

BALTIMORE CITY MS4 RESTORATION AND TMDL WIP



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ACRONYMS AND GLOSSARY

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Appendix D: Summary of Contingency Projects

ACRONYMS / GLOSSARY

BMP – Best Management Practice (for controlling pollutant discharges)

DOT – Department of Transportation

DPW – Department of Public Works

ENR – Enhanced Nutrient Reduction

ESD-Environmental Site Design (aka Low Impact Development / LID), comprehensive strategy for maintaining predevelopment runoff characteristics by integrating site design, natural hydrology, and smaller controls to capture and treat runoff at the source.

EPA – Environmental Protection Agency

Impervious Surface-surfaces that prevent stormwater from infiltrating to below the ground, includes rooftops, pavement, and gravel.

MDE – Maryland Department of the Environment

MD DNR – Maryland Department of Natural Resources

MEP – Maximum Extent Practicable

MS4 – Municipal Separate Storm Sewer System

NPDES – National Pollutant Discharge Elimination System

Nutrients – Total phosphorus and total nitrogen

TMDL – Total Maximum Daily Load, the maximum amount of a pollutant a water body can receive and still meet water quality standards; “pollution diet”.

TN – Total Nitrogen

TP – Total Phosphorus

TSS – Total Suspended Solids

Watershed – an area of land that drains down slope to the lowest point, discharging to a river, river system or other body of water.

WIP – Watershed Implementation Plan; document that sets the way an agency will meet the regulatory requirements.

WLA – Waste Load Allocations

WQA – Water Quality Analysis, developed when supplemental data indicates the water body is meeting water quality standards for that substance

EXECUTIVE SUMMARY

The Baltimore City Municipal Separate Storm Sewer System (MS4) and Total Maximum Daily Load (TMDL) Watershed Implementation Plan (WIP) is a requirement of the City's MS4 Permit, which was issued on December 27, 2013. The WIP is a plan for achieving the 20% restoration requirement set out in the permit, in addition to attaining applicable waste load allocations (WLAs) for each established or approved Total Maximum Daily Load (TMDL) for each receiving water body.

The WIP presents the strategies to meet the restoration and TMDL goals as specified in the current MS4 permit. Specifically, the WIP will provide the basis for the City to:

1. Provide Best Management Practices (BMPs) to restore an equivalent of 20% of the existing impervious area which stormwater runoff is not currently managed to the maximum extent practicable (MEP).
2. Meet TMDL Waste load Allocations (WLAs) approved by the Environmental Protection Agency (EPA).
3. Educate and involve residents, businesses, and stakeholder groups in achieving measurable water quality improvements.
4. Establish a reporting framework that will be used for annual reporting as required in the City's National Pollutant Discharge Elimination System (NPDES) MS4 Permit.
5. Identify necessary maintenance, adaptive management, staffing, and financial strategies to implement the WIP.

Baltimore: Existing Conditions and Challenges

The City's MS4 permit coverage area includes the land within the legal City boundary, plus the properties owned by the City associated with Back River Wastewater Treatment Plant and the drinking water reservoirs at Loch Raven, Pretty Boy and Liberty. For the purposes of the restoration and TMDL compliance conditions of the MS4 permit, the WIP will concentration on the area within the City limits, which includes five 8-digit watersheds, as defined by the Department of Natural Resources:

1. Back River
2. Baltimore Harbor
3. Jones Falls
4. Gwynns Falls
5. Lower North Branch of the Patapsco River (LN Branch Patapsco)

Each of the above watersheds is listed as impaired and has a TMDL associated with nutrients, sediment, bacteria, chlordane and PCBs. The City is also part of the Chesapeake Bay watershed, and therefore subject to the Chesapeake Bay TMDL (Bay TMDL) for nutrients and sediments. The Bay TMDL has been a major regulatory driver, therefore available guidance documents were focused on the pollutant loadings based on impervious area and the correlation of BMPs to quantified reductions of nutrients and sediment, as associated with equivalent impervious area reduction. Illicit discharge detection and elimination (IDDE) programs will be used to reduce the loadings of the other pollutants.

The City is characterized as an ultra-urban environment that is characterized by high densities of paved surfaces and buildings which result in a high degree of stormwater runoff. Not only is 45% of the city impervious, but much of its storm drain infrastructure is 100 years or older. This means that there is limited space for installing stormwater management facilities, with increased installation costs due to demolition and removal of existing pavement, relocation of existing utilities and structures and the installation of off-site soils. Additionally, the City

contains approximately 14,000 vacant lots, with 19% of households in Baltimore live below the poverty line. This impacts the City's ability to manage and fund infrastructure improvements.

However, the City is slowly growing in population, and new development occurring in many neighborhoods. The Baltimore Harbor is an asset for tourism, economic development, and industry, with efforts like the Healthy Harbor Plan focusing renewed attention and resources on its health and the health of its tributaries. Finally, there are several initiatives, including 21st Century Schools, Growing Green, and TreeBaltimore, that are bringing together environmental non-profits and other partners to work collaboratively on improving the City. These factors have all guided the development of the WIP.

Six Pillars of Practical Watershed Planning

In developing The WIP, the City used available guidance documents from the U.S. Environmental Protection Agency and the Maryland Department of the Environment, in addition to the following pillars to practical watershed planning:

1. Plan for more projects than you need: contingency projects were identified.
2. Plan for resources that will affect funding needs: public lands, local and re-purposed materials, and local labor forces were emphasized.
3. Plan to maintain: long-term maintenance resources and costs were evaluated.
4. Plan to be a part of a bigger picture: existing environmental, social, and economic development initiatives in the City were considered.
5. Plan for effective public participation: various stakeholders were engaged to develop The WIP and will continue to be engaged during the implementation and maintenance phases.
6. Plan to adapt: methods for tracking and reporting were identified, in addition to a plan for annual evaluation and adaptive management to reflect changes in regulatory guidance documents, legal mandates, and technologies.

Meeting our Goals

To meet the 20% restoration goal, the City will restore an equivalent of 4,041 acres of impervious area. Given the ultra-urban nature of Baltimore, a diverse and comprehensive approach for meeting our restoration and TMDL requirements is needed. This includes:

- Installing stormwater management projects, including traditional Best Management Practices (BMPs), Environmental Site Design (ESD) practices, and Alternative BMPs (1,191 equivalent impervious acres);
- Employing a variety of programs to improve water quality, including mechanical street sweeping, preventive inlet cleaning, and IDDE (2,766 equivalent impervious acres); and
- Fostering partnerships to encourage private development of stormwater management (279 equivalent impervious acres).

Installing projects by far will restore the greatest amount of equivalent impervious acres (see Appendix A)¹. A goal of identifying and prioritizing projects is to build on existing capital projects and city initiatives, including:

1. Priority projects listed in the Watershed Assessments and vacant lot feasibility studies;
2. Neighborhoods adjacent to and/or upland from stream restoration project;
3. Neighborhoods adjacent to and/or upland from flood prone areas;

¹ The projected impervious acres restored identified in the WIP is 4,822. A higher than needed goal is proposed in order to accommodate project feasibility, accepted credits, and other factors that may arise during the coverage period of the WIP.

4. Neighborhoods adjacent to DPW storm drain projects (inlet screens) or other DPW initiatives (Municipal Trash Container Pilot, alley sweeping, etc);
5. Other identified stormwater projects and partnerships (schools, parks, etc);
6. CIP project locations by other agencies. In particular, DPW will coordinate with the Department of Transportation as they develop streetscape and Complete Streets plans, including a Complete Streets plan for the Casino Area Master Plan;
7. Neighborhoods with Year 1 and Year 2 Vacants to Value demolition clusters.
8. Neighborhoods with large numbers of vacant properties AND in or adjacent to Vacants to Value development clusters; and
9. Priority Planting Areas for increasing tree canopy.

Finally, Baltimore City believes that by meeting, or exceeding, our MS4 restoration requirements, we will be on track to meet our TMDL goals. Restoring 20% of our currently untreated impervious surfaces will result in a reduction on the order of 40,000 lbs nitrogen, 15,000 lbs of phosphorus, and 2,400 tons of sediments by the end of the permit period. Education and enforcement programs focused on illicit discharges, in concert with water and sanitary sewer infrastructure improvements, will also result a reduction of bacteria. Monitoring program focused on illicit discharges will address the TMDL for chlordane and PCB.

Public Outreach

In order for the MS4 WIP to be successful, it will need an informed public and engaged partners to review and provide advice on the Plan as well as identify needs and issues that will need to be addressed. DPW recognizes and is committed to the role that public outreach and stewardship will play if improved water quality conditions are going to be achieved. This will require engaging a broader and more diverse set of stakeholders who can serve as the leaders and champions for clean water in their communities, including greater participation from minority and faith-based groups, business groups, schools, and neighborhood associations. Additionally, this approach requires working collaboratively with other City agencies to look for better and more efficient ways to communicate messages, cross-train, and create synergies that result in greater engagement, greater awareness, and sustained changes in behavior.

Maintenance

Having a successful restoration program does not stop with the installation of the facilities. Currently, each City agency is responsible for the stormwater BMPs that it installs. It has been agreed that the current system can be more effective and efficient. In order to improve maintenance of our current facilities, as well as meet the growing number of stormwater facilities that will be constructed to meet our MS4 and TMDL requirements, DPW will establish a Stormwater BMP Maintenance Team. This team will maintain all city-owned BMPs, regardless of the agency that installed or is responsible for the facility.

1 INTRODUCTION

On December 27, 2013, The Maryland Department of the Environment (MDE) reissued a National Pollutant Discharge Elimination System (NPDES) Municipal Separate Storm Sewer (MS4) permit to the City of Baltimore. This permit lasts for 5 years and covers stormwater discharges from the municipal separate storm sewer system owned or operated by Baltimore City.

In order to reduce contaminated stormwater runoff and improve water quality, Baltimore's MS4 permit requires that the City develop a watershed implementation plan (WIP) by the end of 2014 to restore 20% of the City's impervious surface area which is not currently managed to the maximum extent practicable (MEP). Twenty percent restoration represents 4,041 acres – the equivalent of 3,000 football fields or 2,000 rowhouse blocks.

The City MS4 Permit requires that the permittee manage, implement, and enforce a stormwater management program in accordance with the Clean Water Act (CWA) and corresponding stormwater NPDES regulations, 40 CFR Part 122, to meet the following requirements:

1. Effectively prohibit pollutants in stormwater discharges or other unauthorized discharges into the MS4 as necessary to comply with Maryland's receiving water quality standards;
2. Attain applicable waste load allocations (WLAs) for each established or approved Total Maximum Daily Load (TMDL) for each receiving water body, consistent with Title 33 of the U.S. Code (USC) §1342(p)(3)(B)(iii); 40 CFR §122.44(k)(2) and (3); and
3. Comply with all other provisions and requirements contained in this permit, and in plans and schedules developed in fulfillment of this permit.

One condition of Baltimore's MS4 Permit is to make progress toward implementation of TMDL load reduction allocations in the City watersheds. In addition to the Chesapeake Bay TMDL, there are 11 local TMDLs for Baltimore City Watersheds covering nutrients (nitrogen and phosphorus), sediments, and bacteria (e. Coli).

Understanding the physical, economic, social, hydrologic, and organizational conditions of Baltimore will allow us to craft an implementation plan that best achieves our restoration goal. The WIP is divided into 6 Sections and an Appendix:

1. Background – this section sets the stage for the WIP strategy, identifying the existing conditions, current initiatives, and other information that form the basis of decision making.
2. Projects, Programs, and Partnerships – this section includes a brief description of the strategy for implementing the WIP, including public outreach and maintenance.
3. Milestones – this section summarizes year-by-year goals to track progress within the permit period. Progress of the milestones will be included in Annual MS4 Reports submitted to the Maryland Department of the Environment (MDE).
4. Adaptive Management – this section includes the plan for evaluating and adjusting the implementation plan.
5. Financial Strategy – this section identifies the funding sources and strategies for financing implementing and maintaining the projects and programs identified in the WIP.
6. Resources – this section includes a list of resources, publications, and website referenced.
7. Appendix A – this appendix includes a detailed chart for tracking proposed projects. Status summaries of the charts will be included in the Annual MS4 Reports submitted to MDE.

2 BACKGROUND

2.1 Existing Conditions

2.1.1 Geography

Baltimore is in north-central Maryland on the Patapsco River close to where it empties into the Chesapeake Bay. The city is also located on the fall line between the Piedmont Plateau and the Atlantic Coastal Plain. The City's elevation ranges from sea level at the harbor to 480 feet in the northwest corner near Pimlico. Baltimore borders with Baltimore County in most directions. It is bordered by Anne Arundel County to the south.

The city has a total area of 92.1 square miles, of which 81.6 sq mi is land and 10.5 sq mi is water. Baltimore can be defined as an “ultra-urban environment” - a densely developed urban area in which little pervious surface exists. Not only has most of the city already been developed, but this development occurred prior to the Clean Water Act. This means that there are few stormwater management controls in place.

2.1.2 History²

Many of Baltimore's small streams and tributaries have been buried over the years. By the late 19th century, in an effort to manage floods and protect property, Baltimore placed many streams in man-made channels or in massive pipes. In Baltimore, contractors installed storm water mains in 1873. On average the age of Baltimore's storm drain system is 80 years old.

By the turn of the century, the Lower Jones Falls had become “an odorous, poisonous water hole” according to a local Baltimore paper of the time. Sewage, and stormwater ran into the river, and the factories and mills along its banks poured industrial waste into the Jones Falls. (Figure 1) Baltimore had the highest typhoid rate in the country, and public health officials encouraged the conversion of the last two miles of the river into an underground drain. A major engineering operation channeled the river into a huge culvert emerging at the Inner Harbor. The City completed the project by 1915, and at the dedication the master of ceremonies, Henry Barton Jacobs claimed he had come to “bury the Jones Falls—not to praise it”.

On February 7, 1904, the Great Baltimore Fire destroyed downtown but it provided the impetus to rebuild bigger and better. In 1905, voters backed a plan for a comprehensive system of building separate storm and sanitary sewers including primary and secondary treatment of human and industrial wastes before returning the treated wastewater to the Bay, thus resulting in the City's municipal separate storm sewer system.

Sanitary Sewers

In 2002, eight Combined Sewer Overflow Structures were identified in the Forest Park and Walbrook areas. Under the City's Consent Decree, all of the identified sewers were disconnected by 2006. (See Section 2.7 Other Regulatory Factors).

Figure 1: Lexington Street bridge over the Jones Falls, ca. 1910-1914 (Source: Baltimore City Life Museum Collection, Maryland Historical Society)



² From “History of the System” on the Baltimore City Department of Public Works web site <http://publicworks.baltimorecity.gov/Bureaus/WaterWastewater/SurfaceWater/HistoryoftheSystem.aspx>.

2.1.3 Neighborhoods

Baltimore is known as a city of neighborhoods. According to the Live Baltimore website, there are 245 neighborhoods throughout the city, some only a few blocks in size while others have tens of thousands of residents.³

Baltimore's neighborhoods are often combined into Community Statistical Areas (CSAs) as a way to more easily collect and track data. The Baltimore Neighborhood Indicators Alliance (BNIA) has identified 55 CSAs using clusters of Census Tracts that correspond to Baltimore's neighborhood boundaries (Figure 2). For the purposes of planning, we will use both the CSAs, as well as neighborhoods, for project location identification.⁴

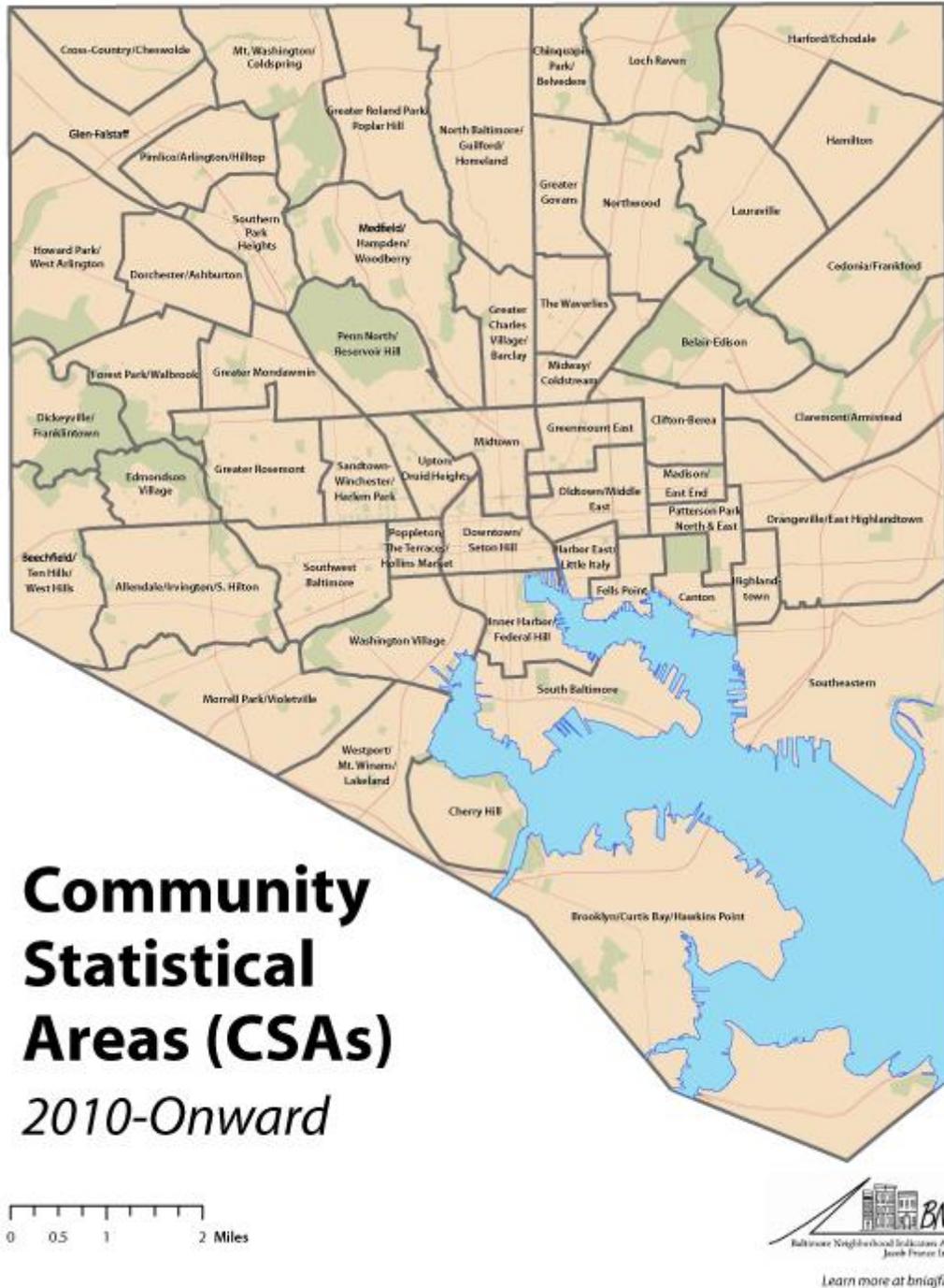


Figure 2: Community Statistical

³ <http://livebaltimore.com/neighborhoods/>

⁴ The maps on pages 10-13 are from BNIA's Vital Signs 12 report and represent data mapped according to the Community Statistical Areas.

2.1.4 Population Trends

Baltimore is the largest city by population in Maryland, and the fourth largest jurisdiction. In 2013, the population was estimated at 622,104⁵, an increase of 1,143 people (.2%) from 2010 census. African-Americans make up 63.3% of the population, followed by Caucasian (non-Hispanic) 28.3%, Hispanic or Latino 4.6%, and all others 3.8%. Hispanic and Latino residents are the fastest growing demographic.

Population change can also be characterized by age group. In the report entitled, “Who’s Moving to the Cities, Who Isn’t: Comparing American Cities”, Allan Mallach studied population changes between 2000 – 2012 for several cities, including Baltimore. His study found that in Baltimore there was a decrease in population for the age groups 45-64 and 65+ (empty nesters and retirees), with a slight gain in the 35-44 age group. The most significant increase in population were ages 25-34 (recent graduates and young adults)⁶, with Baltimore doing better than the state average.⁷

Based on the 2008-2012 American Community Survey, the median income in Baltimore was \$40,803. Nearly 35% of the City’s households earn less than \$25,000 annually, with nearly 19% of the households in Baltimore City were living below the poverty line. (Figure 3) Slightly more than 23% of households earn more than \$75,000 annually.

2.1.5 Transportation Infrastructure

Like stormwater, Baltimore City has an extensive transportation infrastructure⁸, consisting of:

- 2,000 miles of roadways
- 7 miles of interstate highways
- 298 bridges and culverts
- 3,600 miles of sidewalks, curbing and gutters
- 456 miles of alleys
- 100 miles of bike lanes and bicycle-friendly streets
- 39 miles of off-road trails

The Department of Transportation is responsible for the planning, designing, building and maintenance of this system. Although funding and coordination is provided by the State Highway Administration (SHA), they do not have jurisdiction in Baltimore (which means that SHA’s MS4 Permit does not extend into the City).

**Percent of Households in Poverty
By Community Statistical Area, 2008-2012**

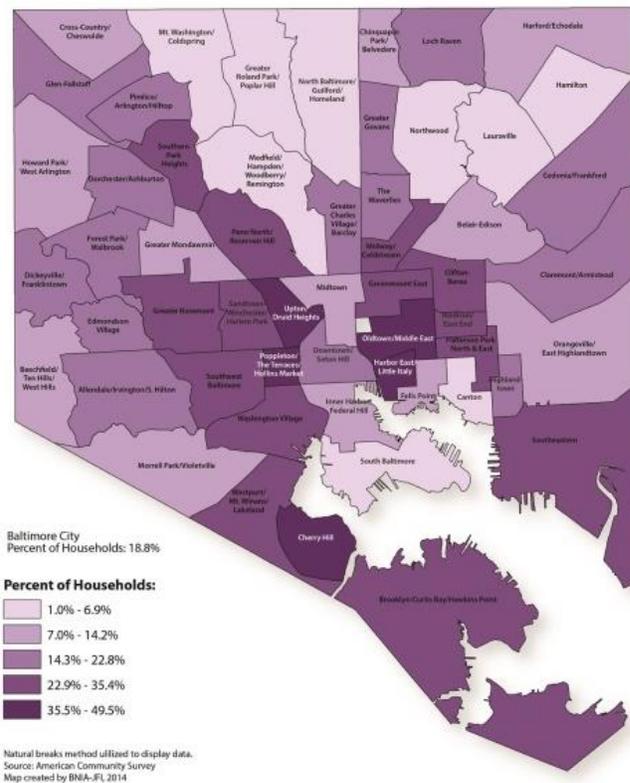


Figure 3: Percentage of Households in Poverty

⁵ <http://quickfacts.census.gov/qfd/states/24/24510.html>

⁶ <http://www.baltimoresun.com/business/bs-bz-millennials-20141025-story.html#page=1>

⁷ Who’s Moving to Cities, Who Isn’t: Comparing American Cities”, Allan Mallach, Center for Progress, September 2014

⁸ <http://archive.baltimorecity.gov/Government/AgenciesDepartments/Transportation/TransportationSystemOverview.aspx>

2.1.6 Development Trends⁹

Mayor Stephanie Rawlings-Blake has set a goal of attracting 10,000 new households to Baltimore by the next decade. One of the initiatives established by the Mayor to achieve this is Baltimore Housing’s Vacants to Value program (V2V). V2V runs several different programs to market and develop vacant property. While many are city-wide (like the sale of individual properties or the Adopt-a-Lot program), others are more targeted. Community Development Clusters facilitate investment near areas of strength, including Barclay, Hollins Market, Oliver, Park Heights, and Sandtown. Additionally, V2V assembles larger tracks of land for major redevelopment; two recent projects are the Uplands in west Baltimore and O’Donnell Heights in southeast Baltimore. (See Section 2.8 Environmental Initiatives)

Redevelopment of residential and commercial properties is also increasing. The percentage of residential properties with rehabilitation permits in excess of \$5,000 increased slightly from 2.4% in 2011 to 2.6% in 2012. (Figure 4) Between 2011 and 2012, new construction permits increased from 0.7 to 0.9 per 1,000 homes. From 2011 to 2012, the percentage of commercial properties that applied for and received a rehabilitation permit greater than \$5,000 increased from 13.6% in 2011 to 14.4% in 2012.

