Bush River Watershed
Total Maximum Daily Load (TMDL)
Restoration Plan for PCBs

August 2017

Prepared by:

Harford County Department of Public Works
Watershed Protection and Restoration Office
212 South Bond Street, 1st Floor
Bel Air, Maryland 21014

Barry Glassman
County Executive

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Table of Contents

List of Figures

List of Tables

Harford County, Maryland
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Introduction

The Bush River Watershed Total Maximum Daily Loads (TMDL) for Polychlorinated Biphenyls (PCBs) (April 2016) was established by Maryland Department of Environment (MDE) and approved by the U.S. Environmental Protection Agency (EPA) on August 2, 2016.

On December 30, 2014, MDE reissued the Phase I National Pollutant Discharge Elimination System (NPDES) Municipal Separate Storm Sewer System (MS4) permit to Harford County (County). The permit has several new requirements, including stringent stormwater management criteria, implementation of strategies to reduce litter and floatables, and development of restoration plans. Part IV.E.2.b of the NPDES MS4 permit requires the County to develop restoration plans to address stormwater wasteload allocations (SW-WLAs) for the waterbodies in the County that have EPA-approved TMDLs. Additionally, the County is required to develop restoration plans for subsequent TMDL SW-WLAs within one year of EPA approval.

Bush River was identified as impaired by PCBs in the 2014 Integrated Report developed by MDE for Sections 305(b) and 303(d) of the Clean Water Act (CWA). The impairment is based on PCBs in fish tissue (2002). The designated use for the Bush River is Use II, or estuarine and marine aquatic life and shellfish harvesting.

PCBs are man-made chemical compounds manufactured as an insulator and coolant in transformers and capacitors. The manufacturing of PCBs was banned in 1977 based on its carcinogenic properties and its persistence to readily breakdown in the environment.

Four 8-digit basins drain into the Bush River including Atkisson Reservoir (02130703), Lower Winters Run (02130702), Bynum Run (02130704), and Bush River (02130701) (Figure 1). A TMDL for sediment for the Bynum Run Watershed was approved in September 2011. The County completed the *Bynum Run Watershed Total Maximum Daily Load Restoration Plan for Sediment* in March 2016.

Watershed Description

The Bush River Watershed is located entirely within Harford County and receives drainage from the Town of Bel Air and portions of the City of Aberdeen, both of which are Phase II MS4 jurisdictions. Additionally, a majority of the Bush River tidal mainstem receives direct drainage from Aberdeen Proving Ground (APG), a Phase II MS4 federal jurisdiction. APG which dates

