.27	0.1917	9.574666034	1.786015931	703.4240675	0.08	6.843763814	0.496330705	103.763636	2.37	0.38	142.97	40%	Bay Prog.	60%	Bay Prog.	80%	0.95	0.23	114.38
74	RIVER POINTE PKWY (3812 Falling River Point Road)	SIT2007-00040	36.86282	-76.357603	020802080205	Wetpond	Wet Ponds and Wetlands	17.7	8.673	9.574666034	1.786015931	703.4240675	9.03	6.843763814	0.496330705	103.763636	144.82	19.97	7037.47	20%	Bay Prog.	45%	Bay Prog.	60%	28.96	8.99	4222.48
97	SOUTH ST (1139 South Street)	SIT2012-00019_1	36.830724	-76.308854	020802080203	Bioretention (Rain Garden)	Bioretention C/D soils, underdrain	0.21	0.1218	9.574666034	1.786015931	703.4240675	0.09	6.843763814	0.496330705	103.763636	1.77	0.26	94.83	25%	Bay Prog.	45%	Bay Prog.	55%	0.44	0.12	52.16
98	SOUTH ST (1139 South Street)	SIT2012-00019_2	36.830724	-76.308854	020802080203	Bioretention (Rain Garden)	Bioretention C/D soils, underdrain	0.07	0.0406	9.574666034	1.786015931	703.4240675	0.03	6.843763814	0.496330705	103.763636	0.59	0.09	31.61	25%	Bay Prog.	45%	Bay Prog.	55%	0.15	0.04	17.39