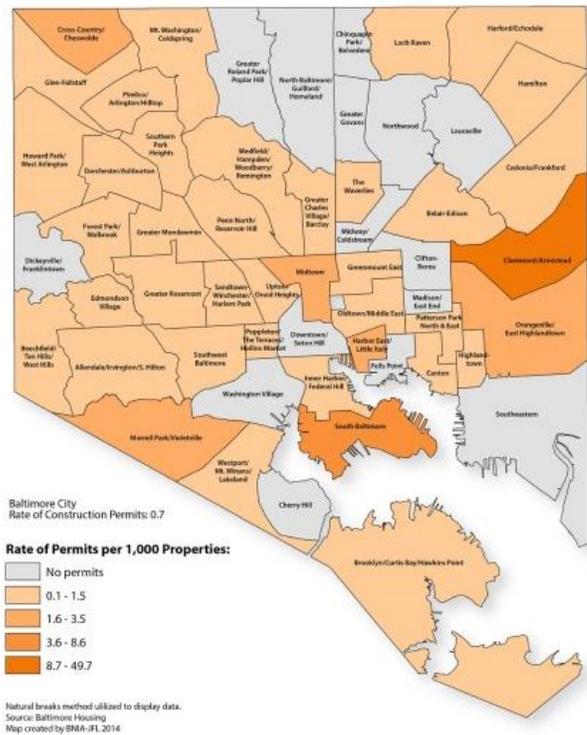
Because Baltimore is mostly built-out, it is projected that a majority of construction and building projects will be considered “redevelopment” as outlined by MDE.

2.1.7 Vacant Properties

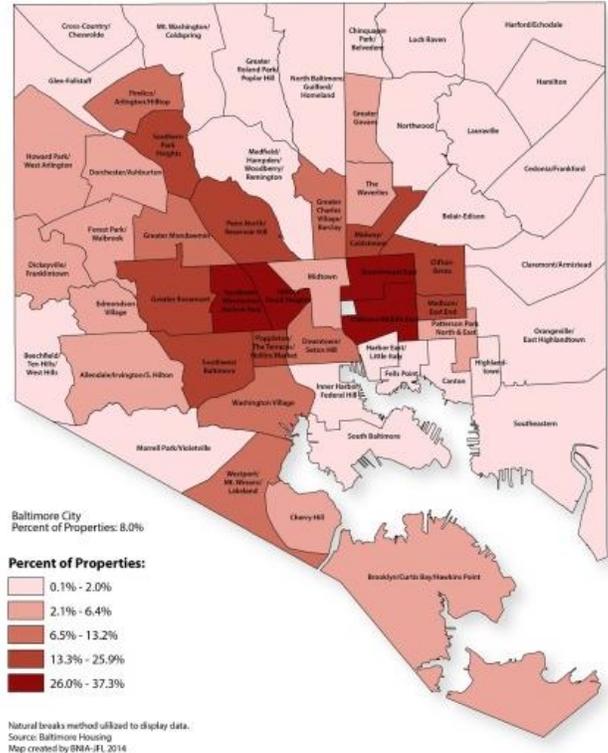
It is estimated by Baltimore Housing that there are approximately 16,000 vacant buildings and 14,000 vacant lots in the city. More than 75% of all vacant properties in Baltimore are privately owned. Figure 5 illustrates those CSA’s with the highest percentage of vacant and abandoned properties; the darker the color the higher the percentage.

Between 2011 and 2012, the rate of demolition permits increased from 1.6 to 1.9 per 1,000 homes. This increase can be attributed to Baltimore Housing’s blight elimination effort. Additionally, the V2V program is targeting an additional 4,000 vacant houses to be demolished over the next 10 years.¹⁰ (See Section 2.8 Environmental Initiatives)

**Rate of Construction Permits
By Community Statistical Area, 2012**



**Percent of Properties that are Vacant and Abandoned
By Community Statistical Area, 2012**



*Figure 4: Construction Permits (above)
Figure 5: Vacant and Abandoned Properties (below)*

⁹ From Vital Signs 12, unless otherwise noted

¹⁰ City of Baltimore, Change to Grow: Ten-Year Financial Plan. 2013. Pg. 14.

2.1.8 Sanitation

Dirty streets and alleys not only diminish the quality of life of neighborhoods, they also carry pollutants into waterways.

The rate of reported dirty streets and alleys increased from 65.3 per 1,000 residents in 2011 to 70.5 per 1,000 residents in 2012. (Figure 6) These areas are predominantly in the near west and east sides, and the Park Heights corridor in northwest Baltimore.

In order to reduce the amount of trash and litter in the city's streets and alleys, DPW expanded its mechanical street sweeping program in April, 2014. Instead of sweeping only the Central District and main commuter routes, all neighborhoods in the city are now swept at least once a month. (See Section 4.2 Programs)

In June of 2014 Baltimore also piloted a municipal trash can program in the Belair-Edison / Four by Four and Greater Mondawmin neighborhoods. Residents were provided with 64-gallon trash containers with lids, as well as recycling bins.

Finally, in August, 2014, proactive alley sweeping was initiated in eleven neighborhoods.

2.1.9 Flooding

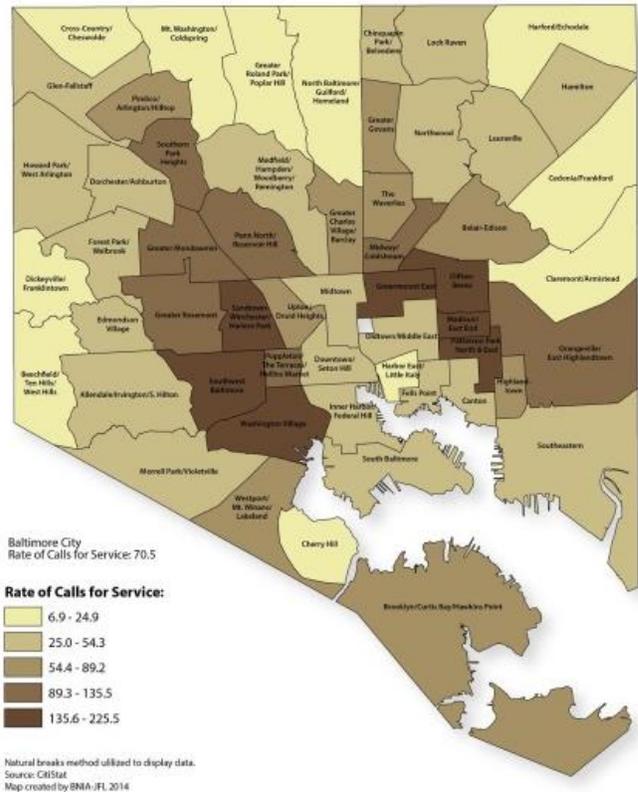
The rate of reported clogged storm drains decreased from 6.4 per 1,000 residents in 2011 to 6.2 per 1,000 residents in 2012. (Figure 7, also see Section 4.2 Programs). The areas reporting the most service requests coincide with the dirty street and alley map. In addition, the following areas have continual flooding problems:

- North Point Road
- Clipper Mill
- Mt. Washington Village / Whole Foods
- Kenwood Ave at Pulaski
- Cherry Hill at Patapsco Ave

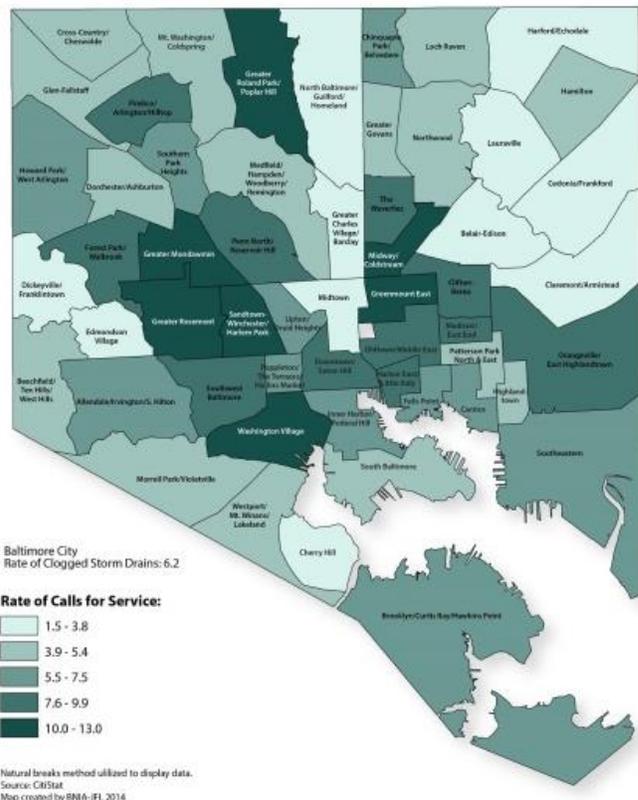
Figure 6: Dirty Streets and Alleys (above)

Figure 7: Clogged Storm Drains (below)

Rate of Dirty Streets and Alleys per 1,000 Residents By Community Statistical Area, 2012



Rate of Clogged Storm Drains per 1,000 Residents By Community Statistical Area, 2012



2.1.10 Stormwater Infrastructure and Streams

Baltimore City has about 116 miles of streams, the primary ones being the Jones Falls, Herring Run, and Gwynns Falls. However, this represents a fraction of what was originally a network of small streams and creeks that were piped and paved over as the city developed in the late 19th and early 20th centuries. Many of these streams were either entirely buried or significantly covered, like Harris Creek (originally running from Patterson Park to the Harbor) and the Gwynns Run. Replacing the historic hydrology of the City is a storm drain infrastructure, primarily installed prior to 1950, that includes:

- 1,146 miles of storm drain pipes
- 52,438 storm drain inlets
- 27,561 manholes
- 1,709 outfalls.



Figure 8: Gwynns Falls Stream (Source: Van Sturtevant)

2.1.11 Shoreline¹¹

Baltimore has approximately 59 miles of coastline. Over half of the coastline (55%) is open pervious. (Open pervious areas present potential buffer re-establishment opportunities.) The amount of coastline buffer that is forested is approximately 7%, while wetland areas make up approximately 1% of the coastline buffer. There is a relatively high percentage of impervious area in the coastline buffer zone; approximately 38%. (See Section 2.7 Other Regulations)

2.1.12 Tree Canopy

In 2007 the City’s tree canopy cover was 27.5%. Figure 9 illustrates tree canopy, with dark green having the highest canopy cover and dark red the lowest. Areas along the harbor, the downtown, and the dense rowhouse neighborhoods surrounding the downtown, have the fewest trees. (See Section 2.8 Environmental Initiatives)

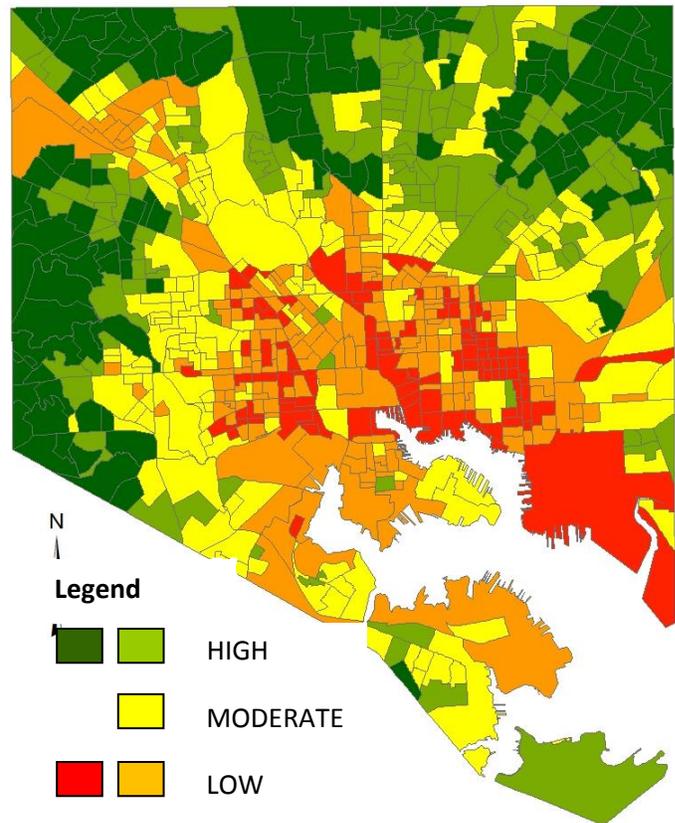


Figure 9: Tree Canopy Cover (Source: TreeBaltimore)

¹¹ Direct Harbor Water Characterization Report Draft – July 2013

2.1.13 Land Usage and Zoning

Water has always been important in defining Baltimore. The city was founded and first populated along its harbor and the Jones Falls. As the city grew, it expanded outward and uphill, with industry filling in along the waterfront and the Jones Falls and Gwynns Falls stream valleys.

This pattern of growth and development is still evident today (Figure 10). The downtown (dark red and magenta) surrounds the Inner Harbor. Dense rowhouse neighborhoods (bright yellow) surround the downtown, extending to the northwest in Park Heights, to the north along the east side of York Road, and in Brooklyn/Curtis Bay and Cherry Hill in south Baltimore. Further out, less dense rowhouses and single family houses (pale yellow) can be found, including neighborhoods like Roland Park, Homeland, Mt. Washington, Hamilton, and Ten Hills.

Industrial areas (purple) are typically clustered around the outer harbor, the lower Gwynns Falls area in the southwest, and in east Baltimore near the Back River. Commercial corridors follow the arterial roads extending outward from the central downtown.

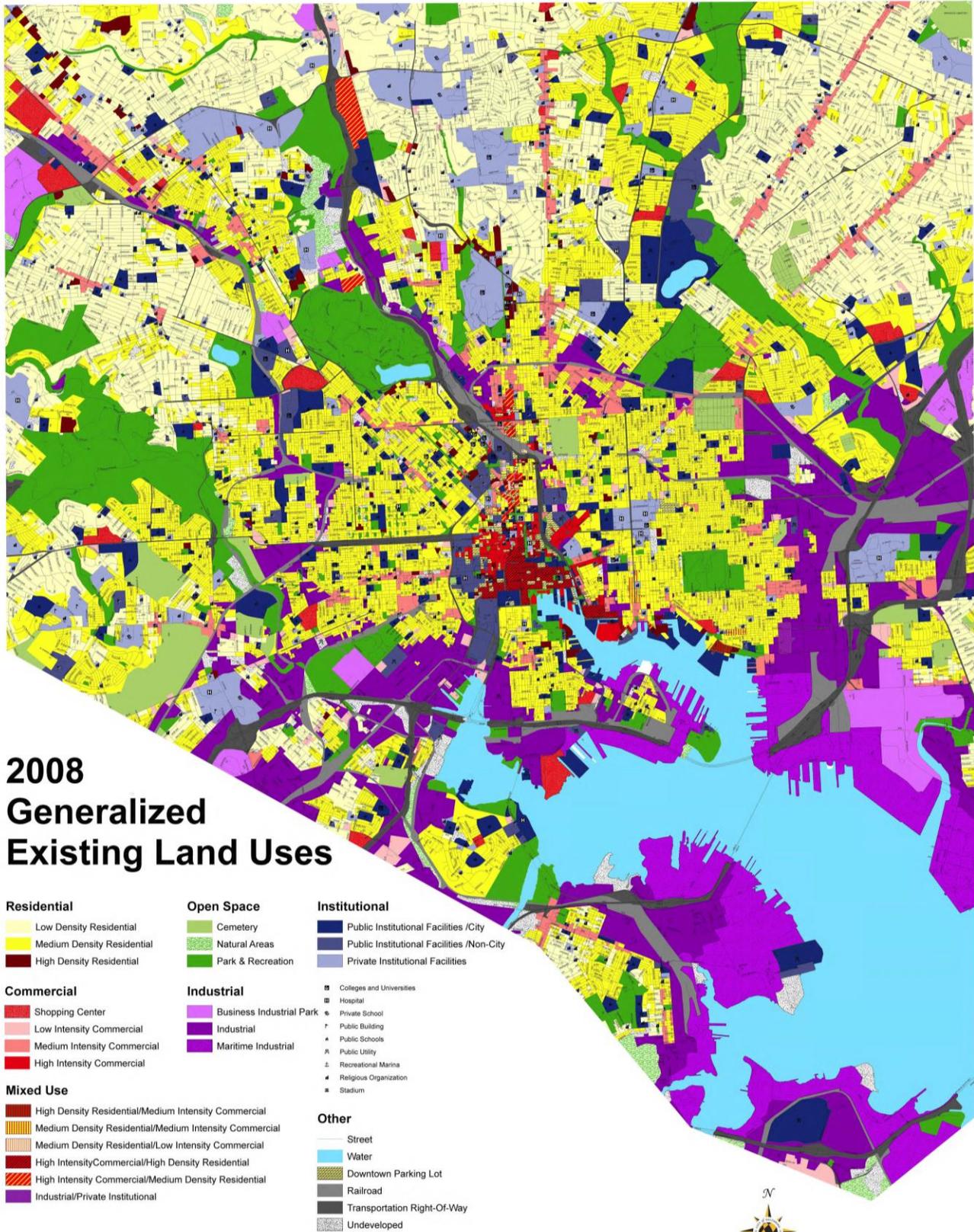
Several parks (green) are located along or adjacent to streams, including Leakin Park and Carroll Park (Gwynns Falls), Druid Hill Park, Cylburn, and Stony Run (Jones Falls / Stony Run), and Herring Run and Chinguapin Park (Herring Run / Chinguapin Run). The Middle Branch Park borders the Direct Harbor and mouth of the Lower North Branch of the Patapsco.

Baltimore's land use pattern is also illustrated in the Transform Baltimore proposed zoning map (Figure 11). Transform Baltimore is the first comprehensive update of the zoning code since 1971. At that time, the focus was on auto-oriented development, separation of uses, and preserving the City's heavy manufacturing base. Over the past 40 years, the economic realities and design goals of the City have evolved, and the current Code is no longer able to move Baltimore forward. The goal of Transform Baltimore is to preserve and enhance the long-term economic health of the City of Baltimore well into the 21st century.

In 2008, the Department of Planning began a process to review and rewrite the current Zoning Code. A Zoning Advisory Committee (ZAC) was established, made up of stakeholders from City Agencies, Community Leaders and the local development community. In addition, a series of community meetings took place centered on specific topics related to zoning, design and development. In September 2013 the new Zoning Code was approved by the Planning Commission and is currently being reviewed by the City Council for final approval.

One of the goals in the re-write of the Zoning Code is, "To promote the principles and standards enacted in the Baltimore City Sustainability Plan". This includes:

- A Landscape Manual was developed to support the new zoning code. The Zoning Code and the Landscape Manual are cross-referenced, and the Landscape Manual also references related regulations including the Stormwater Design Manual, Critical Areas Manual, and Forest Conservation.
- To control stormwater runoff and promote on-site groundwater recharge, the zoning code includes a maximum allowable percentage of impervious surfaces for all residential zoning districts.
- Green roofs are encouraged in Commercial (Title 10) and Industrial (Title 11) zoning districts.
- Rain barrels, compost piles, greenhouses, hoop houses, and recycling collection stations are considered permitted encroachments in the appropriate yard area.



2008 Generalized Existing Land Uses

- | | | |
|--|--------------------------|---|
| Residential | Open Space | Institutional |
| Low Density Residential | Cemetery | Public Institutional Facilities /City |
| Medium Density Residential | Natural Areas | Public Institutional Facilities /Non-City |
| High Density Residential | Park & Recreation | Private Institutional Facilities |
| Commercial | Industrial | Colleges and Universities |
| Shopping Center | Business Industrial Park | Hospital |
| Low Intensity Commercial | Industrial | Private School |
| Medium Intensity Commercial | Maritime Industrial | Public Building |
| High Intensity Commercial | | Public Schools |
| Mixed Use | | Public Utility |
| High Density Residential/Medium Intensity Commercial | | Recreational Marina |
| Medium Density Residential/Medium Intensity Commercial | | Religious Organization |
| Medium Density Residential/Low Intensity Commercial | | Stadium |
| High Intensity Commercial/High Density Residential | | Other |
| High Intensity Commercial/Medium Density Residential | | Street |
| Industrial/Private Institutional | | Water |
| | | Downtown Parking Lot |
| | | Railroad |
| | | Transportation Right-Of-Way |
| | | Undeveloped |


Sheila Dixon
 Mayor
 Thomas J. Stosur
 Director



Figure 10: Land Use Map (Source: Baltimore City Department of Planning)

2009

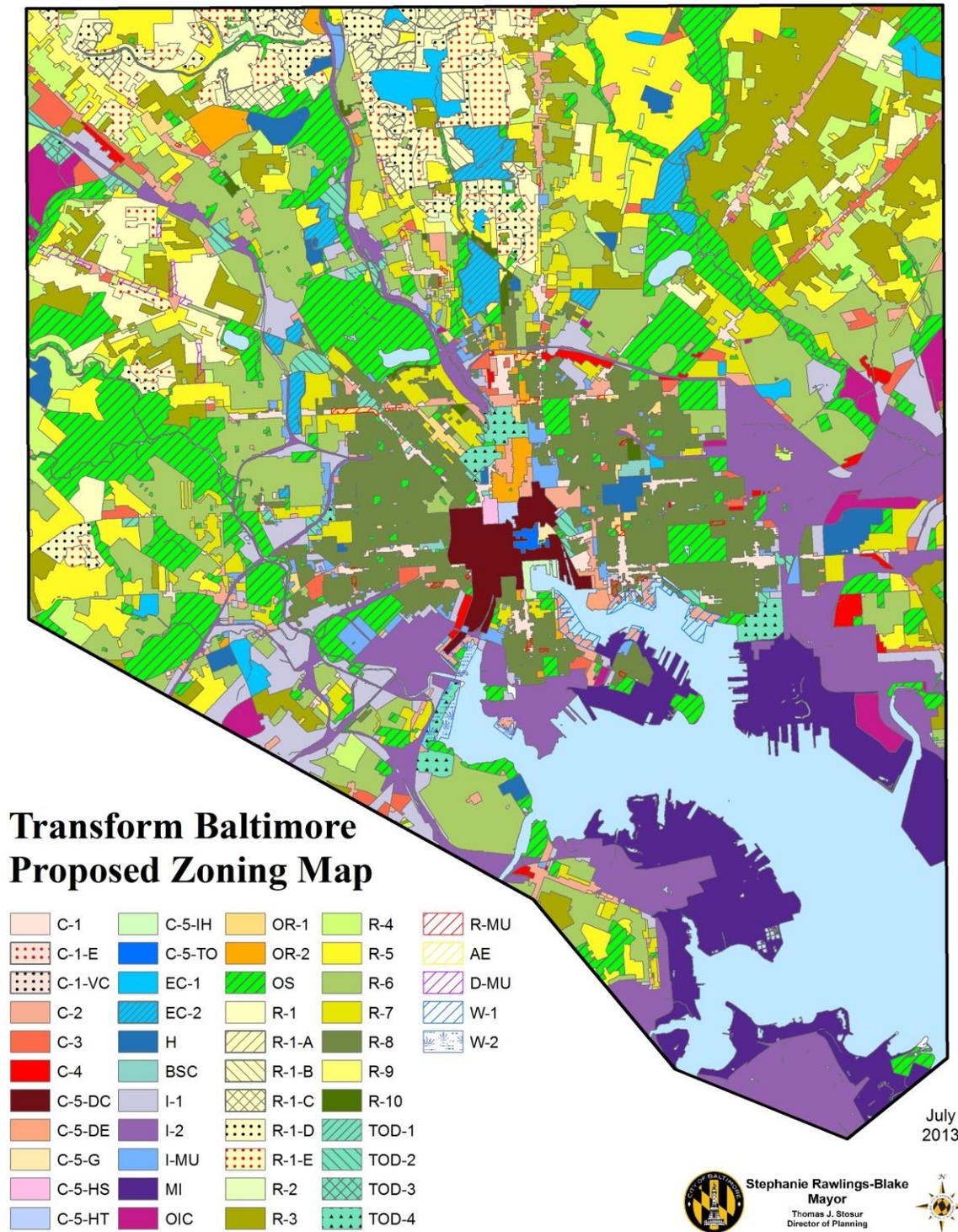


Figure 11: Proposed Zoning Map (Source: Baltimore City Department of Planning)

2.2 MS4 Permit Coverage

The land area within the Baltimore City geographic boundary encompasses about 81.6 acres. The City is responsible for the right-of-way. Although state and federal funding may be used for maintaining the roadways, the MS4 jurisdiction of the State Highway Administration (SHA) does not extend within the City. Two Phase II MS4 jurisdictions (Maryland Stadium Authority and Maryland Port Administration) are located within the City. Several state universities and colleges are located within Baltimore but are not specifically listed within the Phase II MS4 jurisdiction related to the University of Maryland. Over 200 industrial facilities subject to the NPDES Industrial Discharge Permit are located within the City, primarily along the water's edge of the Baltimore Harbor and Back River. Some of these properties have industrial surcharge permits, allowing for surface water to be discharged to the wastewater collection system and treated at the City's wastewater treatment plants.