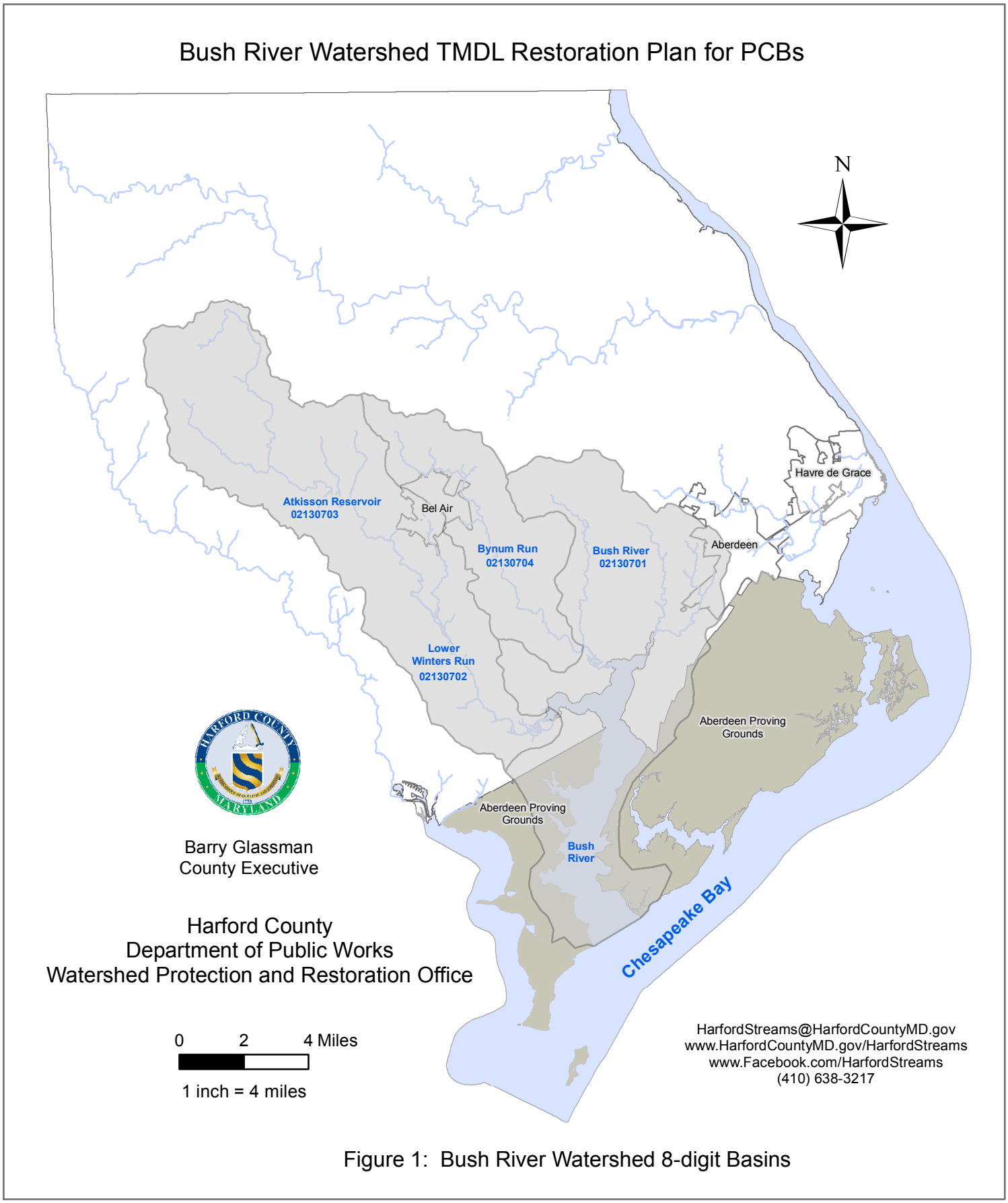

Figure 1: Bush River Watershed 8-digit Basins

back to World War I, is the U.S. Army's oldest active proving grounds. http://armyalliance.org/about-apg/history-of-apg/). The portion of APG located on the western shore of the Bush River focused on chemical weapons research and development.

Bush River Watershed begins near the intersection of Norrisville Road and Jarrettsville Pike and extends southeast to the confluence of the Bush River and Chesapeake Bay. The watershed is roughly bounded on the west by Maryland Route 152, the northeast by Maryland Route 22, and the northwest by Jarrettsville Road / Old Federal Hill Road (Figure 2).

Bush River Watershed is the most urban watershed in the County. Most of the County's Priority Funding Area or development envelope is located within this watershed. The development envelope spans north to south from Forest Hill to Edgewood along MD Route 24 and east to west Aberdeen to Joppa along US Route 40.

The major tributaries to the Bush River are Otter Point Creek, Church Creek and Bynum Creek. Their tributaries include Winters Run, Bynum Run, James Run and Grays Run.

TMDL Development

Bush River was first identified as impaired in MDE's 2002 Integrated Report based on fish tissue sampling. The criteria for impairments is based on concentration in the water column and concentration in fish tissue. The human health criterion is based on consumption of fish and their interaction with the water column and food chain. "Drinking water consumption does not pose any risk for cancer development at environmentally relevant levels." (TMDL, 2016)

Table 1: PCB Criteria for Impairment

	Concentration
Water Column for Human Health	0.64 ng/L
Fish Tissue	39 ng/g

In 2013 and 2014, MDE conducted PCB monitoring for the water column for six tidal and four non-tidal locations (Figure 3). The data used to develop the TMDL was collected on three dates as shown in Table 2. The six tidal locations exceeded the PCB criteria for human health for 2 of 3 sample dates. All four non-tidal locations were significantly below the PCB criteria for human health for 2 of 3 sample dates.