In addition to this area, the City owns approximately 17,580 acres (27.47 square miles) of forested watershed property surrounding three reservoirs – Loch Raven and Prettyboy Reservoirs on the Gunpowder Falls and Liberty Reservoir on the North Branch Patapsco River. The watershed properties are forested with the majority of the water draining into the reservoir for treatment at either the Ashburton Water Filtration Plant or Montebello Water Filtration Plants for distribution in the public drinking water system. The reservoirs are listed as impaired; however, Baltimore County and Carroll County will be responsible for the associated TMDL implementation plans associated with the drainage areas that discharge to the source surface waters (streams) of the reservoirs.

Additionally, the City owns and operates the 466-acre Back River Wastewater Treatment Facility. The facility is in the process of an Enhanced Nutrient Reduction (ENR) technology upgrade, which is part of the Maryland Phase II WIP for the Bay TMDL for wastewater treatment facility source sectors. The facility has also been issued an NPDES Industrial Discharge permit, which requires the restoration of 20% of impervious area. The City maintains jurisdiction for the management programs conditions listed in the MS4 permit. For the purposes of The WIP, the City-owned property located outside of the City limits are not considered in the baseline impervious area calculation and subsequent 20% goal estimate.

2.2.1 Watersheds

Baltimore has five 8-digit watersheds as designated by the Maryland Department of the Environment:

- Back River
- Baltimore Harbor
- Jones Falls
- Gwynns Falls
- Lower North Branch of the Patapsco River (LN Branch Patapsco)

The drainage area for these five watersheds is 339.6 square miles, of which 81.6 square miles are within Baltimore City limits (24%) [Table 1¹²]. The remainder of the drainage area is shared by Baltimore County (Back River, Jones Falls, Baltimore Harbor, L N Branch Patapsco), Anne Arundel County (Baltimore Harbor, L N Branch Patapsco), and Howard County (Patapsco River L N Branch). Of Baltimore's five watersheds, Baltimore Harbor is the only one that is tidal influenced. While the Direct (Baltimore) Harbor watershed has the largest drainage area (28%), it has the smallest percentage of open streams (6%); most of which have been buried.

¹² Data derived from the "Watershed Needs Assessment" report by Parsons Brinckerhoff, 2010.

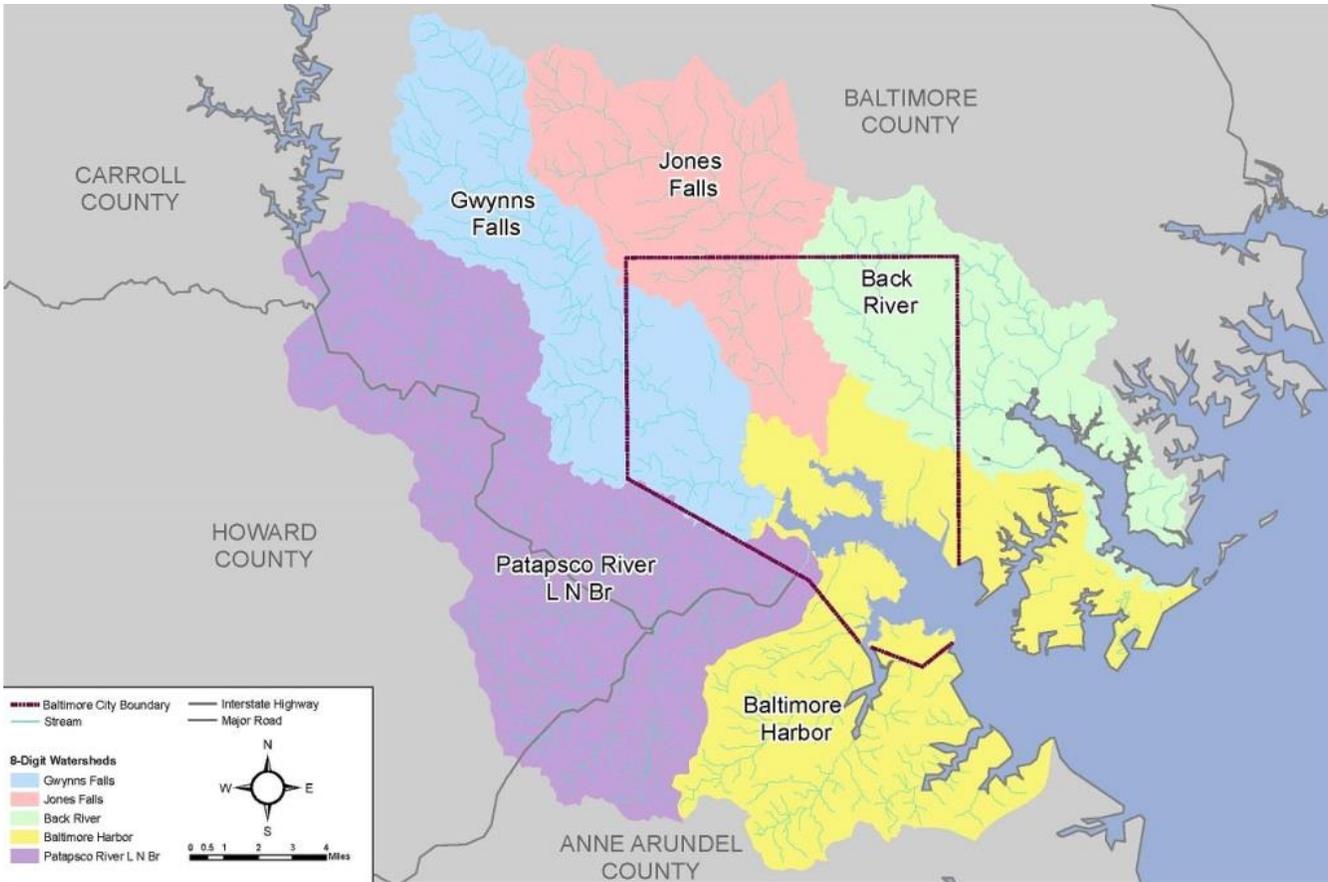


Figure 12: 8-digit Watersheds (Source: Watershed Needs Assessment)

Table 1: 8-digit Watersheds and Subwatershed

8-digit watershed	MDE 8-digit ID	Subwatersheds	Total Area (sq miles)	Area within City Limits (sq miles)	% within City Limits
Back River	02130901	West Branch Herring Run	2.9	0.7	24%
		East Branch Herring Run	4.2	0.8	19%
		Herring Run Mainstream	6.9	6.7	97%
		Chinquapin Run	2.6	2.0	77%
		Tiffany Run	1.4	1.4	100%
		Armistead Run	0.6	0.6	100%
		Biddison Run	1.2	1.2	100%
		Moores Run	4.4	3.6	82%
		Redhouse Run	4.7	1.0	21%
		Unnamed Tributary	0.9	0.9	100%
		Stemmers Run	5.8	0.2	3%
		Drainage Area Outside of City Limits	7.7	0	
		TOTAL DRAINAGE AREA	43.3	19.1	44.3%
Baltimore Harbor	02130903	SW Harbor	5.9	5.9	100%
		Middle Branch	5.0	5.0	100%
		Inner Harbor	6.2	6.2	100%
		East Patapsco	5.4	5.4	100%
		Drainage Area Outside of City Limits	65.9	0	
				TOTAL DRAINAGE AREA	88.4
Jones Falls	02130904	Western Run	5.6	3.2	57%
		Stony Run	3.5	3.5	100%
		Lower Jones Falls	11.5	10.8	94%
		Drainage Area Outside of City Limit	5.5	0	
				TOTAL DRAINAGE AREA	26.1
Gwynns Falls	02130905	Gwynns Run North	3.4	3.4	100%
		Gwynns Run South	2.3	2.3	100%
		Lower Gwynns Falls	8.0	7.8	97.5%
		Middle Gwynns Falls	9.7	0.1	1%
		Dead Run	7.9	1.4	18%
		Maidens Choice	4.8	3.2	67%
		Powder Mill	4.0	2.5	62.5%
		Drainage Area Outside of City Limit	25.4	0	
				TOTAL DRAINAGE AREA	65.4
Patapsco River L N Br		Upper Portion	1.8	1.8	100%
		Drainage Areas Outside of City Limit	114.7	0	
				TOTAL DRAINAGE AREA	116.4
		DRAINAGE AREA W/IN CITY LIMITS	339.6	81.6	24%

Note: Reservoirs are part of the MS4 Permit area, but strategy for MS4 WIP only within the city.

2.3 Local Government

Implementing the MS4 WIP and compliance with the City's MS4 permit requires a collaborative effort among city agencies, local non-profits, community partners, and the private sector. This collaboration will focus on the planning, design, construction, implementation, and maintenance of projects and programs.

Department of Public Works

The Department of Public Works (DPW) is primarily responsible for the planning, implementation, maintenance, monitoring, and reporting related thus MS4 WIP. An organization chart of the DPW is shown Figure 13. Further descriptions of the DPW divisions are as follows:

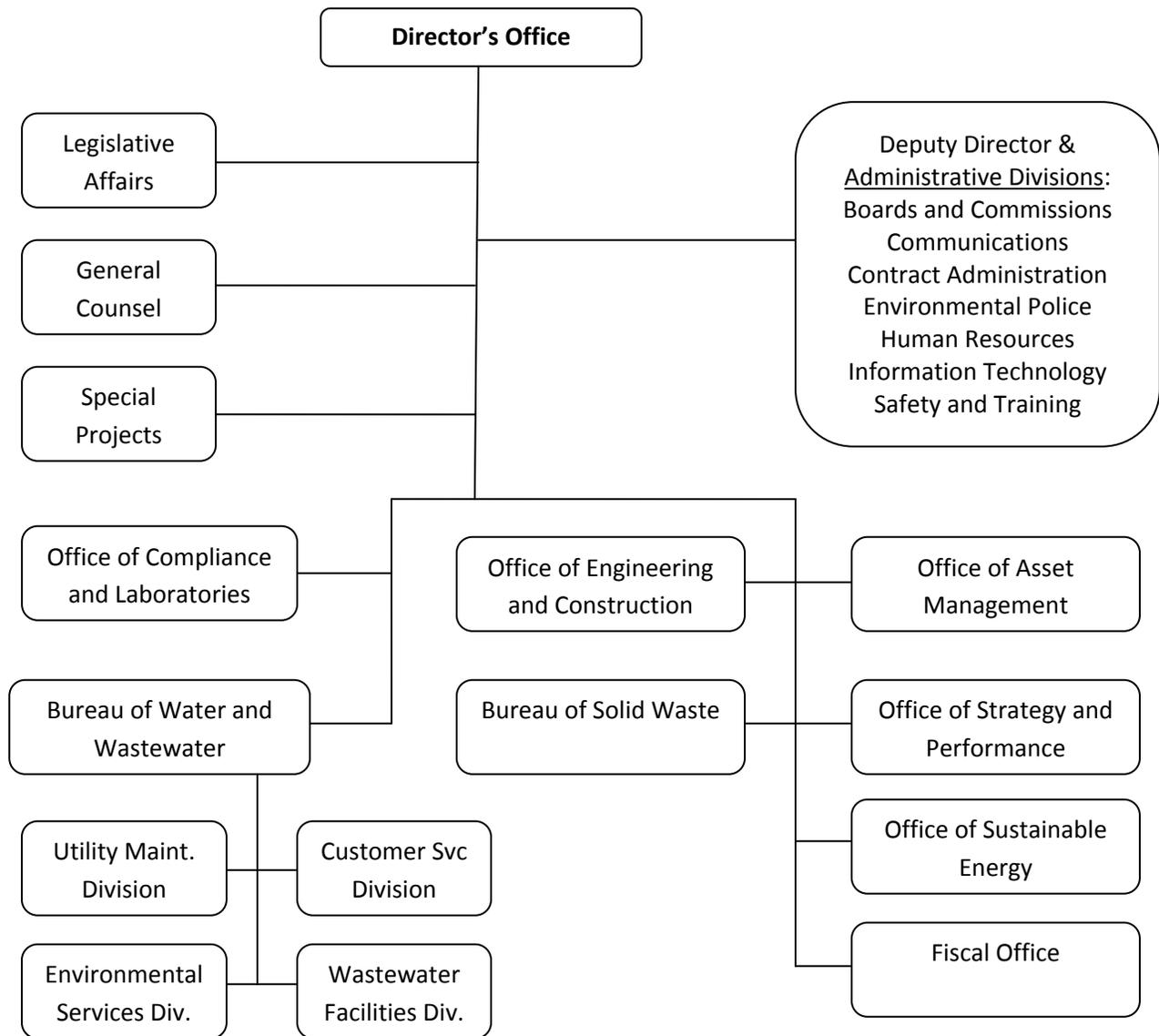


Figure 13: Organization Chart of the Department of Public Works

Director of Public Works

- Final approval of proposed policy, financial planning, rate structure and budget recommendations related to DPW to be submitted to the Mayor and / or City Council for adoption
- Final approval of proposed WIP and other MS4 deliverables to be submitted to MDE for review and agreement
- Co-chair of the Growing Green Initiative (with Department of Planning)
- Co-chair of the Healthy Harbor Steering Committee (with Waterfront Partnership of Baltimore)
- Oversight of Communications and Community Affairs Office for outreach and education materials, including the management of the Cleanwaterbaltimore.org website

Office of Compliance and Laboratories

- Point of contact for the MS4 permit
- WIP development and annual reporting for the MS4 permit
- Partnership coordination for grant funding, community engagement, education content
- Stormwater management and erosion and sediment control program for development (plans reviews and inspections)
- Response and investigation for erosion and sediment control and polluted surface waters response
- Maintenance of GIS information related to planned and completed Stormwater management facilities
- Surface water quality monitoring - sampling and analysis
- Illicit discharge detection and elimination (IDDE) program
- Facility management and hot spot investigations

Office of Engineering and Construction

- Implementation of the capital projects listed in this MS4 WIP
- Design and construction of stormwater management facilities related to design requirements for other DPW capital projects
- Development of design standards and specifications for stormwater management and erosion and sediment control, as used in the City's capital projects
- Compliance with NPDES General Construction permit of all DPW capital projects
- Coordination of City and other utility capital improvement projects to reduce land (soil) disturbance

Office of Asset Management

- Maintenance of GIS information related to the public storm drain system.
- Preventive inlet cleaning program (transition from Bureau of Water and Wastewater in FY 2017)
- Preventive DPW stormwater facility maintenance program (transition from Bureau of Water and Wastewater in FY 2017)
- Routine waterway maintenance and large debris collection system program (transition from Bureau of Water and Wastewater in FY 2017)
- Infrastructure inventory and condition assessment program (transition from the Office of Engineering and Construction in FY 2017)

Bureau of Water and Wastewater / Utility Maintenance Division

- Immediate response to repair and replace infrastructure as it relates to flooding, sewer overflows, and water main breaks

Bureau of Water and Wastewater / Wastewater Facilities Division

- Compliance with NPDES Industrial permit
- Operation of ENR upgrades at wastewater treatment plants
- Fats, oil, and grease (FOG) inspection and abatement program
- Industrial surcharge program (tracking of properties where stormwater runoff is collected within the sanitary sewer system)
- Pollution control program related to exterior lead based paint removal

Bureau of Water and Wastewater / Customer Service and Support Division

- Management of customer data (impervious area and fee reduction) related to the stormwater management fee

Bureau of Solid Waste

- Mechanical street sweeping
- Alley sweeping
- Recycling education and outreach programs
- Vacant property management: land management of vacant lots
- Rat abatement program
- Operation of solid waste facilities under NPDES industrial permit

Other City Agencies

Other City agencies will contribute to the implementation of The WIP. Each agency will be required to construct and maintain stormwater facilities (or stabilized impervious area removal projects) to comply with development requirements for their capital projects. These agencies and their contributions include:

Department of Planning (includes the Office of Sustainability)

- Co-chair of the Growing Green Initiative
- Transform Baltimore (zoning code)
- Forest Conservation Program
- Green Building Standards
- Critical Area Management Program
- Planning Commission and Sustainability Commission
- Floodplain management program and disaster preparation related to climate change

Department of Recreation and Parks

- Management of waterway recreation programs
- Education / outreach for nature / environmental initiatives
- Tree Baltimore

Baltimore Housing

- Vacants to Value program
- Building and grading permitting
- Green Building Standards

Department of Transportation

- Green streets program
- Right of way capital project coordination
- Bike Baltimore program
- Coordination with MTA and public transit programs
- Snow management (de-icing materials)

Department of General Services

- Right of way permitting
- Preventive maintenance for fleet management
- Operation of fleet substations under NPDES industrial permit

Department of Emergency Services

- Response to and reporting of hazardous materials spills

Baltimore City Health Department, Mayor's Office of Neighborhoods and Constituent Services, Baltimore Office of Promotion and the Arts, and Baltimore City Public Schools

- Outreach / education content and distribution

Real Estate

- Vacant land ownership and disposition

2.4 Non-government Organizations (NGOs)

Baltimore is fortunate to have a number of NGOs that have been active in addressing stormwater issues, providing education, advocacy, and project implementation:

Alliance for the Chesapeake Bay – an environmental non-profit that works to educate, train, and advise all those with an interest in the health of the Chesapeake Bay. The Alliance sponsors conferences, organizes on-the-ground clean-ups and projects, and educates the public on restoration and pollution prevention. Although the Alliance works at a regional level, they collaborate on projects and with various partners in Baltimore, and are a member of the Urban Water Federal Partners (see 1.4 Other Regulatory Factors).

Baltimore Community Foundation – the Foundation provides support to many of the City’s sustainability efforts, including the Healthy Harbor Trash Work Group (see Section 4.6 Public Outreach: Partnering and Collaborating).

Baltimore Ecosystem Study – The Baltimore Ecosystem Study (BES) is a long-term ecological research project funded by the National Science Foundation. BES scientists conduct research on the soil, plants, and animals on the land and in streams, as well as water and air quality. Most importantly, BES studies how social and political decisions affect ecological processes. Researchers work with DPW on various studies, helping to expand our understanding of the City’s urban watersheds and inform our actions for monitoring and improving water quality.

Baltimore Port Alliance (BPA) - The BPA is a non-profit group of maritime business representatives dedicated to addressing the needs and interests of businesses and individuals who make their living and support their families through maritime commerce. Through information advocacy and service, BPA seeks to protect the business climate for Marylanders by promoting the importance of the Maritime Industry in Maryland through sponsoring community and legislative forums, keeping elected officials informed, and fostering better communications with state and federal resource agencies.

Blue Water Baltimore (BWB) – In September, 2010, BWB was formed with the merging of the Jones Falls Watershed Association, Herring Run Watershed Association, Gwynns Falls Watershed Association, and the Baltimore Harbor Watershed Association. Blue Water Baltimore’s mission is to restore the quality of Baltimore’s rivers, streams and harbor to foster a healthy environment, a strong economy, and thriving communities. BWB runs several programs, including the Water Audit program (installation of residential stormwater practices), Blue Water Congregations (faith-based communities), Baltimore Harbor WaterKeeper, and Storm Drain Art program.

Chesapeake Bay Foundation – founded in 1967, the Chesapeake Bay Foundation (CBF) is the largest independent organization dedicated solely to saving the Bay. CBF provides education, advocacy, and litigation, as well as coordinating various restoration efforts. They have recently expanded their efforts by establishing a Baltimore initiative to work in closer partnership with the City, local non-profits, and the business community.

Civic Works / Center for Green Careers - Founded in 1993, Civic Works’ mission is to strengthen Baltimore’s communities through education, skills development, and community service. Central to this mission is the Community Lot Team, which transforms vacant and abandoned lots in Baltimore City into community gardens and green spaces, and the Baltimore Center for Green Careers. The Center is dedicated to the creation of business and employment development initiatives that contribute to environmental sustainability and are open to all Baltimore job seekers. In addition to providing training for residential energy retrofit and brownfields remediation, Civic Works is developing a program for green infrastructure installation and maintenance training.



Figure 14: Civic Works Community Lot Team (Source: Civic Works)

Living Classrooms Foundation – Living Classrooms offers hands-on environmental education and job training for the City’s youth and young adults by using urban, natural, and maritime resources as “living classrooms”. Living Classrooms focuses on under-served and minority populations. Their Workforce Development Center contracts with Baltimore City to provide maintenance of vacant properties and landscaping services.

National Aquarium - National Aquarium is a nonprofit aquatic education and conservation organization whose mission is to inspire conservation of the world’s aquatic treasures. The National Aquarium provides education, school programs, and community engagement. The Aquarium Conservation Team (ACT!) provides volunteers hands-on opportunities to help restore habitats, learn about watershed dynamics and develop the knowledge and skills to serve as participants and leaders in environmental stewardship.

Parks and People Foundation – The mission of the Parks and People Foundation is to improve the environmental, physical and social health of Baltimore. In 2003-2004, the Parks and People Foundation initiated the Watershed 263 Project, a 930-acre storm drain area in west and southwest Baltimore City that encompasses part of 12 urban neighborhoods and empties into the Middle Branch near the mouth of Gwynns Falls. Over the years Parks and People have led efforts to plant trees, remove impervious surfaces, install stormwater BMPs, and educate residents on best practices for stormwater reduction and community greening.

Waterfront Partnership of Baltimore – Working in partnership with the City, the Waterfront Partnership of Baltimore, was created in 2005 to manage, promote and advocate on behalf of the waterfront. Waterfront Partnership provides programming, maintenance, and greening, within their service area (currently bounded by the Rusty Scupper on the south and extending around the harbor to Bond Street Wharf), as well as special projects like the Inner Harbor Plan 2.0. In 2010 the Waterfront Partnership created the Healthy Harbor Initiative and the subsequent Healthy Harbor Plan. (See Section 2.8 Environmental Initiatives)

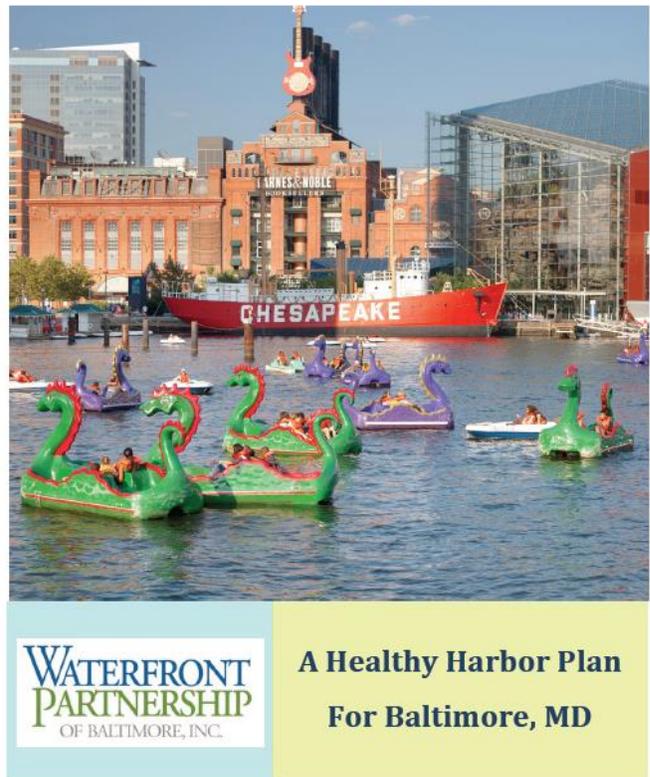


Figure 15: Healthy Harbor Plan (Source: Waterfront Partnership)

2.5 TMDLs

2.5.1 Chesapeake Bay Total Maximum Daily Load (TMDL)

The Chesapeake Bay Total Maximum Daily Load (TMDL), established by the US Environmental Protection Agency (EPA), set pollution limits for nitrogen, phosphorus, and sediment in the Chesapeake Bay Watershed. This TMDL, established under provisions of the Clean Water Act, is in response to the slow progress by states within the watershed to limit their pollutants to levels which meet water quality standards in the Bay and its tidal tributaries. Total limits set in the Bay TMDL for the states of Delaware, Maryland, New York, Pennsylvania, Virginia, West Virginia, and the District of Columbia are “185.9 million pounds of nitrogen, 12.5 million pounds of phosphorus and 6.45 billion pounds of sediment per year – a 25 percent reduction in nitrogen, 24 percent reduction in phosphorus and 20 percent reduction in sediment”¹³. The TMDL also sets rigorous accountability measures for state compliance. The State has completed Phase I and Phase II of the WIP for all source sectors.