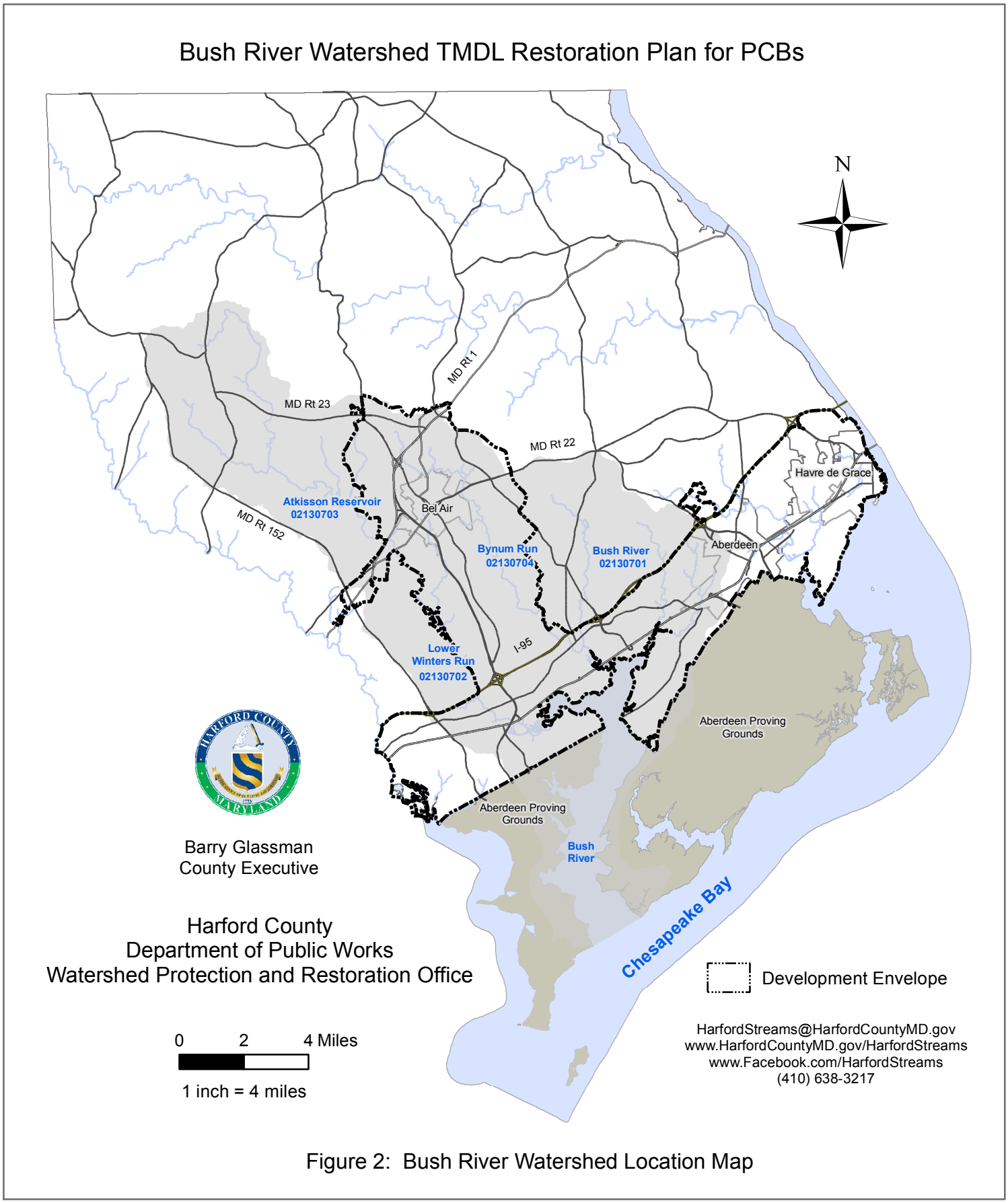

Figure 2: Bush River Watershed Location Map

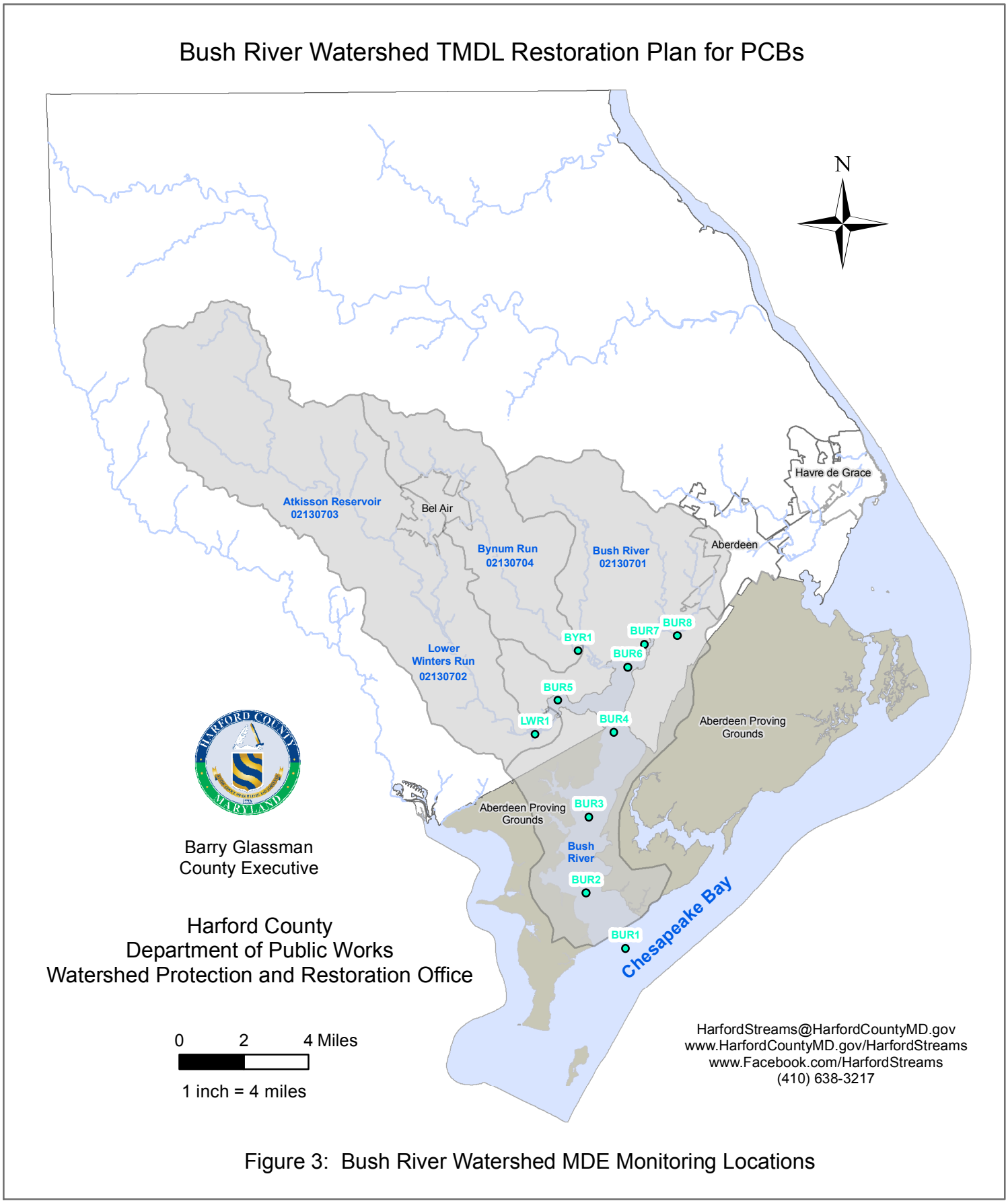

Figure 3: Bush River Watershed MDE Monitoring Locations

Table 2: MDE PCB Water Column Monitoring for Bush River TMDL (ng/L)