Baltimore City provided local approaches for the Maryland Phase II WIP and has since provided its 2-Year Milestone schedules. The City only has two primary source sectors: wastewater treatment plants and regulated stormwater. The City owns and operates the two largest wastewater treatment plants in the State; both are in the process of implementing Enhanced Nutrient Reduction (ENR) technology upgrades. The ENR upgrades are part of the State’s WIP to significantly reduce the nitrogen waste loads, and thus are partially funded by revenues from the state-managed Chesapeake Bay Restoration fund. Regulated stormwater is expected to be addressed within the state’s timeline through the 20% impervious area restoration goal of the MS4 permit.

2.5.2 Local Baltimore City TMDLs

The City has a number of watersheds where EPA-approved TMDLs have established pollutant loading limits for water bodies. These loading limits represent the maximum amount of a pollutant that the water body can receive and still meet water quality standards, and an allocation of that load among the various sources of that pollutant. Pollutant loads must be reduced by implementing a variety of measures.

One condition of Baltimore’s MS4 Permit is to make progress toward implementation of TMDL load reduction allocations in the City watersheds. Table 2 below lists TMDLs and Impairments per watershed. The local nutrients and sediment TMDLs are expected to be folded within the Bay TMDL. Due to the regional focus of the Chesapeake Bay TMDL, quantified nutrient and sediment reduction benefits have been established for various practices and programs. Estimated reductions for nutrients and sediments related to proposed projects and programs within the WIP are shown in Appendix A.

Four of the five watersheds in Baltimore have been listed as impaired for bacteria. The City is under a Consent Decree for wet weather sanitary sewer overflows, however the City’s routine surface water monitoring program has shown bacteria levels during the dry weather periods, due to failing sanitary sewer and drinking water infrastructure, undocumented / unpermitted sanitary connections, and poor pet waste management. The City’s significant investment into the rehabilitation of the wastewater collection system related to Consent Decree is expected to have a secondary benefit of a reduction of bacteria and nitrogen; replaced and relined sanitary pipes will remove the source of the wastewater. An increase of the replacement of the City’s failing drinking water infrastructure should also decrease the subsurface system water loss which mimics a discrete wet weather event. At this time, the estimated efficiency of bacteria removal has not been established for various stormwater best management practices.

¹³ USEPA December 2010

Table 2: Baltimore City TMDL Summary by Impairment

Impairment	Watershed	Issue Date	Pollutant	MS4 Baseline Load	WLA	Units	Description	% Reduction	Source
Nutrients	Back River	2005	TN	73,429	62,415	LBS/year	Annual Avg.	15%	Total Maximum Daily Loads of Nitrogen and Phosphorus for Back River in Baltimore City and Baltimore County, Maryland
	Baltimore Harbor (includes Jones Falls and Gwynns Falls)	2007	TN	260,323	221,274	LBS/ year	Annual Avg.	15%	Total Maximum Daily Loads of Nitrogen and Phosphorus for the Baltimore Harbor in Anne Arundel, Baltimore, Carroll and Howard Counties and Baltimore City, Maryland
	Back River	2005	TP	8,316	7,069	LBS/ year	Annual Avg.	15%	Total Maximum Daily Loads of Nitrogen and Phosphorus for Back River in Baltimore City and Baltimore County, Maryland
	Baltimore Harbor (includes Jones Falls and Gwynns Falls)	2007	TP	28,177	23,951	LBS/ year	Annual Avg.	15%	Total Maximum Daily Loads of Nitrogen and Phosphorus for the Baltimore Harbor in Anne Arundel, Baltimore, Carroll and Howard Counties and Baltimore City, Maryland
Sediments	Gwynns Falls	2010	TSS	7,205	3,712	Tons/year	Annual Avg.	48.5%	Total Maximum Daily Load of Sediment in the Gwynns Falls Watershed, Baltimore City and Baltimore County, Maryland
	Jones Falls	2011	TSS	4,733	3,489	Tons/year	Annual Avg.	26.3%	Total Maximum Daily Load of Sediment in the Jones Falls Watershed, Baltimore City and Baltimore County, Maryland
	Lower N. Branch Patapsco	2011	TSS	610	457	Tons/year	Annual Avg.	25.1%	Total Maximum Daily Load of Sediment in the Patapsco River Lower North Branch Watershed, Baltimore City and Baltimore, Howard, Carroll and Anne Arundel Counties, Maryland

Baltimore City MS4 and TMDL Watershed Implementation Plan

Impairment	Watershed	Issue Date	Pollutant	MS4 Baseline Load	WLA	Units	Description	% Reduction	Source
Bacteria	Back River (Herring Run)	2007	E.coli	5,860,942	214,920	Billion MPN/year	Annual Avg.	96.3%	Total Maximum Daily Loads of Fecal Bacteria for the Herring Run Basin in Baltimore City and Baltimore County, Maryland
	Gwynns Falls	2007	E.coli	98,157	322	Billion MPN/day	Daily	99.7%	Total Maximum Daily Loads of Fecal Bacteria for the Non-Tidal Gwynns Falls Basin in Baltimore City and Baltimore County, Maryland
	Jones Falls	2008	E.coli	8,608	314	Billion MPN/day	Daily	96.4%	Total Maximum Daily Loads of Fecal Bacteria for the Non-Tidal Jones Falls Basin in Baltimore City and Baltimore County, Maryland
	Lower N. Branch Patapsco	2009	E.coli	5,393	3,902	Billion MPN/year	Annual Avg.	27.6%	Total Maximum Daily Loads of Fecal Bacteria for the Patapsco River Lower North Branch Basin in Anne Arundel, Baltimore, Carroll, and Howard Counties, and Baltimore City, Maryland

Source: <http://www.mde.state.md.us/programs/Water/TMDL/CurrentStatus/Pages/Programs/WaterPrograms/TMDL/Sumittals/index.aspx>

Other TMDLS

Back River: Chlordane (Approved 1999); PCBs (Approved 2012)

Baltimore Harbor: Chlordane (Approved 2001); PCBs (Approved 2012)

Bear Creek, Baltimore Harbor: PCBs (Approved 2012)

The following WQAs (Water Quality Analysis) have been approved by EPA (date in parentheses); no TMDLs are needed for the impairments listed:

Back River: Zinc (2004)

Baltimore Harbor, Northwest Portion: Zinc & Lead (2005); Chromium (2012)

Gwynns Falls: Nutrients (2010)

Jones Falls: Zinc (2003); Copper & Lead (2004); Nutrients (2010)

Lower North Branch of the Patapsco: Metals (2005)

2.6 Impervious Area Coverage

As previously mentioned, the City’s MS4 Permit requires treatment of an additional 20% of impervious cover not currently receiving treatment to the MEP. The baseline impervious area and subsequent impervious area restoration estimate are shown in Table 3¹⁴:

Table 3: Impervious Area

Description	Area (acres)
Existing Impervious Area within City’s boundaries	24,479
Properties not part of the MS4 jurisdiction	
Federal-owned property (excludes Housing Authority)	-76
State Phase II MS4	-107
Other State-owned property	-1,063
NPDES Industrial discharge permit	-1,119
City MS4 jurisdiction	22,114
Existing Treated Impervious Area (as of 2010)	-1,909
Baseline Impervious Area (as of 2010)	20,205
Estimated 20% Impervious Area Restoration	4,041

About 35% of the impervious area within the City MS4 jurisdiction is located within the right of way, used for existing public roadways, bus stops, on-street parking, pedestrian cross walks, and sidewalks. City-owned properties include an estimated 1,290 acres of the impervious area, which is less than 9 percent of the total area outside of the right-of-way within the City’s MS4 jurisdiction.

2.6.1 Restoration Prior to 2010

Baltimore City’s previous MS4 permit expired in December 2010. The following information was derived from the 2009 MS4 Annual Report:

Table 4: Restoration Prior to 2010

Treatment	Description	Impervious Acres Restored
Street sweeping and inlet cleaning prior to 2010	14,555 tons / year	1,570
Stream restoration	1,325 linear feet	150
DPW BMPs	3 facilities	178
Facility Greening (schools / vacant lots)	5 facilities	11
Private / Other City BMPs	12 as-builts	Data not available
	TOTAL	1,909

Street sweeping figures are an average of years 2000-2009. During those years, only a portion of the city received street sweeping – in the central core, commercial corridors and gateway streets, and scattered other streets. Inlet cleaning was done on an as-needed basis or in response to service requests.

¹⁴ Accounting for Stormwater Wasteload Allocations and Impervious Acres Treated Guidance for National Pollution Discharge Elimination System Stormwater Permits, MDE, August 2014, pgs 5 – 7.

A total of 13,225 linear feet of streams were restored, including Biddison Run Phase 1, Upper Stony Run, Middle Stony Run, Lower Stony Run, and Maiden’s Choice. The DPW BMPs represent two volume control facilities – Gwynns Run and Brooklyn Park - as well as 6 ultra-urban Best Management Practices (BMPs) in Watershed 263. Facility greening represents asphalt removal projects at three schools and one vacant lot.

Finally, there were twelve stormwater management BMPs for which the as-built drawings were approved during 2009. As a result of the stormwater management fee and subsequent customer credit program, the City has received more as-built documentation of the BMPs installed prior to 2010. At the time of this report, the evaluation of the as-built data is not complete.

2.6.2 Watershed Assessments

Since 2001, Baltimore City has had 11 watershed assessments completed (Table 5) following the EPA’s guidance for watershed assessment and small watershed action plans (known as the “A thru I” criteria). To date, no watershed assessment has been completed for the Lower North Branch of the Patapsco that is within the City’s boundaries. A draft Direct Harbor Watershed Characterization Report was completed in 2013; the full assessment is scheduled for completion in 2016.

Table 5: Watershed Assessment

Planning Area	Major Watershed	Report Title	Year
Upper Back River	Back River	Small Watershed Action Plan	2008
Biddison Run	Back River	SW Improvement Feasibility & Conceptual Design	2006
Herring Run	Back River	Stream Assessment & Restoration Concept Plan	2004
Moore's Run	Back River	Watershed Restoration Plan	2001
Direct Harbor	Baltimore Harbor	Watershed Characterization Report	On Hold
Masonville Cove	Baltimore Harbor	Small Watershed Action Plan	2014
Watershed 246	Baltimore Harbor	Small Watershed Action Plan	2010
Watershed 263	Baltimore Harbor	Management Plan	2006
Lower Jones Falls	Jones Falls	Small Watershed Action Plan	2008
Western Run	Jones Falls	Stream Assessment	2004
Stony Run	Jones Falls	Watershed Restoration Plan	2001
Gwynns Falls	Gwynns Falls	Water Quality Management Plan	2004
Powder Mill	Gwynns Falls	Targeted Watershed Assessment	2004
Maidens Choice	Gwynns Falls	Watershed Restoration Plan	2001

2.7 Other Regulatory Factors

2.7.1 National Pollutant Discharge Elimination System Permits

As authorized by the Clean Water Act, the National Pollutant Discharge Elimination System (NPDES) permit program controls water pollution by regulating point sources that discharge pollutants into waters of the United States. Industrial, municipal, and other facilities must obtain permits if their discharges go directly to surface waters. The NPDES permit program is administered by MDE. In addition to the MS4 Permit, three NPDES permits regulate activities in Baltimore City:

- NPDES General Construction Permit
Stormwater discharges from construction activities (such as clearing, grading, excavating, and stockpiling) that disturb one or more acres, or smaller sites that are part of a larger common plan of development or sale, are regulated under the NPDES stormwater program. Prior to discharging stormwater, construction operators must obtain coverage under an NPDES permit. The General Construction Permit, with its increased regulations, will result in less sediment entering Baltimore's waters.
- NPDES Industrial Permit (General Permit Number 12-SW)
MDE authorizes the discharge of stormwater associated with industrial activity to waters of the state under the NPDES General Permit Number 12-SW. This permit replaces the General Permit Number 02-SW that was issued in December, 2002. The permit contains provisions that require industrial facilities in 26 different industrial sectors to, among other things, implement control measures and develop site-specific stormwater pollution prevention plans (SWPPP) to comply with NPDES requirements.

The stormwater management requirement for the restoration of impervious surfaces is a significant change from MDE's 02SW Permit. The new requirement is to provide for treatment of 20% of the impervious surfaces not currently treated to the standards of the Department's Stormwater Design Manual for the first inch of runoff, or equivalent, to be accomplished within the 4 years of the permit term. The restoration requirements apply to any permittee whose facility is 5 acres or greater in size and is located within the Chesapeake Bay Watershed within a Phase I or Phase II MS4 jurisdiction.¹⁵ Permit holders who are not able to treat their 20% restoration on-site and require off-site mitigation are added to the City's baseline.

- Wastewater Treatment Plant Discharge Permits
The operations of the Patapsco and Back River Wastewater Treatment Plants are governed by NPDES Discharge Permits. These permits contain general operating restrictions as well as limitations on the contents of the plants' effluent. Compliance with these numeric effluent limits is determined by regular sampling and reporting to the MDE.

2.7.2 Consent Decree for Wet Weather Sanitary Sewer Overflows

Like most large cities in the nation, Baltimore City faces the challenges of dealing with an aging infrastructure. In 2002, the City entered into a consent decree, or agreement, with the U.S. Environmental Protection Agency and the Maryland Department of the Environment to inspect, identify, and improve the entire sanitary sewer system. This agreement focused primarily on the elimination of sewage overflows.

¹⁵

http://www.mde.state.md.us/programs/Permits/WaterManagementPermits/WaterDischargePermitApplications/Pages/Permits/watermanagementpermits/water_applications/stormwater.aspx

Since 2002, the Department of Public Works has invested over \$500 million on system improvements, including:

- Eliminated 60 engineered sewage overflow structures.
- Improved operations and maintenance for the sanitary sewer system.
- Completed 39 consent decree projects on schedule, at a cost of over \$300 million.
- Upgraded the Jones Falls Sewage Pumping Station from 35 to 55 million gallons per day.
- Constructed the 20 million gallon per day Stony Run wet weather sewage pumping station.
- Separated the Forest Park and Walbrook combined sewer systems.
- Upgraded the City's GIS and mapping database.
- Reduced wet-weather related sewage overflows citywide.

2.7.3 Baltimore City Critical Area Management Program

The State of Maryland Chesapeake Bay Critical Area Law establishes the Chesapeake Bay Critical Area Commission (CAC) and requires that the City of Baltimore and other jurisdictions prepare and adopt a Critical Area Management Program (CAMP) to:

1. Improve the water quality of the Bay by controlling pollution from stormwater runoff and;
2. To conserve and protect wildlife habitat along the shoreline of the Bay.

The City's CAMP establishes guidelines for development of properties within the 1,000-foot strip of land measured from the mean high tide line or the bulkhead. The Critical Area is also separated into additional sub-areas (Figure 16). The sub-areas are Intensely Developed Areas (IDA) and Resource Conservation Areas (RCA). Additionally, there are 12 Designated Habitat Protection Areas (DHPA) within the Critical Area. These function as additional overlay districts from the IDA and RCA areas and there may be some overlap on individual parcels.

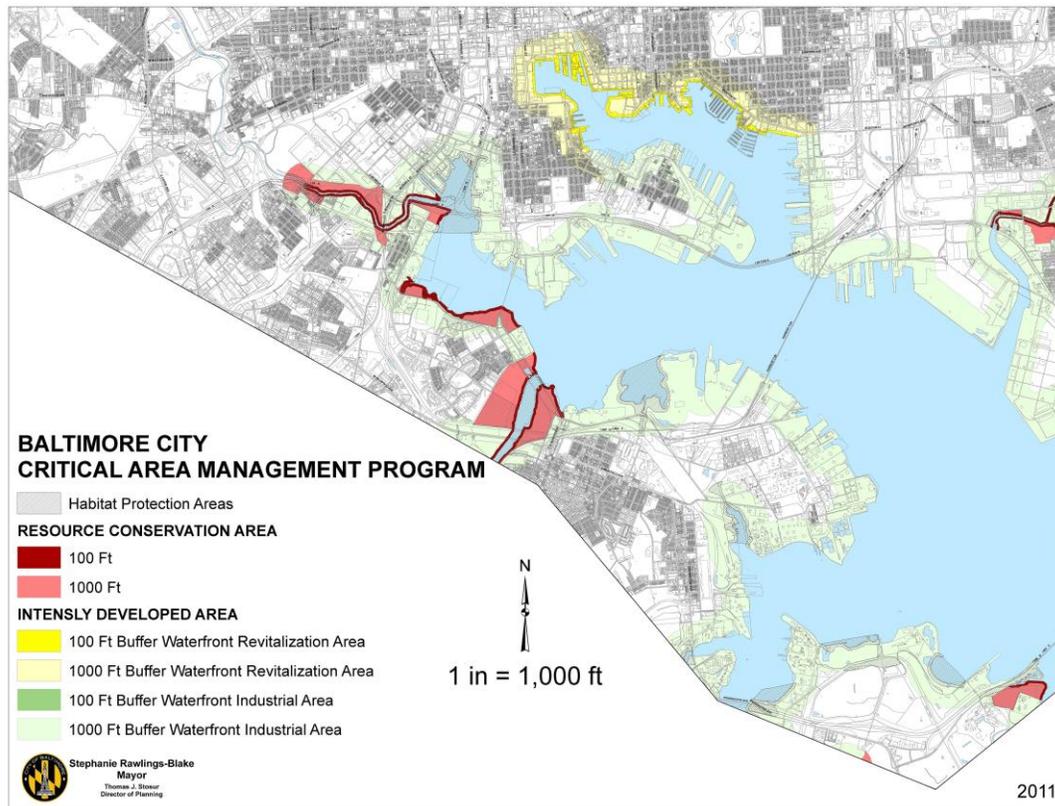


Figure 16: Critical Area Management Program (Source: Baltimore City Department of Planning)

2.7.4 Forest Conservation Act

The Maryland Forest Conservation Act (FCA) was enacted in 1991 to minimize the loss of Maryland's forest resources during land development by making the identification and protection of forests and other sensitive areas an integral part of the site planning process. While the Maryland DNR Forest Service administers the FCA, it is implemented on a local level;¹⁶ in Baltimore City it is administered by the Department of Planning. Because conditions in the City are different from those in the counties of Maryland, certain changes have been made so that the Forest Conservation Act will work under urban conditions. In Baltimore City, the act is triggered by any application for a subdivision on a lot great that 20,000 square feet or any application for sediment/erosion control permit on a single lot which disturbs more than 20,000 square feet.¹⁷ This results in stricter requirements for replacement, mitigation, and reforestation.

2.7.5 Maryland Stormwater Management Act of 2007

On April 24, 2007, Governor Martin O'Malley signed the "Stormwater Management Act of 2007" (Act), which became effective on October 1, 2007. Prior to this Act, environmental site design (ESD), was encouraged through a series of credits found in Maryland's Stormwater Design Manual. The Act requires that ESD, through the use of nonstructural best management practices and other better site design techniques, be implemented to the maximum extent practicable. In May 2010, Baltimore updated the City Code to address the Act, which resulted in increased requirements for redevelopment, from treating 20% of the existing impervious to treating or removing 50% of the existing impervious. DPW also added additional staff for plans review. Charged with implementation, MDE is in the process of addressing the requirements of the Act including changes to regulations, the 2000 Maryland Stormwater Design Manual, and other guidance materials.¹⁸

2.7.6 Erosion and Sediment Control Act of 2011

Maryland's Erosion Control Law and regulations specify the general provisions for program implementation; procedures for delegation of enforcement authority; requirements for erosion and sediment control ordinances; exemptions from plan approval requirements; requirements for training and certification programs; criteria for plan submittal, review, and approval; and procedures for inspection and enforcement. Proper design, installation, and maintenance of erosion and sediment control practices are essential to having an effective program. MDE has established minimum criteria for effective erosion and sediment control practices. The 2011 Standards and Specifications for Soil Erosion and Sediment Control are incorporated by reference into State regulations and serve as the official guide for erosion and sediment control principles, methods, and practices. In February 2013, Baltimore updated its City Code in accordance with the act.¹⁹

2.7.7 Green Building Standards

The Baltimore City Green Building Standards (Standards) are the regulations and process by which the City will ensure the design and construction of green buildings for public and private development in Baltimore. Established in 2007, the Standards are based on the US Green Building Council LEED® v3.0 (2009) Leadership in Energy and Environmental Design rating program, which has been adapted and customized to fit the

¹⁶ <http://www.dnr.state.md.us/forests/programapps/newFCA.asp>

¹⁷

<http://archive.baltimorecity.gov/Portals/0/agencies/planning/public%20downloads/Supplement2StateForestConservationManual.pdf>

¹⁸ <http://mde.maryland.gov/programs/water/stormwatermanagementprogram/pages/programs.aspx>

¹⁹

<http://www.mde.state.md.us/programs/Water/StormwaterManagementProgram/SoilErosionandSedimentControl/Pages/programs/waterprograms/sedimentandstormwater/erosionsedimentcontrol/index.aspx>

development conditions, local market and sustainability goals of the City. Meeting the Standards requires addressing a range of sustainable practices, including stormwater management.²⁰

Changes are being made to the City's Green Building Standards. In 2011, the Maryland legislature enacted enabling legislation permitting local governments to adopt the IgCC (international Green Construction Code), which will eventually replace the Green Building Standards.

2.7.8 Baltimore City Landscape Manual

As described earlier, Transform Baltimore is the new Zoning Code for Baltimore City (see Section 2.1.13 Existing Conditions: Land Use). One of the key components regarding the regulation of stormwater is the Landscape Manual. The Landscape Manual was developed in conjunction with and in support of the update of the Zoning Code and has been coordinated with the Critical Areas Management Program, Forest Conservation, and Stormwater Management regulations.

One of the chapters specifically addresses stormwater management facilities. The intent of the Landscape Manual is not to create another regulation governing stormwater management, but to help integrate stormwater BMPs into the design and development review process, including:

- Identifying all existing and proposed stormwater BMPs on the landscape plan.
- Requiring that the stormwater BMPs meet the standards of the MD Stormwater Design Manual, Volumes I & II and the Baltimore City Stormwater Management Design Guidelines where applicable.
- Encouraging the use of Environmental Site Design (ESD) principles and practices.
- Using stormwater BMP landscaping to improve the edges of natural areas, create or strengthen connections to existing natural areas or open spaces, or increase the ecological potential of the site.

2.8 Environmental Initiatives

The following are existing City initiatives and partnerships that DPW will continue working with to implement the MS4 Permit goals (Pillar #4: Plan to be part of the bigger picture):

2.8.1 Healthy Harbor Initiative / Plan

In 2010, the Waterfront Partnership of Baltimore unveiled its Healthy Harbor Initiative (HHI) with a goal of making the harbor swimmable and fishable by 2020. Included in the initiative are pilot projects to help improve water quality and help educate the public about the Harbor's health. The HHI is led by a Steering Committee, which is co-chaired by Baltimore City's Director of Public Works, and meets on a regular basis. The HHI also convenes a Trash Work Group to address harbor and neighborhood trash problems and clean-up efforts.

To reach the swimmable and fishable goal, the Waterfront Partnership commissioned the Healthy Harbor Plan. The plan was completed in 2011 by the Center for Watershed Protection and BioHabitats, with input from Baltimore City, Baltimore County, and Blue Water Baltimore. The plan outlines serves as a guide for the Healthy Harbor Steering Committee in achieving the goal of creating a swimmable and fishable harbor.

The Healthy Harbor Plan includes a number of strategies for reducing polluted stormwater that meet the goals of the MS4 WIP, including:

- Reduce stormwater pollution through redevelopment and controlling stormwater through green infrastructure;
- Utilize vacant properties to provide stormwater management as part of an offset and banking program;

²⁰ http://static.baltimorehousing.org/pdf/bcgbs_vol1.pdf

- Install green infrastructure practices in neighborhoods as stormwater retrofits
- Implement a public education campaign for residents and businesses to encourage reduction of stormwater pollution
- Restore stream channels degraded by runoff

2.8.2 Vacants to Value (V2V)

This program, administered by the Department of Housing and Community Development, is a multi-pronged strategy for redeveloping vacant and abandoned properties. One of the strategies is to demolish and maintain severely distressed blocks. Rather than using scattered site demolition, a whole block approach is utilized, with the goal of demolishing clusters of vacant houses to create more useable tracts of land. This supports large-scale redevelopment efforts as well as provides opportunities for new green spaces (see below).