Station	Type	8/14/2013	10/30/2013	3/12/2014
BUR1	Tidal	0.90	0.35	1.20
BUR2	Tidal	1.34	0.51	4.64
BUR3	Tidal	2.02	0.37	4.00
BUR4	Tidal	2.15	0.87	5.19
BUR5	Tidal	0.80	0.33	1.56
BUR6	Tidal	1.46	1.16	8.43
BUR7	Non-tidal	0.01	0.03	1.15
BUR8	Non-tidal	0.00	0.03	1.72
BYR1	Non-tidal	0.02	0.01	7.20
LWR1	Non-tidal	0.02	0.03	0.44

In 2013 and 2014, MDE conducted PCB monitoring for sediment for five tidal locations (Figure 3). The data used to develop the TMDL was collected on two dates as shown in Table 2.

Table 3: MDE PCB Sediment Monitoring for Bush River TMDL (ng/g)

Station	Type	5/20/2013	10/3/2014
BUR2	Tidal	32.2	18.9
BUR3	Tidal	36.9	10.1
BUR4	Tidal	12.6	12.5
BUR5	Tidal	14.2	4.2
BUR6	Tidal	16.5	14.1

In 2014, MDE collected a total of thirty fish at BUR4 (Figure 3) for fish tissue sampling. The concentrations ranged from 54.22 ng/g to 658.96 ng/g which far exceed the impairment criterion of 39 ng/g. Therefore, demonstrating that a PCB impairment exists within the tidal mainstem of Bush River.

Since the Chesapeake Bay Model does not simulate the impacts of pollutants within the food chain, MDE calculated the PCB concentrations for the water column and sediment necessary to support fish tissue concentrations below the impairment criterion of 39 ng/g. Based on their analysis, the TMDL concentrations for the water column and sediment are listed in Table 4.

Table 4: TMDL Concentrations for PCBs

	Concentration
Water Column	0.12 ng/L
Sediment	1.14 ng/g

Source Assessment

While PCBs are no longer manufactured, there are many sources for existing PCBs including 1) transformers still allowed to be in use 2) buildings constructed or renovated before 1979 which used PCB-containing materials such as caulks, paints, fireproofing materials, and fluorescent light ballasts 3) improper disposal 4) tidal influence from Chesapeake Bay and 5) atmospheric deposition. PCBs also bind strongly with sediment and can be introduced to the water column through erosion or resuspension of sediments.

The Chesapeake Bay Model through observed PCB concentrations has determined the net PCB load transported into the Bay from the Bush River is 1,049 g/year. Using concentration rates for urban areas from an atmospheric deposition study completed by the Chesapeake Bay Program, the PCB load from atmospheric deposition to the Bush River Watershed was calculated as 48.9 g/yr. Likewise, MDE has identified one known PCB contaminated site (MD 446 Union Road Dump) which contributes 2.37 g/yr.

Based on the average concentrations from the water column monitoring (Table 2) and stream flow from USGS stations within the watershed, loads for each of the non-tidal monitoring sites was calculated (Table 5). The total non-tidal load is 134.6 g/yr.

Table 5: MDE PCB Loads from Watershed Runoff

Watershed	Average Concentration (ng/L)	Load (g/yr)
Bush River	0.49	37.2
Bynum Run	2.41	85.3
Winters Run	0.16	12.1
		134.6

While resuspension of PCBs from the bottom sediment is a significant source of PCBs to the water column, predicted by MDE as 3,328 g/yr, no allocation has been assigned since it is not a directly

controllable source. The load from resuspension (3,328 g/yr) is nearly 25 times greater than the contribution from the watershed (134.6 g/yr).