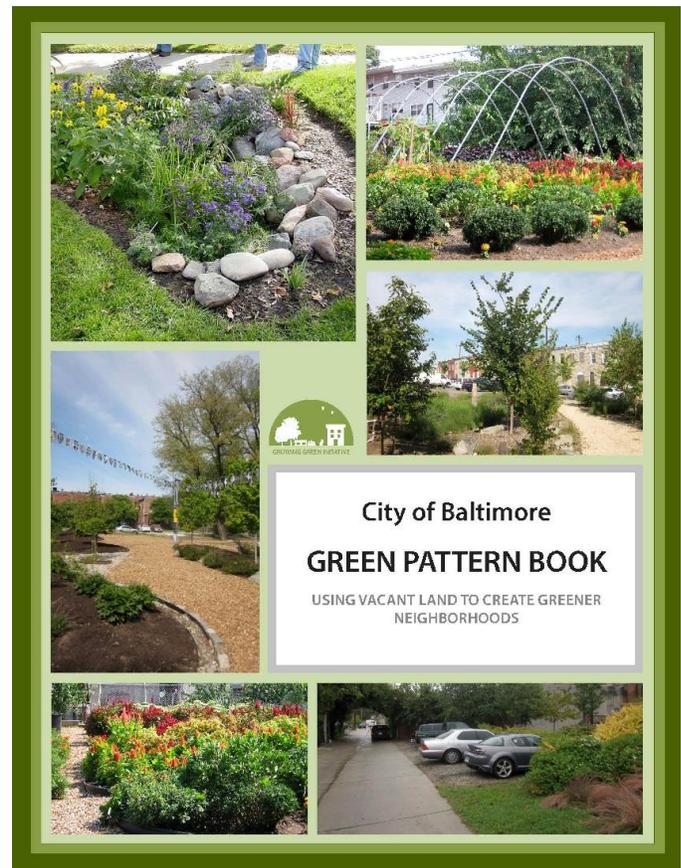
2.8.3 Growing Green Initiative

The Growing Green Initiative (GGi) evolved from the Vacants to Value program. The goal of GGi is to use sustainable, innovative, and cost-effective practices for stabilizing and holding land for redevelopment, and reusing vacant land to green neighborhoods, reduce stormwater runoff, grow food, and create community spaces that mitigate the negative impacts of vacant properties and set the stage for growing Baltimore. One of the goals of GGi is to support the City’s MS4 stormwater permit requirements by providing opportunities to construct cost-efficient stormwater management practices on vacant land.

To facilitate the implementation of GGi, a “Green Pattern Book” was created using funding and assistance from the Urban Waters Federal Partnership. The Green Pattern Book is a guide for the greening of vacant land by City agencies, NGOs, community-based organizations, and residents, and features eight green project types or patterns, one of which is Stormwater Management.

Although the Department of Planning leads the initiative, the Department of Public Works is co-chair of the Growing Green Work Group, an advisory committee for overseeing the implementation of the GGi. Other members of the work group include DOT, Recreation and Parks, Housing, and the Mayor’s Office.

Finally, the Power in Dirt program (originally part of Step Up Baltimore) has been incorporated into the Growing Green Initiative. Power in Dirt staff will assist communities in post-demolition greening, as well as helping people adopt and re-use existing vacant lots.



*Figure 17: Cover of the Green Pattern Book, 2014
(Source: Baltimore City Department of Planning)*

2.8.4 Waste to Wealth (W2W)

The City of Baltimore throws away tons of valuable resources every day. Many of these resources could be captured and re-used as an engine of economic development, creating jobs and new products, supporting resident-led greening efforts, and revitalizing neighborhoods. The Waste to Wealth Program is designed to do this by targeting three high-value, primarily non-residential waste streams: food waste, construction and demolition waste, and urban wood waste. The City is exploring the establishment of a W2W Incubator with a sorting yard and addressing City operation and policy barriers to incentivizing private sector wood re-use businesses. These efforts will support the proposed STORM Centers.

2.8.5 Tree Baltimore

Tree Baltimore is a mayoral initiative led by the Baltimore City of Recreation and Parks to increase the City's tree canopy to 40% by 2030. It serves as the umbrella organization for all City agencies and non-profit organizations, like Blue Water Baltimore, the Parks & People Foundation, and the Alliance for the Chesapeake Bay. TreeBaltimore strives to increase the urban tree canopy through the establishment, management and preservation of trees, partnering with individual homeowners as well as communities, schools, and businesses.

2.8.6 Disaster Preparedness and Planning Project (DP3)

In 2013, The Baltimore City Department of Planning and Office of Sustainability created the Disaster Preparedness and Planning Project, an effort to address existing hazards while simultaneously preparing for predicted hazards due to climate change. One of the most pressing challenges facing states and municipalities today is the quality and capacity of public infrastructure, such as stormwater, to withstand these hazards. Included in the DP3 are recommendations for enhancing and expanding the stormwater infrastructure system:

- Encourage urban landscaping requirements and permeable surfaces into community managed open spaces;
- Expand, protect, and restore riparian areas within the city;
- Create an interconnected network of green spaces to support biodiversity and watershed based water quality management; and
- Increase the urban tree canopy and target areas with urban heat island impacts.

2.8.7 Baltimore City Public Schools' 10-Year Plan

In 2013, the Board of School Commissioners approved the 10-Year Plan, with the goal of modernizing all school buildings over the next ten years. The plan will include renovating and adding to existing buildings, as well as demolishing and building new school buildings. One of the guiding principles of the plan is to, "Create school buildings on the cutting edge of technology and environmental sustainability". In addition to meeting the requirements of the Green Building Standards, the plan also encourages using school grounds for environmental education, including the installation of rain gardens, green roofs, and the removal of excess pavement. Other guiding documents for the school system include:

- MD Environmental Literacy Standards: COMAR 13A.03.02 requires that students graduate environmentally literate and that LEAs integrate environmental education in all grades
- MOU (City Schools, City of Baltimore, IAC, MSA): requires green building and integration of sustainability
- MD High Performance Building Act: requires all large new public construction and major renovation projects to achieve at least LEED Silver.

2.8.8 Baltimore Urban Waters Federal Partnership

The Urban Waters Federal Partnership was established in 2011 to reconnect urban communities with their waterways by improving coordination among federal agencies and collaborating with community-led revitalization efforts to improve our Nation's water systems and promote their economic, environmental and social benefits. The Patapsco Watershed in Baltimore was one of the initial locations selected for this effort.

In Baltimore, the partnership includes the US Forest Service and USGS at the Federal level, Maryland Department of the Environment, public agencies including the Department of Public Works, Planning, and TreeBaltimore, and local non-profits like Blue Water Baltimore, Civic Works, and the Parks & People Foundation. The partnership has four focus areas: Mapping, Monitoring, Green Pattern Book, and Local Projects.

3 WIP DEVELOPMENT

In addition to the Watershed Assessments and the City's contribution to the Maryland Phase II Chesapeake Bay TMDL WIP, DPW developed "Six Pillars of Practical Watershed Planning" to guide the development of its MS4 WIP.²¹

1. Plan for more projects than you need
2. Plan for resources that will affect funding needs
3. Plan to maintain
4. Plan to be part of a bigger picture
5. Plan for effective public participation
6. Plan to adapt

3.1 MS4 Public Meetings

During the summer of 2014, four public meetings were held for the MS4 WIP. These meetings were an opportunity to help educate people about the MS4 Permit and WIP, present preliminary recommendations, and receive public comments and questions, with each meeting addressing the various parts of the WIP.

Meeting invitations were sent to a stakeholder list of over 200 people as well as to the City's community association list. Meeting dates and locations were posted on www.cleanwaterbaltimore.org and advertised on the Mayor's weekly e-newsletter, DPW's Facebook page, and through partner organizations.

A total of 74 people attended the meetings, representing a diversity of sectors – environmental non-profits, businesses, consultants, City Council and agency representatives, and citizens. Presentation from each meeting, as well as notes and public comment, were made available on www.cleanwaterbaltimore.org.

3.2 Stakeholder Meetings

During the Spring and Summer of 2014, smaller stakeholder meetings were held to discuss issues, concerns, and recommendations. These meetings included:

- Environmental NGOs – including Blue Water Baltimore, Parks & People, National Aquarium, Chesapeake Bay Foundation, and the Alliance for the Chesapeake Bay.
- Community Development Corporations – including Southeast CDC, Belair-Edison Neighborhoods, Banner Neighborhoods, and the Community Development Network of Maryland
- Developers and Consultants – organized by 1000 Friends of Maryland, the meeting addressed the potential for stormwater banking.

In addition to public and stakeholder meetings, the Watershed Assessments, and Small Watershed Action Plans (SWAPs), the following studies and data were used in the development of the WIP:

3.3 Vacant Lot Feasibility Studies for Stormwater Management

Two separate studies were conducted in 2013 that evaluated the feasibility of using vacant land for stormwater management. The first was the Unified Planning Work Program (UPWP) conducted by the Baltimore City Office of Sustainability for the Department of Transportation. The purpose of the study was to identify the feasibility of using vacant land by the Baltimore City Department of Transportation for off-site stormwater mitigation.

²¹ These pillars are meant to supplement EPA's "A-I Criteria" that was used in developing the Watershed Assessments.

The second study was conducted by the Center for Watershed Protection and the University of Maryland Environmental Finance Center for implementing a stormwater offset and banking system with the City. Included in the study was an assessment of vacant lots for treating stormwater to gauge whether there are enough sites to establish a mitigation bank and to generate an initial list of potential sites.

3.4 Flood prone areas

There are several locations throughout the City that are prone to flooding (see Section 2.1 Existing Conditions). While the causes of the flooding vary from topographic low points, undersized storm drains, and failing infrastructure, what they all have in common is too much runoff. The neighborhoods adjacent to these areas will be studied as locations for BMPs in order to reduce the volume of water impacting these areas.

3.5 3-1-1 Service requests

Through Baltimore City’s 3-1-1 system, citizens can report any number of complaints and issues, including choked inlets, flooded streets, dirty streets and alleys, and illegal dumping. Service requests made regarding these complaints are tracked to identify “hotspots” – locations that are either repeat problems or where there are clusters of service requests – so as to best target services, maintenance, and enforcement.

3.6 Water Quality Data (SIS Data)

The Stream Impact Sampling (SIS) program is a comprehensive water quality monitoring effort designed to document chemical analyses of city streams over long spans of time. Each of the 33 sampling locations are visited once a month and laboratory analysis is performed on the samples for various parameters, including nutrients, sediments, and bacteria.²² Historic data for the SIS Program are available on-line²³. The purpose of this program is to evaluate the quality of our surface waters for any long-term trends and determine any capital investment programs or operational programs to implement. This sampling is performed in addition to the weekly ammonia screening program, which is conducted to meet the IDDE condition of the City’s MS4 permit.

3.7 Priority Planting Map (TreeBaltimore)

In 2012, TreeBaltimore, created a priority planting map to guide their work and that of their partners. The priority map considered multiple factors, including heat island effect, existing tree canopy, and impervious areas (see Section 2.1 Existing Conditions). These priority neighborhoods will also be considered as locations for various BMPs in order to complement the planting of trees. In addition, the plantings will also compensate for loss of tree canopy due to the Emerald Ash Borer

infestation. (Figure 18):

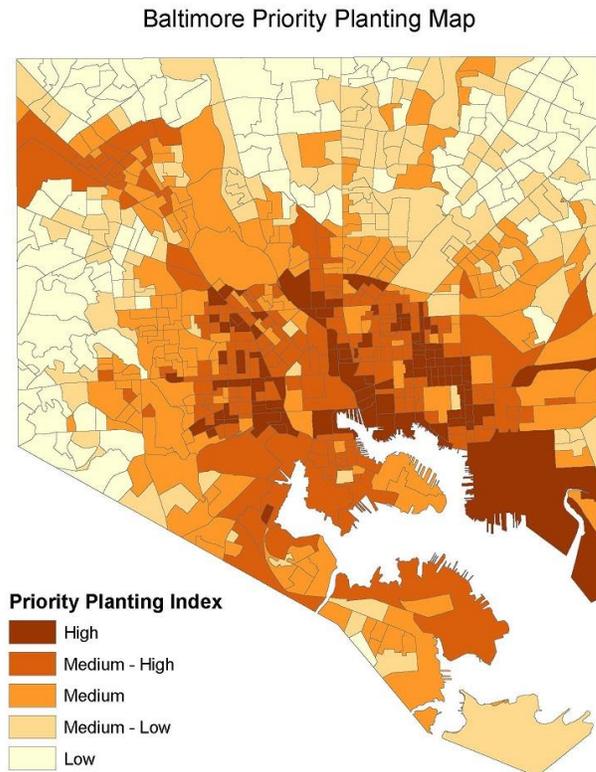


Figure 18: Priority Planting Areas (Source: TreeBaltimore)

²² <http://www.cleanwaterbaltimore.org/stream-impact-sampling>

²³ <https://data.baltimorecity.gov/Public-Works/Stream-Impact-Sampling-and-Ammonia-Screening/39h2-7kjs>

4 PROJECTS, PROGRAMS, AND PARTNERSHIPS

Given the ultra-urban nature of Baltimore, a diverse and comprehensive approach for meeting the 20% restoration and TMDL requirements is needed. This will include:

- Restoring streams;
- Installing “green” stormwater management facilities like bio-retention in public right-of-ways, parking lots, and vacant lots, as well as green roofs;
- Retrofitting and installing ponds and wetlands;
- Planting street trees and trees in parks and at schools;
- Removing impervious surfaces at schools and vacant lots and replacing with these with green spaces;
- Inspecting and eliminating illicit discharges into the storm sewer system;
- Reducing trash and litter with mechanical street sweeping and inlet cleaning; and
- Educating the public about what they can do to reduce polluted runoff.

To best organize this diverse suite of projects and programs, we have divided our approach into three categories:

1. **Projects** – capital projects like stormwater ponds, bio-swales, rain gardens, impervious surface removal, and reforestation resulting in a definable asset. DPW will either be the lead for the installation of these projects and/or work in collaboration with other city agencies and the school system to provide capital funding.
2. **Programs** – DPW support services and operations, including street and inlet cleaning, inspections, and public outreach and education.
3. **Partnerships** – stormwater facilities and practices that are installed as required by regulation or through voluntary installation by private and non-profit entities.

The following is a description of the strategies and goals for each of the above categories. It should be noted that, while the 20% restoration goal is 4,041 acres, the following strategies estimate restoring an equivalent of 4,823 impervious acres. This is based on Pillar #1 of Practical Watershed Planning “Plan for more projects than you need”. Identifying more projects than is needed will accommodate changes due to projects being determined not feasible, too expensive, or delayed. It also accommodates assumptions made for changes in allowable restoration credits that are being made for stream restoration, IDDE, erosion and sediment control, and public education.

4.1 Projects

Projects consist of three types: Traditional BMPs, ESD Practices, and Alternative BMPs. It is projected that these projects will restore the equivalent of 3,747 impervious acres (APPENDIX A).

Identifying and Prioritizing Project Locations

Project locations are a combination of specific locations (streams, schools, parks, streets) and targeted neighborhoods, and have been selected using the following data:

- Projects identified in various Watershed Assessments, including the Back River, Jones Falls, and Gwynns Falls Watersheds, as well as Watershed 263, Watershed 246, and Masonville Cove Small Watershed Action Plans.
- Other plans and studies, including the Middle Branch Master Plan and the Herring Run Park Master Plan.
- DPW Capital Improvement Program (CIP) project budget for FY2015 – FY20120.

- Information from agencies (Recreation & Parks, Schools) and non-profits (Blue Water Baltimore, Parks & People, Center for Watershed Protection).
- Vacant Lot Feasibility studies, one by the Center for Watershed Protection (2013) and the other by the Baltimore City Office of Sustainability (2013) and Sabra Wang (2014).

4.1.1 Traditional BMPs

For the purposes of The WIP, Traditional BMPs, also known as structural BMPs, are practices that treat drainage areas of 5 acres or more, such as stormwater ponds, wetlands, detention basins, infiltration swales, and sand filters.²⁴ Unfortunately, Baltimore has very few stormwater management ponds, and limited space to install new ponds or large practices. However, there are several that were developed prior to 2010 that are candidates for retrofitting. These include the stormwater facilities at Gwynns Run, Seton Business Park, and North Point Road at Kane Street.

Opportunities for installing new ponds, wetlands, and large bio-retention facilities are typically in parks or major right-of-ways; several have been identified in the Watershed Assessments and park master plans.

4.1.2 ESD Practices

ESD Practices are small stormwater facilities that treat 5 acres or less, including micro-bioretenion, rain gardens, enhanced filters, permeable paving, and green roofs.²⁵ Given the small size of these practices, they fit well into Baltimore's urban environment of streets, parking lots, small parks, and school grounds. Unfortunately, they can be expensive to install, limited by existing conduits, utilities, and soil conditions, and conflict with right-of-way needs like on-street parking or community acceptance.



*Figure 19(top):
12th Avenue Green Street, Portland
(Source: City of Portland, Environmental Services)*

*Figure 20(bottom):
Peerce's Park bioretention, Baltimore
(Source: Amy Gilder-Busatti)*



²⁴ 2000 Maryland Stormwater Design Manual Volumes I & II, Center for Watershed Protection and Maryland Department of the Environment Water Management Administration, Chapter 4

²⁵ 2000 Maryland Stormwater Design Manual Volumes I & II, Center for Watershed Protection and Maryland Department of the Environment Water Management Administration, Chapter 5

Several ESD projects have been selected from previous studies, such as the Masonville Cove SWAP and Belair-Edison Green Streets study. Other projects will be identified during the Permit period of the WIP using a community planning process led by the Watershed Liaison Office. These neighborhoods, or clusters of neighborhoods, are:

- Brooklyn / Curtis Bay / Cherry Hill
- Cameron Village / Chinquapin Park / other neighborhoods adjacent to Chinquapin Run
- Coldstream-Homestead-Montebello
- Frankford / Belair-Edison / Greater Lauraville / Cedonia
- Greater Mondawmin / Walbrook / Rosemont / NW Community Action / Coppin Hts / Easterwood
- Hampden / Remington / Wyman Park
- Howard Park / Grove Park / West Arlington / Fairmont
- Hunting Ridge / Rognel Heights / Edmondson Village / Edgewood
- Lakeland / Mt. Winans / Westport
- McElderry Park / CARE Community / Milton-Montford / Patterson Place
- Morrell Park / Wilhelm Park / Gwynns Falls / Carroll-South Hilton
- Mt. Washington / Glen / Cheswolde / Cross Country
- Orchard Ridge / Armistead Gardens / Orangeville
- Central Park Heights / Towanda Grantley / Lucille Park
- Patterson Park / Highlandtown / Baltimore Highlands
- Sharp-Leadenhall / Federal Hill / Otterbein / South Baltimore

These neighborhoods were selected based on a combination of the following criteria:

1. Adjacent to and/or upland from stream restoration project
2. Adjacent to and/or upland from flood prone areas
3. Adjacent to DPW stormdrain projects or other DPW initiatives (Municipal Trash Container Pilot, alley sweeping, etc)
4. Other identified stormwater projects, partnerships, and initiatives (new and renovated 21st Century Schools, park master plans, Watershed 263, Clean Water communities, etc)
5. CIP project locations by other agencies. In particular, DPW will coordinate with the Department of Transportation as they develop streetscape and Complete Streets plans, including a Complete Streets plan for the Casino Area Master Plan.

4.1.3 Alternative BMPs

Alternative BMPs, as outlined in MDE's "Accounting for Stormwater Wasteload Allocations and Impervious Acres Treated" guidance document, include stream restoration, impervious surface removal and greening, and reforestation.²⁶ By far the largest percentage of impervious acres restoration in Baltimore's WIP is alternative BMPs.

Baltimore's streams are highly degraded, with eroding banks, collapsing outfalls, and exposed sewer lines. Stream restoration is an opportunity to reduce erosion and sedimentations, increase natural channel flow, and improve the health of the stream and adjacent riparian areas. Stream restoration projects are located in the Back River, Jones Falls, and Gwynns Falls watershed; no stream restoration projects are located in the Direct

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<http://www.mde.state.md.us/programs/Water/StormwaterManagementProgram/Documents/NPDES%20MS4%20Guidance%20August%2018%202014.pdf>

Harbor watershed, because most of the streams are buried, or in the Lower North Branch of the Patapsco River. The estimated efficiency listed in Appendix A assumes a holistic approach, including invasive species removal and habitat restoration. Therefore, the equivalent impervious area restoration was estimated higher than listed in MDE's guidance document.

Impervious surface removal and greening is incorporated in a combination of school projects and vacant lot restoration and re-use. The Baltimore City Public School System has completed several asphalt removal projects, some of these were with the MD Port Authority, while others were completed by partners like Blue Water Baltimore and Parks & People. The schools listed in the WIP have been identified from various Watershed Assessments as well as conversations with the BCPSS. DPW will continue to work with the school system's facilities planning and Green Schools Coordinator to identify opportunities for removing impervious surfaces and installing stormwater BMPs as part of the Baltimore City Public Schools' 10-Year Plan.

As noted in the Background section of The WIP, many of Baltimore's neighborhoods are plagued by nearly 30,000 vacant properties – which include existing vacant lots and vacant structures. While vacant properties are a problem, they also offer an opportunity as locations for impervious surface removal, small stormwater management practices, and tree planting. These facilities can also become new community green spaces, serving as amenities for redevelopment. DPW will continue to be a partner in the Mayor's Growing Green Initiative to identify vacant properties for stormwater management and reduction, as was tested in the Growing Green Design Competition in 2014. Rather than targeting individual vacant properties, neighborhoods, or clusters of neighborhoods, have been identified²⁷:

- Carrollton Ridge / Shipley Hill / Mill Hill / Pigtown / New Southwest / Union Square / Franklin Square
- Harlem Park / Sandtown-Winchester / Upton
- McElderry Park / CARE Community / Milton-Montford *
- Mt. Winans*
- Oliver / Broadway East
- Central Park Heights*

Neighborhoods were chosen based on the following criteria:

1. Areas identified in the two vacant lot feasibility studies
2. Neighborhoods with large numbers of vacant properties
3. Neighborhoods in or adjacent to Vacants to Value development clusters
4. Neighborhoods with Year 1 and Year 2 demolition clusters as identified by Baltimore Housing
5. Areas with existing GGI projects and the potential for economic development

Finally, reforestation and tree planting efforts will coincide with the City's TreeBaltimore Program. The Department of Recreation and Parks manages this program to meet the City's goal of 40 percent tree canopy cover. This effort in turn supports Baltimore's plans for increasing sustainability, improving surface water quality, and minimizing stormwater runoff. Locations will target TreeBaltimore's Priority Planting Areas, which were identified as neighborhoods with minimal tree canopy, high heat island index, high asthma rates, and large amounts of impervious surfaces. We will also coordinate with Baltimore Green Space and its Forest Patch Atlas to identify opportunities for enhancing Baltimore's existing forest patches and riparian areas, including habitat restoration and invasive species removal.

²⁷ Neighborhoods marked with an * are also targeted neighborhoods in the ESD strategy

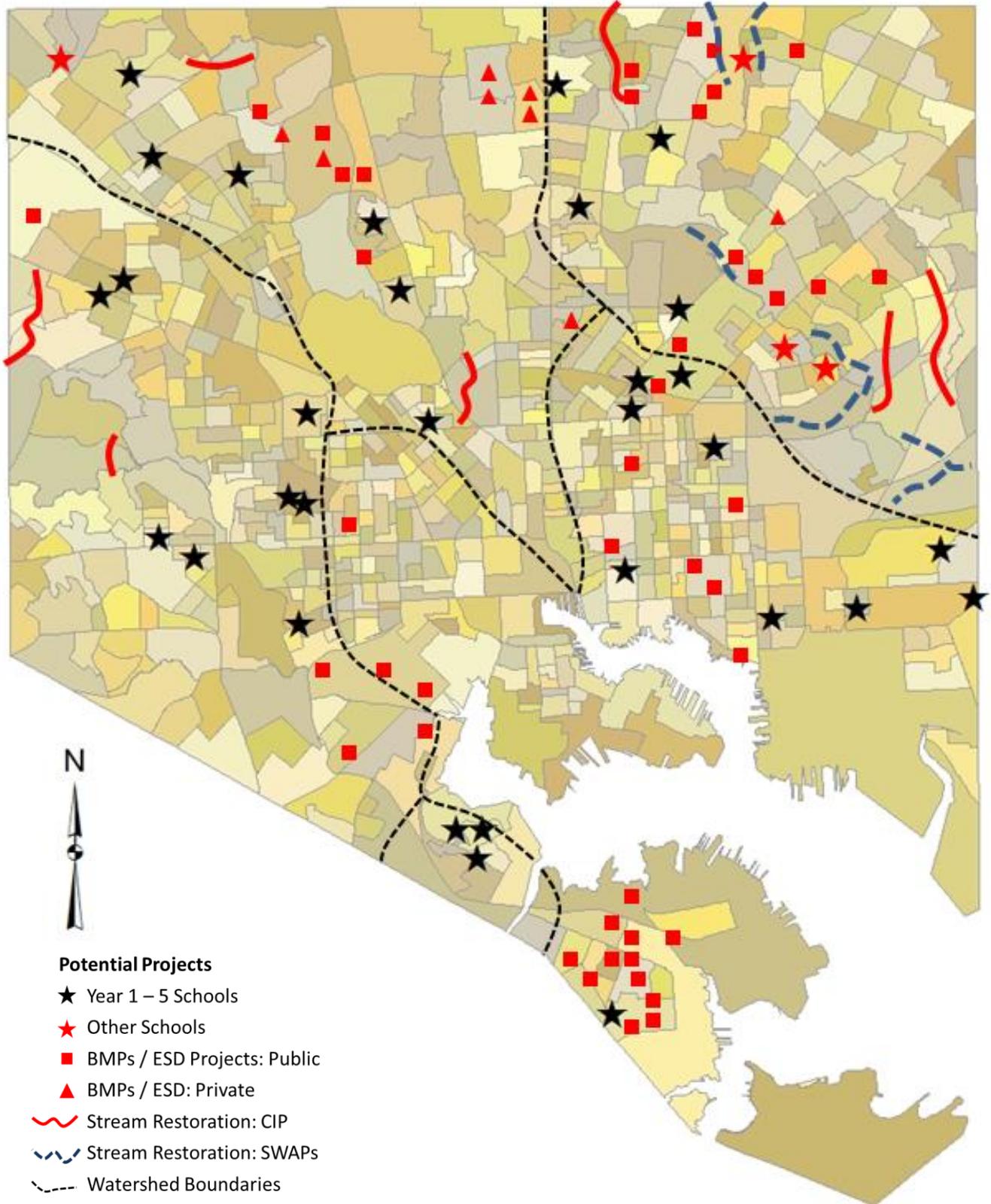


Figure 21: Projects Target Areas (Source: DPW)

4.2 Programs

Programs are operations and services that reduce pollutants in stormwater runoff. It is projected that these projects will restore the equivalent of 805 impervious acres. The following are programs that Baltimore City is currently or will be undertaking:

4.2.1 Expanded City-wide mechanical street sweeping

In April of 2014, DPW launched a citywide mechanical street sweeping program, covering neighborhoods which previously had no service or scattered, inefficient service. Instead of sweeping only the Central areas of the City and some of our main commuter routes, all neighborhoods are now being reached using a fleet of 36 vehicles. An additional eleven sweepers have been purchased, and these will be used to replace older vehicles and ensure continuous sweeping operations. Six months in, the program removed nearly 1,600 tons of trash, pollutants and organics from City streets.