Stormwater Waste Load Allocation

The TMDL document calculates the stormwater waste load allocation (SW-WLA) for PCBs as the total contribution of urban land cover from the 2006 USGS land cover data which is used in the Chesapeake Bay Model. The entire SW-WLA was collectively assigned to the regulated MS4 jurisdictions including Harford County, Town of Bel Air, City of Aberdeen, Aberdeen Proving Ground, and MD State Highway Administration. This analysis is based on MDE's expansive interpretation of the County's Permit Area in documents external to the County's current MS4 permit, which correctly defines the MS4 Permit Area in Part I.B. All rights noted above are reserved. This restoration plan develops strategies to reduce PCBs for the total urban loads within the physical boundaries of Harford County.

Using the 2006 USGS land cover data (downloaded from the TMDL Data Center), the County disaggregated the SW-WLA by calculating the urban land cover for each watershed (Table 6).

Urban loads calculated by Harford County differ from those calculated by MDE. MDE did not calculate the urban load for each watershed. Instead a total urban load was calculated as a percent of the total urban area or 36.9% of 134.6 g/yr.

Table 6: PCB Loads by Watershed

	Bush River	Bynum Run	Winters Run	Total
Total (ac)	31,227	14,582	37,542	83,351
Urban (ac)	9,017	9,162	12,525	30,704
Urban (%)	28.9%	62.8%	33.4%	36.9%
Baseline (g/yr)	10.7	53.6	4.1	68.4
TMDL (g/yr)	4.1	20.4	1.5	26.0

The urban load for each watershed was further disaggregated for each MS4 jurisdiction with exception for MD State Highway Administration. Tables 7 through 10 provide a breakdown of urban acres by watershed for each MS4 jurisdiction.

Table 7: Town of Bel Air by Watershed

	Bush River	Bynum Run	Winters Run	Total
Total (ac)	0	1,094	855	1,948
Urban (ac)	0	992	798	1,789
Urban (%)	0	90.7%	93.3%	91.8%

Table 8: City of Aberdeen by Watershed

	Bush River	Bynum Run	Winters Run	Total
Total (ac)	1,135	0	0	1,135
Urban (ac)	893	0	0	893
Urban (%)	78.7%	0	0	78.7%

Table 9: Aberdeen Proving Ground by Watershed

	Bush River	Bynum Run	Winters Run	Total
Total (ac)	7,367	0	0	7,367
Urban (ac)	1,118	0	0	1,118
Urban (%)	15.1%	0	0	15.1%

Table 10: Harford County by Watershed

	Bush River	Bynum Run	Winters Run	Total
Total (ac)	22,726	13,488	36,687	72,901
Urban (ac)	7,006	8,170	11,728	26,904
Urban (%)	30.8%	60.6%	32.0%	36.9%

Using the urban acres for each MS4 jurisdiction, the percent contribution from each was calculated and summarized in Table 11.

Table 11: Urban Acres by Watershed for each MS4 Jurisdiction

Jurisdiction	Bush River	Bynum Run	Winters Run	Total
Bel Air	0	992 (11%)	798 (6%)	1,789 (6%)
Aberdeen	893 (10%)	0	0	893 (3%)
APG	1,118 (12%)	0	0	1,118 (4%)
County	7,006 (78%)	8,170 (89%)	11,728 (94%)	26,904 (87%)
	9,017 (100%)	9,162 (100%)	12,525 (100%)	30,704 (100%)

The County further disaggregated the baseline loads by watershed for each of the MS4 jurisdictions. The baseline loads by watershed for each jurisdiction was calculated as the product of the percent urban acres for each MS4 by watershed and the baseline watershed loads (Table 12).

Table 12: Baseline PCB Loads (g/yr) from Watershed Runoff by MS4 Jurisdiction

Jurisdiction	Bush River	Bynum Run	Winters Run	Total
Bel Air	0	5.8	0.3	6.1
Aberdeen	1.1	0	0	1.1
APG	1.3	0	0	1.3
County	8.3	47.8	3.8	59.9
	10.7	53.6	4.1	68.4

MDE through modeling calculated a 62% reduction in baseline loads from the watershed runoff was necessary in combination with a measured 6.5% annual decrease in sediments within Chesapeake Bay. This scenario will take approximately 81 years to achieve the designated use for Bush River.

Using a 62% reduction from baseline loads, TMDL loads for each jurisdiction by watershed was calculated (Table 13).