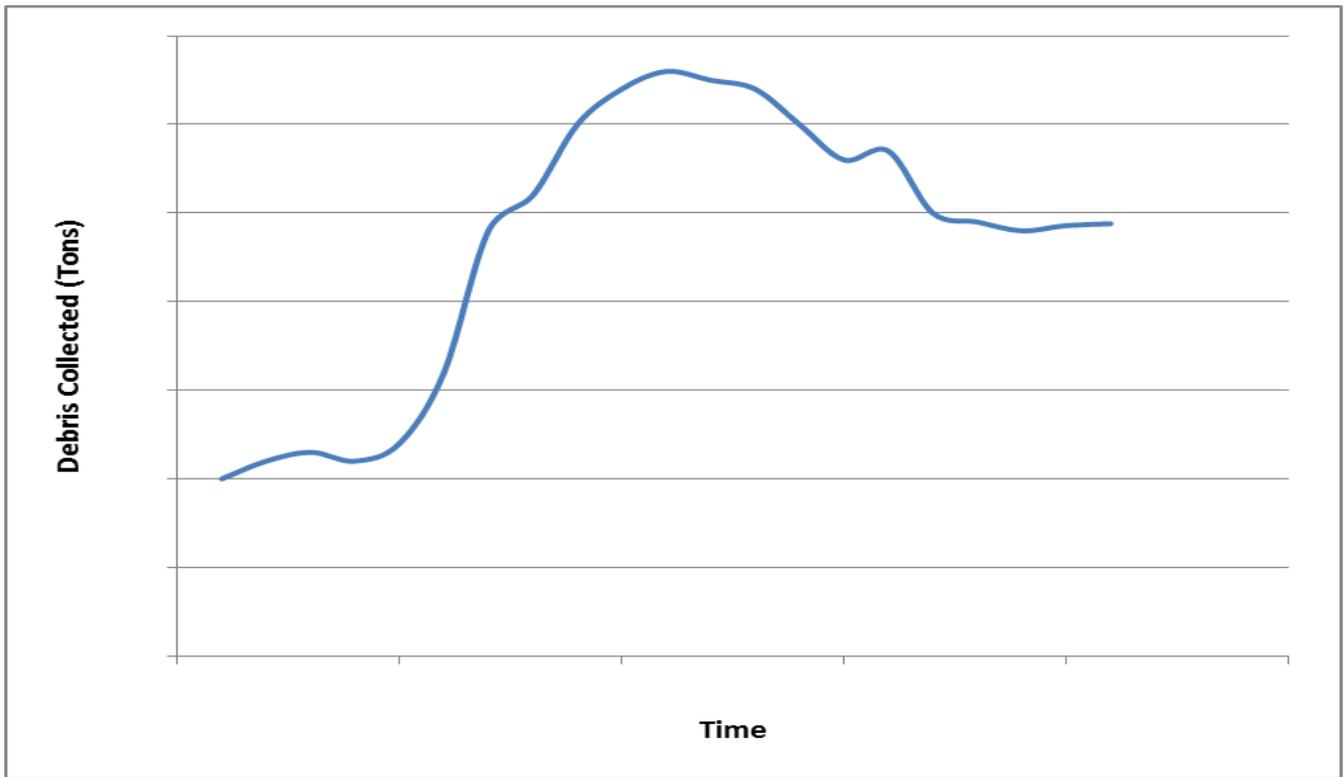


Figure 22: Projected Trash and Debris Collection

In addition, in August of 2014, custom designed sweeping machines were employed to clean alleys in nine neighborhoods. The sweeping schedule will be on days after regular trash collection. The neighborhoods in the alley sweeping program were chosen for wide, paved, and intact alleys, where the mechanical sweepers can be the most effective. If successful, the City will look to expand the program in coming years.

With increased public education and outreach, we expect the amount of trash and debris collected by the mechanical street sweeping program to decrease over the course of this permit (Figure 22). The peak amount collected will be attributed to the mechanical street sweeping program. The decrease will be monitored and attributed to education and outreach programs.

4.2.2 Preventive cleaning of catch basins and debris collectors

In 2015, approximately 760 storm drain inlet screens and inserts will be installed in five neighborhoods – McElderry Park, Baltimore-Linwood, Oliver, Franklin Square, and Carrollton Ridge. The purpose of these screens is to allow stormwater to pass through while keeping trash out, which will also reduce the number of clogged storm drains (for storm events of greater than 1” rain, the screens are designed to open so as to prevent flooding). If the pilot is successful, then additional neighborhoods will be added to the CIP program.

In conjunction with the installation of the storm drain inlet screens, DPW will be initiating a proactive catch basin and debris collector cleaning program. Using 3-1-1 “hot spot” information, DPW will also target problematic storm drains and catch basins and clean these on a regular schedule.

Additionally, over the next four years DPW will be installing several debris collection systems (sometimes called trash interceptors), including Biddison Run, Bush Street, and the repair of Gwynns Run. These debris collectors will be cleaned on a regular, proactive basis.

4.2.3 Illicit Discharge Detection and Elimination (IDDE) program²⁸

DPW’s Office of Compliance and Laboratories (OCAL) is responsible for monitoring the quality of the streams and Harbor in the City of Baltimore. It uses ammonia screening (AS) as a water quality monitoring program designed to rapidly identify potential pollutants with the intent to initiate pollution source tracking (PST).²⁹ In order to better identify and eliminate illicit discharges, OCAL will be hiring additional staff for monitoring and testing. Additionally, a 3-1-1 Service Request category has been created that will allow citizens to report illicit discharges. DPW will also be reviewing the enforcement regulations for IDDE to identify whether any changes are needed to achieve better enforcement.

In November, 2014, an Expert Panel convened by the Chesapeake Stormwater Network evaluated approved eight discharge types for an annual nutrient reduction credit:

1. Laundry Washwater
2. Commercial Car Washing
3. Floor Drains
4. Miscellaneous High Nutrient Non-Sanitary Discharges
5. Sanitary Direct Connections
6. Sewage Pipe Exfiltration
7. Drinking Water Transmission Loss
8. Dry Weather Sanitary Sewer Overflows



*Figure 23: Pollution Control Analyst
(Source: Van Sturtevant)*

The programmatic credit is only available to localities that go above and beyond the minimum requirements set forth under their MS4 permit and SSO consent decree, and is contingent on documentation that their program elements are targeted to screen, detect and correct the nutrient discharges with the highest nutrient loading risk.³⁰

²⁸ The Chesapeake Bay Program and MDE have not quantified the benefit in relation to impervious restoration at this time.

²⁹ The AS program is an alternative methodology to the prescribed sampling listed in the City’s NPDES MS4 permit for Illicit Discharge Detection and Elimination (IDDE).

³⁰ <http://chesapeakestormwater.net/bay-stormwater/baywide-stormwater-policy/urban-stormwater-workgroup/illicit-discharge-detection/>

4.2.4 Erosion and sediment control practices³¹

In 2013, Baltimore City adopted new legislation for erosion and sediment control (Baltimore City Code, Article 7). The legislation updates the City’s erosion and sediment control law, provides clear guidance to developers and property owners, and provides additional authority to enforce violations. To better enforce these measures, OCAL will be hiring additional inspectors in 2015. OCAL will also provide continued education and training to contractors and other city agencies regarding erosion and sediment control. Finally, the City has implemented a 3-1-1 Service Request category allows citizens to report any erosion problems, whether construction sites, street work, or from properties. Although noted in the WIP, no quantified benefits for impervious area restoration and TMDL compliance have been determined at this time.

4.2.5 Public Education and Enforcement³²

DPW recognizes that meeting the City’s MS4 and TMDL requirements cannot be done solely by government – residents, faith organizations, schools, and businesses each play a role. In order to facilitate and expand public education and enforcement of stormwater best practices, OCAL will develop and provide educational material and training in support of the MS4 WIP and the Department’s stormwater management efforts, and assist in the promotion and dissemination of this information. As with identifying project locations, public education and outreach for trash and litter reduction will target areas where storm drain inlet screens are being installed and 311 “hot spots” for clogged inlets and dirty streets and alleys. Encouraging the reduction of stormwater runoff from private properties will target those neighborhoods “upland” of stream restoration projects.

Additionally, DPW will be updating its SWM and ESC Guidelines per state regulation and local policies and making them available on the Clean Water Baltimore website, as well as providing training courses for developers, NGOs, and community leaders regarding the SWM/ESC plans review process. Although noted in the WIP, no quantified benefits for impervious area restoration and TMDL compliance have been determined at this time.

4.2.6 Proposed Methods for Load Reductions

The eligible BMPs approved by the Chesapeake Bay Program are very limited and very expensive in its applicability to ultra-urban environments like the City of Baltimore. In order to offset some of the significant costs of the City’s TMDL Phase II WIP Strategy, the City will conduct studies to quantify the nutrient and sediment removal efficiencies of new, nontraditional BMPs, which include but are not limited to:

- Debris collection systems
- Dry sweep programs
- Public education
- Eroded slope stabilization
- Infrastructure replacement (inflow / infiltration between utility pipes)
- Leaf collection programs
- Pet waste management programs
- Soil amendments (subsoiling)
- Vacant lot management
- Forest patch conservation and enhancement



Figure 24: DPW Community Liaisons providing information at a community festival (Source: DPW)

³¹ See footnote 30.

³² See footnote 30.

4.3 Partnerships

Partnerships are BMPs that are installed by the public, private and non-profit sectors, whether as a requirement for development, projects by environmental non-profits, or stormwater fee credits. It is projected that these projects will restore the equivalent of 271 impervious acres.

4.3.1 Development Requirements

Construction projects with 5,000 square feet of disturbed area or greater are required to meet stormwater management regulations – including city agencies, public and private institutions, and developers. Acceptable stormwater management projects include bio-retention, rain gardens, swales, green roofs, and impervious surface removal. The projections for determining the equivalent acres restored used an average of years 2013 and 2014 along with an expected increase in redevelopment in the City (see Section 2.1 Existing Conditions).

4.3.2 Voluntary Practices & Stormwater Management Credit Fee Program

Over the years, the Parks & People Foundation and Blue Water Baltimore have secured funds to implement various types of BMPs. These projects include right-of-way bioretention, rain gardens, impervious removal at schools, and permeable paving. The projections for equivalent acres restored are based on projects completed in 2014 as well as future projects planned by these partners.

In 2013, the City implemented a stormwater management fee and established a credit program associated with the fee. The purpose of establishing the credit program was to provide a way for ratepayers to reduce their fees, and an incentive for them to implement stormwater management measures. These practices include the installation of rain gardens and BMPs, planting trees, harvesting rainwater, removing impervious surfaces, and volunteering for stormwater participation events.



Figures 25 and 26: Stormwater Participation Events in Lyndhurst and Pigtown (Sources: Cynthia Shaw and Parks & People)

4.4 Suitability by Watershed

Although the City may be considered small in area compared to other MS4 jurisdictions, the variability of the land use conditions, population/ development density, and age / size/ density of infrastructure have determined the practicality of the implementation of BMPs for certain watersheds. Table 6 illustrates the distribution of where BMPs will be targeted.

Table 6: Suitability of BMPs by Watershed

Gwynns Falls	Jones Falls	Back River	Direct Harbor	N. Patapsco
Stream Restoration	Stream Restoration	Stream Restoration		
BMP Retrofits		New BMPs		
Micro-practices	Micro-practices		Micro-practices	
School Greening				
Vacant lots	Vacant Lots		Vacant Lots	
Tree Planting				
IDDE	IDDE	IDDE	IDDE	IDDE
Inlet Screens	Inlet Screens		Inlet Screens	Inlet Screens
Debris Interceptors	Debris Interceptors	Debris Interceptors	Debris Interceptors	
Street Sweeping & Inlet Cleaning				

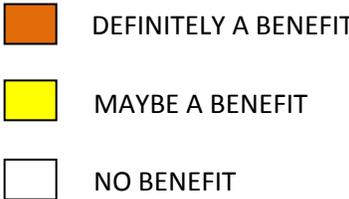
4.5 Prioritization and Benefits

Not all of the projects identified in Appendix A will be implemented. Following Pillar 1, the City has identified more projects than what is needed to meet the current MS4 permit conditions. The surplus projects (listed in Appendix D) may be used by other NPDES permittees or developers meeting offsite mitigation requirements. As part of the adaptive management process, projects will be prioritized based on several factors, including:

- Equitable distribution of implementation across City watersheds, neighborhoods, and demographics and potential to address environmental justice;
- Cost effectiveness of practice compared to load reduction capability;
- Collaboration opportunity with other environmental and sustainability initiatives within the City
- Social and economic benefits to areas surrounding the project location;
- Public outreach and stewardship opportunities to modify behaviors (increase secondary activity-based BMPs for pollution prevention) and decrease maintenance needs;
- Habitat restoration, beyond simple reductions of identified pollutants.

Additionally, while several neighborhoods are targeted for the location of EDS Practices and Facility Greening, other neighborhoods may be considered during the course of the Permit process. These adjustments will be made as part of the Adaptive Management process.

Table 7: Benefits of Green Infrastructure

	Pollutant Reduction	Community Engagement	Job Creation	Habitat Restoration	Reduced Flooding	Reduce Heat Island Effect	Neighborhood Enhancement	Traffic Calming	Recreation / Open Space	Public-Private Partnership / Funding Diversity
										
Stream Restoration	DEFINITELY A BENEFIT	MAYBE A BENEFIT	DEFINITELY A BENEFIT	DEFINITELY A BENEFIT	DEFINITELY A BENEFIT	NO BENEFIT	MAYBE A BENEFIT	NO BENEFIT	MAYBE A BENEFIT	MAYBE A BENEFIT
Tree Planting	DEFINITELY A BENEFIT	DEFINITELY A BENEFIT	NO BENEFIT	DEFINITELY A BENEFIT	MAYBE A BENEFIT	DEFINITELY A BENEFIT	DEFINITELY A BENEFIT	DEFINITELY A BENEFIT	NO BENEFIT	DEFINITELY A BENEFIT
Using vacant land for sw management	DEFINITELY A BENEFIT	NO BENEFIT	DEFINITELY A BENEFIT	NO BENEFIT	DEFINITELY A BENEFIT	DEFINITELY A BENEFIT				
Removing impervious surfaces	MAYBE A BENEFIT	MAYBE A BENEFIT	DEFINITELY A BENEFIT	MAYBE A BENEFIT	DEFINITELY A BENEFIT	DEFINITELY A BENEFIT	DEFINITELY A BENEFIT	NO BENEFIT	DEFINITELY A BENEFIT	DEFINITELY A BENEFIT
Micro-bioretenention and rain gardens - public space	DEFINITELY A BENEFIT	MAYBE A BENEFIT	DEFINITELY A BENEFIT	DEFINITELY A BENEFIT	DEFINITELY A BENEFIT	MAYBE A BENEFIT	DEFINITELY A BENEFIT	DEFINITELY A BENEFIT	MAYBE A BENEFIT	MAYBE A BENEFIT
Micro-bioretenention and rain gardens - private	DEFINITELY A BENEFIT	DEFINITELY A BENEFIT	DEFINITELY A BENEFIT	DEFINITELY A BENEFIT	MAYBE A BENEFIT	MAYBE A BENEFIT	DEFINITELY A BENEFIT	NO BENEFIT	NO BENEFIT	DEFINITELY A BENEFIT
Green Roofs	MAYBE A BENEFIT	NO BENEFIT	DEFINITELY A BENEFIT	DEFINITELY A BENEFIT	DEFINITELY A BENEFIT	DEFINITELY A BENEFIT	NO BENEFIT	NO BENEFIT	NO BENEFIT	DEFINITELY A BENEFIT
Permeable Paving	MAYBE A BENEFIT	NO BENEFIT	DEFINITELY A BENEFIT	NO BENEFIT	MAYBE A BENEFIT	MAYBE A BENEFIT	NO BENEFIT	NO BENEFIT	NO BENEFIT	DEFINITELY A BENEFIT
Street Sweeping	DEFINITELY A BENEFIT	NO BENEFIT	MAYBE A BENEFIT	NO BENEFIT	NO BENEFIT	NO BENEFIT	DEFINITELY A BENEFIT	NO BENEFIT	NO BENEFIT	NO BENEFIT
Inlet Cleaning	DEFINITELY A BENEFIT	MAYBE A BENEFIT	MAYBE A BENEFIT	NO BENEFIT	DEFINITELY A BENEFIT	NO BENEFIT	DEFINITELY A BENEFIT	NO BENEFIT	NO BENEFIT	DEFINITELY A BENEFIT
Illicit Discharge Detection and Elimination	DEFINITELY A BENEFIT	NO BENEFIT	NO BENEFIT	NO BENEFIT	NO BENEFIT	NO BENEFIT	NO BENEFIT	NO BENEFIT	NO BENEFIT	NO BENEFIT
Public Education	DEFINITELY A BENEFIT	DEFINITELY A BENEFIT	NO BENEFIT	MAYBE A BENEFIT	NO BENEFIT	NO BENEFIT	DEFINITELY A BENEFIT	NO BENEFIT	MAYBE A BENEFIT	DEFINITELY A BENEFIT
Erosion and sediment control enforcement	MAYBE A BENEFIT	NO BENEFIT	DEFINITELY A BENEFIT	NO BENEFIT	DEFINITELY A BENEFIT	NO BENEFIT	DEFINITELY A BENEFIT	NO BENEFIT	NO BENEFIT	NO BENEFIT

4.6 Public Outreach

Pillar #5 of Practical Watershed Planning is, “Plan for effective public participation”. In order for the MS4 WIP to be successful, it will need an informed public and engaged partners to review and provide advice on the Plan as well as identify needs and issues that will need to be addressed. The Department of Public Works recognizes and is committed to the role that public outreach and stewardship will play if improved water quality conditions are going to be achieved. This will require engaging a broader and more diverse set of stakeholders who can serve as the leaders and champions for clean water in their communities, including greater participation from minority and faith-based groups, business groups, schools, and neighborhood associations. Additionally, this approach requires working collaboratively with other City agencies to look for better and more efficient ways to communicate messages, cross-train, and create synergies that result in greater engagement, greater awareness, and sustained changes in behavior.

In order to facilitate and lead public outreach and education for the MS4 WIP, the Department of Public Works established the Watershed Liaison Office. The responsibilities of the Watershed Liaison Office are:

- Provide community planning and outreach to neighborhoods where stormwater BMPs are to be located;

- Coordinate with other City agencies, non-profits, and community partners on the planning and implementation of stormwater BMPs;
- Serve as the Department’s “point person” with other City initiatives, such as the Growing Green Initiative and the Casino Area Master Plan;
- Coordinate and staff the Department of Public Work’s Technical Work Group (see below);
- Coordinate and host regular outreach meetings with stakeholder groups, such as the Baltimore Port Alliance, the Baltimore Development Work Group, and the Community Development Network of Maryland;
- Serve on partner-led committees and work groups, including the Healthy Harbor Steering Committee and Trash Work Group. Watershed 263 Council, Urban Waters Federal Partners Partnership, and the Baltimore Ecosystem Study;
- Develop educational and training material in support of the MS4 WIP and the Department’s stormwater management efforts, and assist in the promotion and dissemination of this information;
- Provide outreach and tracking for the stormwater fee credit programs;
- Collect and track information on stormwater management projects by partner organizations; and
- Coordinate grant development and administration for Federal, State, and private foundation funding, as well as administer any DPW grant programs as part of the Stormwater Utility Fund.
- Write the Trash TMDL WIP, including data collection, public outreach, and coordination with DPW’s Solid Waste and Recycling.³³

The Watershed Liaison Office will work closely with other sections within DPW, including the Office of Communications and Community Affairs and the Office of Strategy and Performance.

As outlined above, public outreach will consist of a variety of methods, some led by DPW and others as a partner with other agency and non-profit led efforts. While many of the recommendations build upon existing programs, new outreach programs are also proposed in order to better engage new partner groups.

³³ Baltimore City expects the Trash TMDL to be issued by the end of 2014.

4.6.1 Leadership and Engagement

The following efforts will be led by the Department of Public Works:

Stormwater Advisory Committee (SWAC) - Formed in November, 2014, this committee will advise the Director and the Department on stormwater projects, programs, and issues. The goal in forming this committee is to create a process that is fiscally transparent, has the support of the wider community, and benefits a range of groups in the city.

15 members make up the Advisory Committee from the following stakeholder sectors:

1. Environmental Nonprofit Organizations
2. Industry Groups
3. Business and Development Groups
4. Religious Institutions
5. Anchor Institutions
6. Citizens

The Committee will meet quarterly, and will be staffed and facilitated by the Office of Strategy and Performance. Some of the topics that will be addressed by the Committee include the MS4 annual report, rules and regulations; proposed State legislation; public outreach and education around stormwater, workforce development, budget decisions, and adaptive management. In addition to advising the Director and Department, the SWAC, through the Committee members, will serve to educate stakeholder groups on the stormwater process and programs in place.

Technical Work Group - DPW will be forming a work group in 2015. The purpose of this work group is to share information, resolve issues, and foster collaboration concerning the implementation of stormwater management projects. Members of the work group will be from organizations and agencies who are actively working on putting stormwater projects in the ground. While this group is independent of the SWAC, it will report to the Committee at least once a year.

Outreach and Workforce Development Work Groups – Similar to the Technical Work Group, these groups will include partners who are engaged in various community outreach and workforce development efforts so as to share information, coordinate efforts, and identify target areas and resources needed.

Stakeholder Roundtables - Throughout the year, the Watershed Liaison Office will host meetings of various stakeholder groups from development, industry, religious organizations, and environmental NGOs. These meetings will be an opportunity to discuss the Department's stormwater programs and to solicit questions and issues from these groups in order to inform our adaptive management of the WIP.

Annual Public Progress Meeting - Beginning in FY2016, DPW will hold a public meeting to present progress on the MS4 WIP. The presentation will be a summary of our Annual Report, as well as a look at projects, programs, and partnerships for the coming year.

4.6.2 Partnering and Collaborating

In addition to leading outreach efforts, DPW will continue to serve on partner-led initiatives and work groups, including:

Healthy Harbor Steering Committee - The Healthy Harbor Steering Committee serves as the oversight group for the Healthy Harbor Initiative led by the Waterfront Partnership. The Steering Committee is co-chaired by the Director of Public Works and the Board Chair of the Waterfront partnership.

Healthy Harbor Trash Work Group - A sub-group of the Healthy Harbor Steering Committee; this group addresses trash issues in Baltimore City as related to the quality of water and the harbor. DPW's Watershed Liaison, as well as other staff, are members.

Growing Green Work Group - This work group oversees the City's Growing Green Initiative (see Section 2.7 Other Regulatory Factors: Environmental Initiatives), and is made up of representatives of several city agencies. The Director of DPW is co-chair of the work group.

TreeBaltimore Steering Committee - DPW's Watershed Liaison serves on the committee and will work with the partner organizations to identify targeted planting areas as well as tracking tree planting efforts .

Watershed 263 Council - This group consists of representatives from the neighborhoods and major stakeholders located within the Watershed 263 boundaries in west and southwest Baltimore. The purpose of the Council is to share information and foster collaboration on community greening and stormwater projects. The DPW Watershed Liaison will continue to participate in the quarterly meetings.

Baltimore Urban Waters Federal Partnership - Formed in 2011, the partnership is made up of representatives of federal agencies, environmental non-profits, State agencies, and city and county representatives. Baltimore City DPW staff are members of the partnership and serve on various committees, including Mapping and Local Projects. As part of Urban Waters, DPW is working with the Baltimore Neighborhoods Indicators Alliance to create an interactive, web-based mapping tool for potential, proposed, in-progress, and completed stormwater management projects.

Baltimore Development Work Group / Baltimore Port Alliance / Community Development Network of MD - Maintaining a strong relationship with the business and development community is critical for sharing information and soliciting input on stormwater regulations, legislation, and credit programs. The Office of Compliance and Laboratories will continue to attend regular meetings of these groups.

Green Schools Network - The Baltimore Green Schools Network, which is made up of students, administrators, parents, teachers, and community partners, supports and advances opportunities for school communities to build understanding and to take action to further green and healthy learning and living. DPW will work with the BCPSS to identify opportunities to participate in this network.

4.6.3 Community / School Outreach and Education

In 2012 DPW created the website www.cleanwaterbaltimore.org. Clean Water Baltimore addresses "all things water" and provides an overview of the City's three water utilities – drinking water, wastewater, and stormwater – including compliance with the City's Federal Consent Decree. The web site includes updates on capital projects, events, public meetings, information on how to reduce stormwater pollution, and customer support for billing, fees, and credit programs. MS4 public meetings, plans, and annual reports are also housed on Clean Water Baltimore. The web site was redesigned in 2014. Information posted on the web site is also posted on DPW's Facebook page and Twitter account.³⁴

³⁴ <https://www.facebook.com/BaltimoreCityDepartmentofPublicWorks> and @BaltimoreDPW.

In addition to web and social media, DPW’s Watershed and Community Liaisons regularly provide presentations at community and civic meetings, including information on stormwater fee credits and methods that residents can undertake to reduce stormwater runoff. Increased attention will be given for outreach to minority communities, faith-based organizations, and businesses – not the typical water quality groups – as well as to young adults (ages 25-34) who tend to be more environmentally aware (see Section 2.1 Existing Conditions). This will be accomplished by:

1. Hiring of additional staff for the Watershed Liaison Office, who will assist with these outreach efforts and partnerships;
2. Working in closer collaboration with the DPW Community Liaisons, the Mayor’s Office of Neighborhoods and Constituent Services, and the Department of Planning’s community planners;
3. Regular outreach to community associations, merchant groups (Main Streets), and faith-based organizations; and
4. Attending non-traditional events like the Baltimore Book Festival, African American Heritage Festival, and Artscape.

The Watershed Liaison Office will also assist DPW’s Community Liaisons with educational programs and outreach to public schools, including information on trash reduction, recycling, pet waste, and storm drains, with the connection between these efforts and the health of the harbor. During the 2013-2014 academic year, twenty-four presentations were made at 11 different schools, with 1,041 students participating. DPW will also work with the Baltimore Office of Sustainability and BCPSS’s Green Schools Coordinator to coordinate opportunities for presentations and curriculum-based projects.

In order to support these outreach efforts, DPW will implement the following:

1. Create a “one-stop shop” for resources and information on reducing stormwater pollutants on the cleanwaterbaltimore web site.
2. Implement a stormwater planning and outreach team in the Office of Compliance and Laboratories.
3. Create a consistent set of informational sheets, messages, and signage for reducing stormwater pollutants.³⁵ Bilingual versions of this material will be developed (similar to what was done as part of DPW’s Fats, Oils, and Grease (FOG) Program). Given the large number of BMPs that will be installed across Baltimore, signage at these community locations is important for helping people understand 1) how the project is reducing and cleaning stormwater, 2) other community and environmental benefits, and 3) that the project is being paid for using stormwater fees. In addition signage can recognize any funding partners as well



Figure 27: Clean Water Baltimore web site (Source: DPW)

³⁵ These recommendations focus on stormwater management BMPs; recommendations that target trash reduction will be developed when Baltimore City’s Trash TMDL is approved.

as who to contact if there are any problems.

4. Create an MOU with the Baltimore Office of Promotion and the Arts (BOPA) to incorporate art into stormwater BMP projects, with a particular focus of using art to help educate people about water.
5. Create a pet waste campaign. Pet waste contributes to increased bacteria levels in stormwater runoff. The campaign will include community outreach, working with the Health Department, and developing signage and information that are bi-lingual.

4.7 Maintenance

Having a successful restoration program does not stop with the installation of the facilities. Maintaining public stormwater BMPs is critical to their ability to function as designed (Pillar #3: Plan to maintain). This was one of the top comments and concerns made at the MS4 WIP meetings.

While EPA guidance focuses on the function of facilities, a majority of these practices will be very visible to public, so they need to look good as well. Thus, maintenance can be classified as aesthetic and functional.

- Aesthetic maintenance focuses on how the stormwater facility looks, making sure that it is litter and trash free and that the plants are healthy and attractive. This includes routine maintenance like removing litter and debris, weeding, and mulching. Aesthetic maintenance provides opportunities for collaboration with residents, businesses, and civic groups.
- Functional maintenance makes sure that the facility is properly removing pollutants and filtering stormwater. This includes sediment removal, soil and medium replacement, and inspecting and repairing structural integrity like underdrains and curb/wall replacement. Functional maintenance requires a broader skill set; it is more than mowing or landscaping.

4.7.1 Current Maintenance Practices

Multiple public agencies have installed, and are responsible for, stormwater BMPs, including the Department of Transportation, the Public School System, Baltimore Housing, Department of General Services, Recreation and Parks, and the Department of Public Works. The responsibility for maintaining these BMPs rests with each agency. Some agencies have their own crews who maintain the BMPs, while other agencies use outside contractors to provide these services.

In meetings with city agencies, the following was identified:

- Need for an accurate list of facilities and corresponding responsible agencies;
- Need for maintenance standards; and
- Need for specific training on stormwater BMP maintenance for City staff, community groups, and NGOs.

It has been agreed that the current system can be more effective and efficient. In order to improve maintenance of our current facilities, as well as meet the growing number of stormwater facilities that will be constructed to meet our MS4 and TMDL requirements, DPW will establish a Stormwater BMP Maintenance Team that will maintain all city-owned BMPs, regardless of the agency that installed or is responsible for the facility.³⁶

With each set of BMPs, more crews will need to be hired for preventative maintenance. To determine the number of maintenance staff needed, it is estimated that one crew of 3 people can maintain 10 large BMPs (120 acres) or 60 small BMPs (60 acres) per year. Based on the WIP projections:

- Existing BMPs = 1 crew

³⁶ Tree maintenance will be included in discussions regarding stormwater BMP maintenance roles and responsibilities.

- Large BMPs = 364 acres = 3 crews
- ESD practices = 66 acres = 1 crew
- Alternative BMPs (facility greening) = 38 acres = 1 crew (may be covered by another crew)

While the total number of crews needed would be 5 – 6 by 2018, an initial crew would be hired to maintain existing facilities. Depending on the length of time needed to establish the Stormwater BMP Maintenance Team, the consolidated maintenance might be contracted.

It is projected that the cost of 5 – 6 maintenance crews is \$1.1 million – \$1.4 million / year (based on \$230,000 needed for 1 crew). Utilizing Workforce Development Organizations might reduce the number of crews needed (although funding will be needed for these contract services). The goal is to have a Stormwater BMP Maintenance Plan approved by 2017.

4.7.2 Workforce Development

DPW sees the establishment of a Stormwater BMP Maintenance Team as an opportunity to promote workforce development and local hiring. DPW will explore opportunities for contracting stormwater maintenance to local workforce development organizations, such as Civic Works, Living Classrooms, and Humanim. DPW will also work with local workforce development organizations and employers to determine certification needs, training, and career advancement.

4.7.3 Stewardship

As identified in Appendices A - C, many of the City's BMPs will be installed at parks and schools, in the public right-of-way, and on vacant lots – highly visible locations that are in communities and neighborhoods. While DPW recognizes that the responsibility of these stormwater facilities lies with the city, they also offer opportunities for community partnership and stewardship for aesthetic maintenance.

DPW will work with partner organizations to promote existing programs, like Power in Dirt, the Community Greening Network (CGRN), and the Baltimore Tool Bank, as well as identify education and training needs to help communities adopt maintenance. To further support community stewardship, the creation of STORM Centers will be studied.

The Stormwater Treatment Outreach Resources and Materials Center (STORM Center) will offer community members free or subsidized materials useful to the mitigation of polluted urban runoff: mulch, plants, soil media, leaf bags, rain barrels, etc. The STORM Center will also offer design assistance and advice for rain gardens, green roofs and other stormwater remediation measures. The brick and mortar Center will be complemented by an online Center, which will offer information about stormwater, plans for common projects, an advice forum, and list of available materials and their prices.

Additionally, DPW will explore developing an Adopt-The-Green program that will give community groups incentives to become stewards of BMPs in their neighborhood. Modeled on the successful Adopt-A-Stream and Adopt-A-Road programs, various groups—corporate partners, local businesses, churches, neighborhood associations, and concerned individuals— will commit to maintain and monitor one or more BMPs. Each group will have an Adopt-a-Green sign that will identify them with the site. Providing stormwater fee credits for Adopt-a-Green will also be considered.

5 MILESTONE SCHEDULE

To promote continual progress, EPA’s accountability framework for restoring the Chesapeake Bay calls on states to identify milestones to be reached in two-year increments. The two-year milestones are also tracked closely by Maryland’s BayStat accountability system. There are two broad categories of milestones:

- Program enhancement actions needed to increase resources and improve the implementation processes to accelerate future restoration.
- Implementation actions are on-the-ground activities that will result in nutrient and sediment load reductions.

In 2011, Baltimore City submitted its Phase II WIP Milestones to MDE describing how they plan to reduce pollution from sources in the urban/developed sectors. These were updated for 2014-2015.³⁷

Baltimore’s Milestones are programmatic (staffing, policies and guidelines, program enhancement, etc.) and projects (stream restorations, ESDs, etc).

Table 8: Milestones Schedule

Fiscal Year	Description
	Program Milestones
FY14	Initiate a pilot design competition to test the Green Pattern Book and initial grant assignment
	Increase staff by 8 FTE by hiring or contracting for engineering, monitoring and enforcement.
	Initiate Street Sweeping Enhancement Plan
	Publish water quality (ammonia screening and stream impact sampling) on Cleanwater Baltimore website
FY 2015	Increase staff by 13 FTE by hiring or contracting for engineering, monitoring and enforcement.
	Update SWM and ESC Guidelines per state regulation and local policies to facilitate SWM and ESC Guidelines available on website
	Initiate and provide training courses for developers, NGOs, and community leaders regarding the SWM/ESC plans review process
	Modify review process to facilitate restoration practices, including alternative plan review structure and technical certification requirements.
	Implement preventative inlet cleaning in targeted neighborhoods of the City. The effort will be in collaboration with inlet screen installation and expanded street sweeping operations.
	Create integrated tracking database for SWM/ESC plans review and inspections, including GIS elements, standard reports, paperless field report / input, and work order assignments.
	Expand Urban Waters interactive mapping tool to include SWM BMPs.
	Begin working with 4 neighborhoods on stormwater planning
Initiate the Technical Work Group	

³⁷ http://www.mde.state.md.us/programs/Water/TMDL/TMDLImplementation/Documents/Milestones/2014-2015/Local/2014-2015_Baltimore_City_Milestones.pdf

Baltimore City MS4 and TMDL Watershed Implementation Plan

Fiscal Year	Description
FY2015	Complete an Outreach plan for MS4 WIP, including initiating the Outreach Work Group
	Work with the Office of Sustainability and DPW Solid Waste to create a community-based "Baltimore Clean Corps"
FY 2016	Update 2-Year Milestones (2016-2017)
	Complete Trash TMDL WIP
	Develop standardized designs and supporting calculations for ESD practices
	Complete feasibility studies for private participation incentive programs, such the Adopt the-Green program and STORM Centers.
	Complete feasibility study for the use of recycled materials in BMP construction as a sustainable alternative to material disposal.
	Develop Stormwater BMP maintenance plan for city-owned facilities, including staffing, budget, and funding FY16
	Increase staff by 6 FTE by hiring or contracting for utility maintenance
	Create a "one-stop shop" for resources and information on reducing stormwater pollutants
	Hire community planner in Office of Compliance and Laboratories FY16
	Develop and implement 3 training workshops for community stormwater BMP maintenance
	Begin working with 10 neighborhoods on stormwater planning
Create a consistent set of informational sheets, messages, and signage for reducing stormwater pollutants.	
FY 2017	Begin working with 3 neighborhoods on stormwater planning
	Increase staff by 2 FTE by hiring or contracting for community outreach
	Approve Stormwater BMP Team FY17
	Complete an analysis of city-owned facilities for possible impervious removal and sw retrofits
	Create an MOU with the Baltimore Office of Promotion and the Arts (BOPA) to incorporate art into stormwater BMP projects,
FY 2018	Update 2-Year Milestones (2018-2019)
	Create a pet waste campaign
Project Milestones	
FY14	2,500 trees planted
FY2015	0.4 miles of stream restoration
	1.2 acres restored using ESD Practices
	5,000 trees planted
FY2016	Complete Watershed Assessment report for Direct Harbor Watershed

Fiscal Year	Description
	0.9 miles of stream restoration
FY2016	60 acres restored using Traditional BMPs
	2.9 acres restored using ESD Practices
	1.7 acres of impervious removal and greening projects
	5,000 trees planted
FY2017	Create Watershed Assessment report for Lower North Branch of the Patapsco
	1.8 miles of stream restoration
	5,000 trees planted
FY2018	Update the Watershed Assessment report for the Lower Gwynns Falls
	Update the Watershed Assessment report for the Lower Jones Falls
	6.0 miles of stream restoration
	237 acres restored using Traditional BMPs
	35 acres restored using ESD Practices
	15.5 acres of impervious removal and greening projects
	5,000 trees planted
FY2019	Update the Watershed Assessment report for the Upper Back River
	1.0 mile of stream restoration
	53 acres restored using Traditional BMPs
	25 acres restored using ESD Practices
	20.3 acres of impervious removal and greening projects
	5,000 trees planted

5.1 Tracking Mechanisms

The City will track all BMPs (both planned and constructed) using an Access database and GIS tracking tool. The tracked data will coincide with MS4 permit reporting requirements. A majority of BMP implementation will be reported through the permitting process for construction activities. The credit program for the proposed stormwater fee will provide an incentive for private property owners to report all practices that are part of this Phase II WIP. OCAL will be responsible for maintaining these databases.

The Program and Project Milestones will also be updated as per the development of 2-Year Milestones as part of the Phase II WIP.

5.2 STAFFING

Under this strategy the pace of implementation is required to significantly increase. Meeting our MS4 and TMDL requirements will require an increase in the design and construction of stormwater capital projects, inspection

of facilities, water quality testing and analysis, community outreach, and maintenance. This will require increased staffing and contractual services. New employees include engineers, scientists, inspectors, technicians, community planners, and maintenance staff (Table 9).

The most significant increases will be for plan review and inspections (in order to reduce plan review time and approval and increase the number of site inspections), project implementation (providing dedicated project management and in-house design and engineering), and education and outreach (build community capacity by targeting new partner groups that provide the necessary leadership, oversight, and sustained effort to change behaviors and foster stewardship).

Table 9: Anticipated Staffing for DPW Related to the WIP

Program	Current	Future Increase
Plan Review & Inspections	13	8-10
Water Quality Monitoring & IDDE	14	5-8
Project Implementation (Engineering & Construction)	13	20-30
Education & Outreach	1	2-6
Stormwater BMP Maintenance	NA	15-18*
Inlet Cleaning	3	3

* Some of the Stormwater BMP maintenance may be contracted to Workforce Development organizations

6 ADAPTIVE MANAGEMENT

Sound implementation strategies require ongoing assessment and effective adaptation to respond to changing conditions, new technologies, and lessons learned. This will be the basis of the plan that will be used when benchmarks are not met and the projected funding is inadequate. (Pillar #6: Plan to adapt)

Adaptive management requires monitoring of a variety of measures that can be used to determine whether progress is being made towards meeting the MS4 and TMDL water quality objectives. Ultimately, it is the in-stream water quality and the loading limits with respect to the TMDLs that determine the success of implementation; however, there are many interim measures that can also be correlated to success, which are worth pursuing.

For many restoration strategies, it may be difficult to tease out their individual effectiveness in terms of pollutant load reductions, but collectively, the monitoring and tracking that occurs should provide adequate insight into the overall effectiveness of the implementation strategy. In addition to the monitoring and assessment, Baltimore City will be reporting results on an annual basis as part of their NPDES MS4 Permit annual report. The MS4 Permit requires annual reporting of the following:

- The status of implementing the components of the stormwater management program that are established as permit conditions
- A narrative summary describing the results and analyses of data, including monitoring data that is accumulated throughout the reporting year;
- Expenditures for the reporting period and the proposed budget for the upcoming year;
- A summary describing the number and nature of enforcement actions, inspections, and public education programs;
- The identification of water quality improvements and documentation of progress toward meeting applicable WLAs developed under EPA approved TMDLs; and
- The identification of any proposed changes to the City's program when WLAs are not being met.

The City will build upon annual reporting that has historically occurred to meet permit requirements and will supplement this reporting with tracking table summaries that quantify implementation activities for the range of strategies pursued during that year so that the following can be incorporated and evaluated:

- Adherence to the WIP plan of action and project schedule (design and construction)
- Meeting Milestones
- New technology and innovation practices
- Changes to any stormwater laws, rules and regulations
- Resource availability
- Monitoring Results

As described in the Public Outreach section, the Stormwater Advisory Committee will review the MS4 Permit Annual Report and the adaptive management plan on an annual basis. Any changes to the WIP as a result of adaptive management will be shared through the Stormwater Advisory Committee members and on www.cleanwaterbaltimore.org.

7 FINANCIAL STRATEGY

7.1 Stormwater Utility

The estimated cost for capital projects are shown in Appendix A. In order to fund these projects and the operations to comply with the MS4 permit, a referendum was passed in 2012 to change the City Charter to create a Stormwater Utility. A Stormwater Utility is an enterprise fund that protects the revenues collected from stormwater remediation fees. It provides:

- A more equitable system: contributors to stormwater runoff share based on a metric directly connected with the service provided.
- A stable level of funding: ensures that stormwater management receives adequate support, independent of the City's tax rate and General Fund.
- A dedicated fund: revenues are used solely for stormwater management purposes. This also allows the City to sell bonds which will keep rates stable for longer.

In September 2013, the City implemented the Maryland Stormwater Fee and began charging the fee to Baltimore City property owners on their quarterly water bill. The Stormwater Fee provides a sustainable, dedicated revenue source for maintaining, operating, and improving the City's stormwater management system, with the ultimate goal of reducing flooding and erosion, and keeping our waterways cleaner. The City's stormwater fees are based on the amount of impervious area on a property. It is anticipated that the fees will yield about \$24 million in the first year.³⁸

The Stormwater Utility functions as an enterprise fund, which allows the City to build a reserve and use these funds to leverage revenue bonds. This is similar to the debt service mechanism used by the City's Water and Waste Water utilities to fund their capital improvement projects. In addition to the stormwater fees, plans review and other miscellaneous fees go into this fund. (Pillar #2: Plan for resources that will affect funding needs). For the purposes of this WIP, it is anticipated that the projects and programs listed in Appendix A and B will be funded by the Stormwater Utility or by a debt service mechanism (such as a general obligation bond or a county transportation bond) that will be paid down using the Stormwater Utility.

7.2 Credit Program

Customers may earn credits against their fee by adopting best management practices like installing rain gardens or planting trees. Single- family properties may also earn credits by participating in organized clean ups or other approved activities.

The purpose of establishing a stormwater credit program is to provide a way for ratepayers to reduce their fees, and an incentive for them to implement stormwater management measures. A credit system aims to protect water quality, create equity in the payment system, reduce public expenditures on stormwater management, and promote private sector stormwater management. The credit program also helps to foster private investment and stewardship at one's home and in their community. Projects that have been approved to receive a stormwater remediation credit will be counted toward the MS4 restoration goal.

³⁸ The total amount of stormwater fee billings from September 15, 2013 through June 30, 2014 is \$23,390,580. This is an unaudited figure and therefore may not necessary represent the final stormwater fee revenue amount for FY2014.

7.3 Other Sources of Funds

7.3.1 Grants

Currently, DPW has a Chesapeake & Atlantic Coastal Bays Trust Fund grant from the Maryland Department of Natural Resources for the installation of two BMPs in Watershed 263. The goal of the Department is to increase the number of outside grants (Federal, State, Foundations) in order to leverage public dollars. To meet this goal, a grant procurement officer will be hired for the Watershed Liaison Office.

DPW will also continue to work with our partner NGOs and the Baltimore Ecosystem Study to support grant proposals that they are submitting, providing guidance, letters of support, and matching funds if necessary.

7.3.2 Leveraging other Agency Capital Improvement Program (CIP) Funds

One of the goals of our Watershed Implementation Plan is to work collaboratively with other city agencies in the installation of stormwater BMPs. Often there are CIP projects like roof replacements, new parking lots, or street reconstructions that could incorporate an ESD practice beyond its stormwater management requirements. DPW will continue to work with other agencies to identify opportunities for stormwater projects that would allow us to leverage our stormwater utility fund dollars with other City funds.

7.3.3 Casino Revenue

The State legislation authorizing gaming in Maryland provided that a portion of the proceeds from each gaming facility must be used as local impact aid to benefit the surrounding communities. Local impact aid may be used for: infrastructure improvements, facilities, public safety, sanitation, economic and community development, including housing and other public services and improvements. Impact funds are allocated to the Mayor and City Council of Baltimore, but the City is required to develop a multi-year spending plan for the expenditure of these funds in consultation with the Baltimore Local Development Council (LDC).

The Department of Planning is spearheading a long-range master planning process – the Casino Area Master Plan – to account for the Horseshoe Casino that opened in Baltimore in 2014. The boundaries of the planning area extend from Cherry Hill in the south to Federal Hill and Sharp-Leadenhall on the east, Ridgely's Delight to the north, and Carroll-Camdern and Lakeland to the west. This plan's recommendations and priorities will guide the development of future impact aid spending plans.

Several of the recommendations made in the plan address water quality, trash, and the quality of the Middle Branch. The Department of Public Works has been a partner in the development of the master plan and will continue to work with the Planning Department to identify funds that can be used for stormwater projects in the neighborhoods within the master plan boundaries.

7.3.4 Off-Site Mitigation / Stormwater Banking

DPW is exploring the creation of a stormwater bank and the process for providing off-site mitigation sites to private developers, businesses, and industries.