Table 13: TMDL PCB Loads (g/yr) from Watershed Runoff by MS4 Jurisdiction

Jurisdiction	Bush River	Bynum Run	Winters Run	Total
Bel Air	0	2.2	0.1	2.3
Aberdeen	0.4	0	0	0.4
APG	0.5	0	0	0.5
County	3.2	18.2	1.4	22.8
	4.1	20.4	1.5	26.0

Harford County's TMDL for PCB in the Bush River Watershed is 22.8 g/yr. In comparison to the resuspension loads for the Bush River (3,328 g/yr), a reduction by Harford County of 37.1 g/yr will be inconsequential in the reduction of PCBs in fish tissue and therefore the goal of supporting the Use II designation to support estuarine and marine aquatic life and shellfish harvesting. Likewise, the load contribution from the watersheds was based on averaging concentrations from three sampling dates, two of which were significantly below the TMDL concentration set for this watershed.

Restoration Plan

Source Tracking

Harford County has identified several locations for further investigation as potential sources of PCBs.

A search of EPA's Superfund website (https://www.epa.gov/superfund/search-superfund-sites-where-you-live) lists three sites within Bush River Watershed (Table 14). Harford County will coordinate with MDE to determine if these sites are potential sources of PCBs.

Table 14: Superfund Sites within the Bush River Watershed

Site	Location
Aberdeen Proving Ground (Edgewood Area)	Edgewood, MD 21010
Aberdeen Proving Ground (Michaelsville Landfill)	Aberdeen, MD 21005
Bush Valley Landfill	Abingdon, MD 21009

According the Code of Federal Regulations any transformer that contains 500 ppm or greater PCB dielectric must be registered with EPA (https://www.epa.gov/pcbs/registering-transformers-containing-polychlorinated-biphenyls-pcbs. The registry includes three locations within Bush River Watershed (Table 15).

Table 15: PCB Registered Transformers within the Bush River Watershed

Site	Location
Aberdeen Proving Ground	Bldg E5863 Aberdeen, MD 21005
Aberdeen Proving Ground	Palmer & Access Road Aberdeen, MD 21005
Perryman Generating Station	900 Chelsea Road Aberdeen, MD 21001

All activities including the storage, transport, or disposal of PCBs must be reported to EPA (https://www.epa.gov/pcbs/notifications-polychlorinated-biphenyl-pcb-activities). The registry lists three locations within the Bush River Watershed (Table 16).

Table 16: PCB Activities within the Bush River Watershed

Site	Location	Activity
Aberdeen Proving Ground	Bldg E5850 Edgewood, MD 21010	Generator
City Light & Power EA Yard	Stokes and Hanlon Road Edgewood, MD 21040	Generator
City Light & Power EA Yard	3560 Crozier Loop Aberdeen, MD 21005	Generator

Under EPA's Toxics Release Inventory (TRI) Program (https://www.epa.gov/toxics-release-inventory-tri-program/tri-data-and-tools), PCBs are categorized as persistent bioaccumulative toxic (PBT) chemicals. The program tracks toxic releases through documentation required under the Emergency Planning and Community Right-to-Know Act (EPCRA). Eight facilities located within Bush River Watershed reported toxic releases within the preliminary inventory for 2016. None of the releases were for PCBs.

In addition to the locations listed above, several locations have been added for further investigation based on historic local knowledge (Table 17) and a list of properties constructed prior to 1980 with industrial landuse in the tax records (Table 18).

Table 17: Properties of Interest based on Historical Knowledge

Site	Location
Tollgate Landfill (Closed)	Tollgate Road Bel Air, MD 21014
Landfill (Closed)	Abingdon Road Abingdon, MD 21009
Bata (Redeveloped)	Pulaski Highway Belcamp, MD 21017
Landfill (Closed)	Philadelphia Road Abingdon, MD 21009

Table 18: Properties of Interest based on Industrial Landuse

Tax ID	Location	Tax ID	Location
03194418	Bynum Road Forest Hill, MD 21050	03194396	Melrose Lane Forest Hill, MD 21050
03040186	Calvary Road Churchville, MD 21028	02001209	Old Philadelphia Road Aberdeen, MD 21001
01030078	Edgewood Road Edgewood, MD 21040	02013878	Old Philadelphia Road Aberdeen, MD 21001
01055038	Edgewood Road Bel Air, MD 21014	01073621	Philadelphia Road Aberdeen, MD 21001
03086925	Industry Lane Forest Hill, MD 21050	03050955	Snake Lane Churchville, MD 21028
03052044	Jarrettsville Road Forest Hill, MD 21050		

In addition to industrial use of PCBs, through the 1970s, PCBs were also used in building material including caulks, paints, fireproofing materials, and fluorescent light ballasts. The County will provide outreach to its own Facility Maintenance and Vertical Construction Engineering and Inspections Departments and Harford County Schools to ensure staff are familiar with potential existence of PCBs in older buildings considered for renovation or demolition. EPA's website provides a larger variety of educational materials (https://www.epa.gov/pcbs/polychlorinated-biphenyls-pcbs-building-materials)

Stormwater Management Facilities

According to the Toxics Work Group for the Chesapeake Bay Program, "Much of the PCB load moving through urban watersheds is potentially treatable by stormwater retrofits." They continue by noting that "Remarkably little monitoring has been conducted to assess whether urban stormwater BMPs can remove PCBs", and reference research conducted by Yee and Mckee (2010) which concluded that PCBs behaved very similar to sediments achieving at least 50% PCB removal.

Since little monitoring and research are available to quantify PCB load reductions, the County proposes as recommended in the TMDL document to target TSS reductions as a surrogate. Since, PCBs have a strong affinity to sediment, it can be concluded that reductions in TSS should lead to reductions in PCBs.

As discussed above, Bynum Run Watershed as the most urbanized watershed that drains to Bush River, contributes the largest watershed runoff load. Likewise, Bynum Run also has a TMDL for sediment. Therefore, the County proposes to focus efforts for the implementation of restoration practices within the Bynum Run Watershed that prioritize sediment reductions within areas for potential PCBs based on the source tracking.

Progress towards achieving the TMDL will be evaluated by accounting for stormwater BMPs, especially those BMPS with significant sediment reductions. As stated in the TMDL document, "NPDES-regulated municipal stormwater … should be expressed as Best Management Practices (BMPs) or other similar requirements, rather than as numeric effluent limits".

Monitoring Plan

The stormwater wasteload allocation developed by MDE has based the watershed runoff loads on a limited number of sample dates and results with considerable variability. Therefore, the County proposes to provide additional monitoring to better quantify the extent of the PCB loads prior to investing large quantities of funding for capital improvement projects.

Proposed water column monitoring will initially focus on Bynum Run watershed near its confluence with Bynum Creek in the general vicinity of MDE sampling site BY1 (Figure 2). Sampling will be conducted during storm events to quantify peak concentrations for TSS and PCBs. The laboratory analysis will follow EPA Method 1668 for inclusion of the congeners analyzed by MDE. At a minimum, one quarterly sample will be collected and analyzed.

Since the PCB TMDL for Bush River is based on the presence of PCBs in fish tissue, the County will coordinate with MDE to determine if a schedule for future fish sampling in Bush River has been established.

Along with the implementation of the Bynum Run Sediment TMDL Restoration Plan and the County's Chesapeake Bay TMDL Restoration Plan, all dredge materials from stormwater management retrofit will be tested for PCBs using EPA Method 1668.

Moving Forward

The Toxics Work Group for the Chesapeake Bay Program has developed the "Toxic Contaminants Policy and Prevention Outcome, Management Strategy" that outlines specific approaches for regulations, education and awareness, voluntary programs, and science. By implementing these management approaches, federal, state, and local agencies can move forward in reducing toxic impacts within our waters in the most cost effective and beneficial manner.

A timely opportunity for partnerships is a Toxics Workshop sponsored by USGS schedule for August 3, 2017. The workshop has a full day of relevant topics focusing on monitoring and implementation.