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APPENDIX A – Summary of Projects

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MS4 WIP Project ID	BMP Type	Watershed	Location	Eq. Imp Area Restored (ac)	Estimated Pollutant Removal (lbs / yr)			Estimated Capital Cost	Schedule to Start (FY)		NOTES
					TN	TP	TSS		Design	Construction	
Structural / Traditional BMPs											
S01	SW Pond Retrofit	Gwynns Falls	Gwynns Run, Carrolton Park	25	132	17	15,525	\$505,000	2016	2018	Expansion and retrofit to increase pollutant removal efficiency
S02	SW Pond Retrofit	Gwynns Falls	SetonBusiness Park Park	41	214	27	25,169	\$795,000	2016	2018	Expansion and retrofit to increase pollutant removal efficiency
S03	Pond Retrofit and New Pond	Back River	North Point Road @ Kane and Quad	60	317	40	37,260	\$3,290,000	2015	2016	Ref: Drainage Study Report 2012. Includes infrastructure improvement for flooding.
S04	Wetland / Pond	Back River	Perring Parkway at Cloville (HR-R28B)	15	63	13	8,484	\$344,000	2016	2018	Ref:Back River SWAP
S05	Wetland / Pond	Back River	Herring Run Park below Shannon at Lyndale (HR-R15C)	20	84	17	11,465	\$550,000	2016	2018	Ref:Back River SWAP
S06	Wetland	Back River	Herring Run Park below Shannon at Kavon Ave (HR-R39)	20	84	17	11,465	\$550,000	2016	2018	Ref:Back River SWAP
S07	Wetland	Back River	Herring Run Park below Parkside at Sinclair (HR-R15A)	65	275	56	37,260	\$1,600,000	2016	2018	Ref:Back River SWAP
S08	Wetland	Back River	Chinquapin Run Park between Belvedere and Alameda (CH-R6A)	45	190	39	25,795	\$1,840,000	2016	2018	Ref:Back River SWAP
S09	Bioretention Area	Baltimore Harbor	Faring Baybrook Park Rec Center (MC-18a)	3	17	3	1,702	\$160,000	2016	2018	Ref: Masonville Cove SWAP 2014
S10	Bioretention Area	Gwynns Falls	Park Hts Virginia + Homer	2	11	2	1,135	\$60,000	2016	2018	Ref: UPWP / Sabra Wang Study
S11	Shallow extended detention wetland	Jones Falls	West Colspring and Brand Ave (LJ-R9)	9	46	8	4,624	\$212,000	2016	2018	Ref: Lower Jones Falls SWAP
S12	Shallow wetland	Jones Falls	Woodheights and La Plata (LJ-R38)	4	21	3	2,102	\$96,000	2016	2018	Ref: Lower Jones Falls SWAP
			Subtotal Structural / Traditional:	309	1,455	243	181,986	\$10,002,000			
ESD Practices											
E01	Micro-bioretention	Baltimore Harbor	Cloverleaf - northwest of I-895 and Frankfurst Ave (MC-30)	0.4	2.1	0.34	217	\$50,000	2016	2019	Ref: Masonville Cove SWAP 2014
E02	Micro-bioretention	Baltimore Harbor	Bush St. Curb bump-out	0.2	1.2	0.20	127	\$80,000	2011	2015	Ref: WS 263
E03	Micro-bioretention	Baltimore Harbor	Lafayette inner block retrofit.	0.7	4.0	0.64	411	\$240,000	2011	2015	Ref: WS 263
E04	Micro-bioretention	Baltimore Harbor	Ben Franklin HS (MC-3a)	0.1	0.3	0.05	30	\$15,000	2015	2016	Ref: Masonville Cove SWAP 2014
E05	Micro-bioretention	Baltimore Harbor	Ben Franklin HS (MC-3b)	0.0	0.2	0.03	18	\$42,000	2015	2016	Ref: Masonville Cove SWAP 2014
E06	Micro-bioretention	Baltimore Harbor	Ben Franklin HS (MC-3c)	0.0	0.2	0.03	18	\$15,000	2015	2016	Ref: Masonville Cove SWAP 2014
E07	Micro-bioretention	Baltimore Harbor	Faring Baybrook Park (MC-11a)	0.2	1.0	0.15	97	\$54,000	2015	2016	Ref: Masonville Cove SWAP 2014

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MS4 WIP Project ID	BMP Type	Watershed	Location	Eq. Imp Area Restored (ac)	Estimated Pollutant Removal (lbs / yr)			Estimated Capital Cost	Schedule to Start (FY)		NOTES
					TN	TP	TSS		Design	Construction	
E08	Micro-bioretenion	Baltimore Harbor	Faring Baybrook Park (MC-11b)	0.1	0.7	0.10	66	\$30,000	2015	2016	Ref: Masonville Cove SWAP 2014
E09	Micro-bioretenion	Baltimore Harbor	Faring Baybrook Park (MC-12a)	0.2	0.9	0.14	91	\$54,000	2015	2016	Ref: Masonville Cove SWAP 2014
E10	Micro-bioretenion	Baltimore Harbor	Faring Baybrook Park (MC-12b)	0.2	1.1	0.17	109	\$60,000	2015	2016	Ref: Masonville Cove SWAP 2014
E11	Micro-bioretenion	Baltimore Harbor	Faring Baybrook Park (MC-13a)	0.1	0.5	0.08	54	\$27,600	2015	2016	Ref: Masonville Cove SWAP 2014
E12	Micro-bioretenion	Baltimore Harbor	Faring Baybrook Park (MC-13b)	0.2	1.0	0.16	103	\$50,400	2015	2016	Ref: Masonville Cove SWAP 2014
E13	Micro-bioretenion	Baltimore Harbor	Curtis Bay ES/MS (MC-17b)	0.2	1.1	0.18	115	\$66,000	2015	2016	Ref: Masonville Cove SWAP 2014
E14	Micro-bioretenion	Baltimore Harbor	Bay Brook MS (MC-18b)	0.3	1.5	0.2	157	\$54,000	2015	2016	Ref: Masonville Cove SWAP 2014
E15	Micro-bioretenion	Baltimore Harbor	Bay Brook MS (MC-18c)	0.2	1.1	0.2	115	\$46,800	2015	2016	Ref: Masonville Cove SWAP 2014
E16	Micro-bioretenion	Baltimore Harbor	Bay Brook MS - parking lot (MC-18d)	0.2	1.1	0.2	115	\$34,800	2015	2016	Ref: Masonville Cove SWAP 2014
E17	Micro-bioretenion	Baltimore Harbor	Duane Ave Park (MC-23)	0.2	1.2	0.2	121	\$38,400	2015	2016	Ref: Masonville Cove SWAP 2014
E18	Micro-bioretenion	Baltimore Harbor	Brooklyn / Curtis Bay	0.9	5.0	0.8	513	\$19,800	2015	2016	Each project = 10 locations = 5 ac treated
E19	Micro-bioretenion	Baltimore Harbor	Patterson Park (HA-R5A)	0.2	1.4	0.2	139	\$40,000	2016	2018	Ref: WS 246 SWAP
E20	Micro-bioretenion	Baltimore Harbor	Ellwood Park (HA-R8)	0.1	0.7	0.1	72	\$21,000	2016	2018	Ref: WS 246 SWAP
E21	Micro-bioretenion	Baltimore Harbor	Patterson Park Adjunct (HA-R6)	0.6	3.6	0.6	362	\$105,000	2016	2018	Ref: WS 246 SWAP
E22	Micro-bioretenion	Baltimore Harbor	Patterson Park / Highlandtown / Baltimore Highlands	4.1	24.1	3.79	2,446	\$710,000	2016	2018	GGI / Green Streets
E23	Micro-bioretenion	Back River	Frankford / Greater Lauraville / Belair-Edison / Cedonia	3.6	21.6	3.40	2,198	\$671,000	2016	2018	GGI / Green Streets
E24	Micro-bioretenion	Back River	Erdman Avenue	1.2	6.8	1.07	694	\$128,000	2016	2018	BENI Green Streets projects / CWP
E25	Micro-bioretenion	Back River	Belair Road	0.2	1.2	0.20	127	\$77,000	2016	2018	BENI Green Streets projects / CWP
E26	Micro-bioretenion	Jones Falls	Hampden / Remington / Wyman Park	5.0	29.7	4.67	3,020	\$850,000	2016	2018	GGI / Green Streets
E27	Micro-bioretenion	Gwynns Falls	Howard Park / Grove Park / West Arlington / Fairmount	2.5	14.9	2.34	1,510	\$420,000	2016	2018	GGI / Green Streets
E28	Micro-bioretenion	Gwynns Falls	Hunting Ridge / Rognel Hts / Edmondson Village / Edgewood	2.5	14.9	2.34	1,510	\$420,000	2016	2018	GGI / Green Streets
E29	Micro-bioretenion	Baltimore Harbor	Sharp-Leadenhall / Federal Hill / Otterbein / S. Baltimore	1.3	7.4	1.17	755	\$215,000	2016	2018	GGI / Green Streets

APPENDIX A: Summary of Projects

MS4 WIP Project ID	BMP Type	Watershed	Location	Eq. Imp Area Restored (ac)	Estimated Pollutant Removal (lbs / yr)			Estimated Capital Cost	Schedule to Start (FY)		NOTES
					TN	TP	TSS		Design	Construction	
E30	Micro-bioretenion	L. N. Branch Patapsco	Cherry Hill	2.5	14.9	2.34	1,510	\$500,000	2016	2018	GGI / Green Streets
E31	Micro-bioretenion	Baltimore Harbor	Lakeland / Mt. Winans / Westport	1.3	7.4	1.17	755	\$420,000	2016	2018	GGI / Green Streets
E32	Micro-bioretenion	Baltimore Harbor	McElderry Park / CARE / Milton-Montford / Patterson Place	2.5	14.9	2.34	1,510	\$438,000	2016	2018	GGI / Green Streets
E33	Micro-bioretenion	Gwynns Falls	Greater Mondawmin / Walbrook / Rosemont / NW Community Action /	2.5	14.9	2.34	1,510	\$438,000	2016	2018	GGI / Green Streets
E34	Micro-bioretenion	Jones Falls	Mt. Washington / Glen / Cheswolde / Cross Country	5.0	29.7	4.67	3,020	\$1,350,000	2016	2018	GGI / Green Streets
E35	Micro-bioretenion	Back River	Cameron Village / Chinguapin Park (upstream to Chinguapin Run)	4.0	23.8	3.74	2,416	\$680,000	2017	2019	GGI / Green Streets
E36	Micro-bioretenion	Back River	De Wees Park	1.0	5.9	0.93	604	\$180,000	2017	2019	GGI / Green Streets
E37	Micro-bioretenion	Back River	Orchard Ridge / Armistead Gardens / Orangeville	5.0	29.7	4.67	3,020	\$630,000	2017	2019	GGI / Green Streets
E38	Micro-bioretenion	Jones Falls	Central Park Heights / Towanda Grantley / Lucille Park	4.0	14.9	2.34	1,510	\$513,000	2017	2019	GGI / Green Streets
E39	Micro-bioretenion	Gwynns Falls	MorrellPark / Wilhelm Park / Gwynns Falls / Carroll-South Hilton	6.0	14.9	2.34	1,510	\$625,000	2017	2019	GGI / Green Streets
E41	Micro-bioretenion	Back River	Clifton Park	0.2	1.2	0.19	121	\$35,000	2017	2019	Ref: Back River SWAP
E42	Micro-bioretenion	Back River	Clifton Park	2.3	13.7	2.15	1,389	\$400,000	2017	2019	Ref: Back River SWAP
			Subtotal ESD Practices:	62	336	53	34,180	\$10,843,800			
Alternative BMPs											
A01	Stream Restoration	Gwynns Falls	Leaking Park Stream Restoration at Fairmount Storm Drain	31	156	141	62,400	\$700,000	Completed	Complete	
A02	Stream Restoration	Jone Falls	Lower Lower Stony Run	68	338	306	135,000	\$4,030,000	2015	2016	Ref: Lower Jones Falls SWAP
A03	Stream Restoration	Gwynns Falls	Powder Mill Phase 1	59	293	265	117,000	\$3,420,000	2009	2017	MTA Red Line / portion above mitigation needs credited to the City
A04	Stream Restoration	Jone Falls	East Stony Run Project 1	12	60	54	24,000	\$839,000	2014	2017	Ref: Lower Jones Falls SWAP
A05	Stream Restoration	Back River	Chinguapin Run Project 1	33	165	150	66,000	\$3,670,000	2014	2017	
A06	Stream Restoration	Back River	Chinguapin Run Project 2	39	195	177	78,000	\$1,772,000	2015	2017	
A07	Stream Restoration	Gwynns Falls	Franklintown Culvert	36	180	163	72,000	\$1,700,000	2015	2018	
A08	Stream Restoration	Back River	Lower Moore's Run Project 2	38	188	170	75,000	\$1,960,000	2015	2018	

APPENDIX A: Summary of Projects

MS4 WIP Project ID	BMP Type	Watershed	Location	Eq. Imp Area Restored (ac)	Estimated Pollutant Removal (lbs / yr)			Estimated Capital Cost	Schedule to Start (FY)		NOTES
					TN	TP	TSS		Design	Construction	
A09	Stream Restoration	Back River	Biddison Run Project 2	45	227	206	90,900	\$3,590,000	2014	2018	
A10	Stream Restoration	Gwynns Falls	Western Run at Kelly Avenue	12	60	54	24,000	\$1,324,600	2015	2018	
A11	Stream Restoration	Jone Falls	East Stony Run Project 2	20	101	91	40,200	\$2,040,000	2015	2018	
A12	Stream Restoration	Back River	Biddison Run Projects 3	58	289	262	115,500	\$1,800,000	Complete	2018	
A13	Stream Restoration	Back River	Moore's Run Restoration Project 1	38	188	170	75,000	\$1,822,000	2015	2018	
A14	Stream Restoration	Back River	Moore's Run Restoration Project 2	42	210	190	84,000	\$1,822,000	2015	2018	
A15	Stream Restoration	Back River	Herring Run stream	40	200	181	79,950	\$2,702,000	2015	2018	Back River SWAP
A16	Stream Restoration	Jones Falls	Druid Hill Park Stream Project	28	141	128	56,250	\$2,702,000	2015	2018	Lower Jones Falls SWAP
A17	Stream Restoration	Gwynns Falls	Lower Gwynns Falls	39	195	177	78,000	\$2,702,000	2015	2018	Gwynns Falls Watershed Assessment
A18	Stream Restoration	Gwynns Falls	Lower Gwynns Falls	39	195	177	78,000	\$2,702,000	2015	2018	Gwynns Falls Watershed Assessment
A19	Stream Restoration	Gwynns Falls	Lower Gwynns Falls	35	173	156	69,000	\$2,702,000	2015	2018	Gwynns Falls Watershed Assessment
A20	Stream Restoration	Gwynns Falls	Dead Run	33	165	150	66,000	\$2,702,000	2016	2019	Gwynns Falls Watershed Assessment
A21	Stream Restoration	Back River	Herring Run Western Branch	40	201	182	80,250	\$2,702,000	2016	2019	Herring Run Stream Assessment
A22	Regenerative Step Pool Storm Conveyance	Gwynns Falls	Seamon Avenue	0	1,231	57	19,600	\$1,168,000	2015	2017	Infrastructure improvement
A23	IA Removal, afforestation, bioretention	Direct Harbor	CARE Communities / McElderry Park / Milton-Montford	3.75	19.2	4.34	2852	\$496,000	2016	2018	Ref: Direct Harbor Characterization
A24	IA Removal, afforestation	Direct Harbor	Harford Hts ES (HA-R19)	0.60	3.3	0.92	523	\$110,000	2016	2018	GGI / Green Streets
A25	IA Removal, afforestation, bioretention	Back River	Northwood ES and Rec Center (CH-R2A)	2.85	14.6	3.30	2167	\$565,000	2016	2018	Ref:Back River SWAP
A26	IA Removal, afforestation	Back River	Sinclair Lane ES (HR-R18)	1.31	7.3	2.03	1154	\$260,400	2016	2018	Ref:Back River SWAP
A27	IA Removal, afforestation	Back River	WEB DuBois (HR-R29A)	0.53	2.9	0.81	461	\$104,200	2016	2018	Ref:Back River SWAP
A28	IA Removal, afforestation, bioretention	Back River	Various Schools	0.6	3.1	0.70	456	\$120,000	2016	2018	Location to be determined based on final school construction schedule.
A29	IA Removal, afforestation, bioretention	Gwynns Falls	Mt. Winans	3.75	19.2	4.34	2852	\$496,000	2016	2018	GGI / Green Streets
A30	IA Removal, afforestation, bioretention	Back River	Montebello ES (HR-R41A)	1.05	5.4	1.22	799	\$208,000	2016	2018	Ref: Back River SWAP

APPENDIX A: Summary of Projects

MS4 WIP Project ID	BMP Type	Watershed	Location	Eq. Imp Area Restored (ac)	Estimated Pollutant Removal (lbs / yr)			Estimated Capital Cost	Schedule to Start (FY)		NOTES
					TN	TP	TSS		Design	Construction	
A31	IA Removal, afforestation, bioretention	City-wide	Various Schools	1.76	9.0	2.03	1335	\$350,000	2016	2018	GGI / Green Streets
A32	IA Removal, afforestation, bioretention	Jones Falls	Pimlico ES (LJ-R6)	1.35	6.9	1.56	1027	\$268,000	2016	2018	Ref: Lower Jones Falls SWAP
A33	IA Removal, afforestation, bioretention	Jones Falls	Poly Western HS (LJ-R8C)	1.65	8.5	1.91	1255	\$328,000	2016	2018	Ref: Lower Jones Falls SWAP
A34	IA Removal, afforestation, bioretention	Direct Harbor	Duane Avenue Park - parking lot (MC-21)	0.35	1.8	0.40	262	\$42,000	2016	2018	Ref:Masonville Cove SWAP 2014
A35	IA Removal, afforestation	Direct Harbor	Oliver / Broadway East	1.75	10.9	1.59	818	\$496,000	2017	2019	GGI / Green Streets
A36	IA Removal, afforestation	Gwynns Falls	Carrollton Ridge / Shipley Hill / Mill Hill / Pigtown / New Southwest / Union	1.75	10.9	1.59	818	\$496,000	2017	2019	GGI / Green Streets
A37	IA Removal, afforestation	Direct Harbor	Harlem Park / Sandtown-Winchester / Uplands	0.88	10.9	1.59	818	\$248,000	2017	2019	GGI / Green Streets
A38	IA Removal, afforestation	Direct Harbor	Various Schools	0.88	10.9	1.59	818	\$248,000	2017	2019	GGI / Green Streets
A39	Aforestation of IA	Gwynns Falls	Central Park Heights	0.88	10.9	1.59	818	\$248,000	2017	2019	GGI / Green Streets
A40	Aforestation of IA	Gwynns Falls	City-wide	5.81	10.9	1.59	818	\$496,000	NA	2017	GGI / Green Streets
A41	Aforestation of IA	Jones Falls	City-wide	5.81	10.9	1.59	818	\$496,000	NA	2018	GGI / Green Streets
A42	Aforestation of IA	City-wide	City-wide	2.91	10.9	1.59	818	\$248,000	NA	2019	GGI / Green Streets

APPENDIX B – Summary of Programs

APPENDIX B: Summary of Programs

Project No. / Type	Debris Collected	Equivalent Impervious Area Restoration (ac)	Estimated Pollutant Removal (lbs / yr)			NOTES
			TN	TP	TSS	
Street Sweeping						
Baseline (Average 2002- 2010)	8,891 tons	2,489	21,783	8,713	2,613,954	MS4 Annual Reports
Collection within CY 2012	9,988 tons	2,797	24,471	9,788	2,936,472	Ref: Baltimore's New and Improved Mechanical Street Sweeping Program (October 2013)
Anticipated Increase after City-wide expansion (Peak):	18,000 tons	5,040	44,100	17,640	5,292,000	Ref :Baltimore's New and Improved Mechanical Street Sweeping Program (October 2013)
Sub-total Street Sweeping above Baseline:		2,551	22,317	8,927	2,678,046	
Preventive Inlet Cleaning & Debris Collection						
Prior to 2010, all inlet cleaning was response	0 tons	0	0	0	0	
Collection as of FY 2013 (preventive)	265 tons	10	649	260	77,885	MS4 Annual Reports
Anticipated Increase after Asset Management (4% Inlets cleaned quarterly):	990 tons	215	2,425	970	291,052	Preliminary Asset Management Program and CIP Schedule for Inlet Screens
Sub-total Preventive Inlet Cleaning above Baseline:		215	2,425	970	291,052	
Illicit Discharge Detection and Elimination Program						
Sanitary Direct**		NA	100	18	NA	Asset management inventory.
Sewage Exfiltration**		NA	5,000	909	NA	Lining as part of DPW's capital program for sanitary sewers.
Drinking Water Transmission**		NA	1,500	273	NA	Estimated water line lining / replacement by 2018.
Dry Weather SSO**		NA	350	64	NA	Asset management / FOG program, education, enforcement, and enhanced IDDE
Sub-total Preventive Inlet Cleaning above Baseline:			6,950	1,264	0	
TOTAL Programs:		2,766	31,692	11,161	2,969,098	

* Assuming bi-weekly frequency: Total miles swept / 26

** Equivalent impervious area restoration conversions and TSS reductions have not been designated at this time. Estimates of nutrient reduction are very conservative in estimates.

APPENDIX C – Summary of Partnerships

APPENDIX C: Summary of Partnerships

Project No. / Type	Source ID	Watershed	Location	Eq. Imp Area Restored (ac)	Estimated Pollutant Removal (lbs / yr)		
					TN	TP	TSS
Development							
Impervious area to pervious	DPW Plans Review	City-wide	City-wide	73.8	351	35	29,426
Treatment by ESD	DPW Plans Review	City-wide	City-wide	21.4	102	10	8,539
Treatment by Traditional	DPW Plans Review	City-wide	City-wide	54.7	260	26	21,805
			Sub-total Development:	150	713	70	59,770
Voluntary							
Impervious Removal	BWB	Jones Falls	Guilford ES/MS	0.28	0.4	0.1	33
Impervious Removal	BWB	Gwynns Falls	Calvin Rodwell ES	0.13	0.2	0.04	15
Micro-bioretenion	BWB	Direct Harbor	Library Square	1.1	5.3	0.5	261
IA Removal, Rain Garden	DOT	Baltimore Harbor	200 N. Duncan Street	0.45	2.3	0.5	342
IA Removal, afforestation	DOT	Baltimore Harbor	2300-2400 Eager St	1.5	7.7	1.7	1141
IA Removal, afforestation, bioretention	GGI Design Comp	Gwynns Falls	2306-8 Riggs Street	0.81	4.2	0.9	616
IA Removal, afforestation, bioretention	GGI Design Comp	Back River	CHM Gateway 32nd & Harford	0.18	0.9	0.2	137
IA Removal, afforestation, bioretention	GGI Design Comp	Baltimore Harbor	Day Spring Green Parking 1100 block N. Bradford	0.36	1.8	0.4	274
IA Removal, afforestation	GGI Design Comp	Baltimore Harbor	Druid Heights Peace Park Bloom & Druid Hill Ave	0.15	0.8	0.2	114
IA Removal, afforestation	GGI Design Comp	Baltimore Harbor	Hollins Roundhouse Lots of Art1218-20 W. Lombard	0.06	0.3	0.1	46
IA Removal, afforestation, and rainwater harvesting	GGI Design Comp	Baltimore Harbor	Janes House of Inspiration A-maze-N Lot728 North Avenue	0.20	1.0	0.2	148
IA Removal, afforestation	GGI Design Comp	Baltimore Harbor	Flower Farm1400 block Gay Street	0.75	3.8	0.9	570
Aforestation of IA	Tree Baltimore	Baltimore Harbor	TBD	25.2	10.9	1.6	818
Aforestation of IA	Tree Baltimore	Gwynns Falls	TBD	23.1	10.9	1.6	818

APPENDIX C: Summary of Partnerships

Project No. / Type	Source ID	Watershed	Location	Eq. Imp Area Restored (ac)	Estimated Pollutant Removal (lbs / yr)		
					TN	TP	TSS
Aforestation of IA	Tree Baltimore	Jones Falls	TBD	19.6	10.9	1.6	818
Aforestation of IA	Tree Baltimore	Back River	TBD	21.0	10.9	1.6	818
			Sub-total Volunteer:	95	72.2	12.1	6,971
SW Fee Credit program							
Treatment BMPs	SAIS	City-wide	City-wide	24.0	206.7	26.5	16,157
Private tree planting (Reforestation on pervious)	SAIS	City-wide	City-wide	7.6	142.6	6.6	1596
Rain gardens	SAIS	City-wide	City-wide	2.0	17.2	2.2	1,346
Rainwater harvesting	SAIS	City-wide	City-wide	0.5	12.4	1.0	485
			Subtotal SW Fee Credit:	34.1	378.9	36.3	19,584
			Total for Partnerships:	279	1,164	119	86,325

APPENDIX D – Summary of Contingency Projects

APPENDIX D: Summary of Contingency Projects

BMP Type	Watershed	Location	Eq. Imp Area Restored (ac)	Estimated Pollutant Removal (lbs / yr)			Estimated Capital Cost	NOTES
				TN	TP	TSS		
SW pond/wetland	Back River	Perring Parkway at Westfield (HR-R28A)	35.00	185	30.3	18,391	\$842,800	Back River SWAP
SW pond/wetland	Baltimore Harbor	Clifton Park Adjunct (HA-R20)	5.20	27	4.5	2,732	\$125,216	WS 246 SWAP
SW pond/wetland	Back River	Northwood ES (CH-R2B)	26.50	140	22.9	13,925	\$638,120	Back River SWAP
SW pond/wetland	Back River	Walter P. Carter ES (TI-R2)	36.00	190	31.1	18,917	\$866,880	Back River SWAP
Bioretention	Back River	Clifton Park (HR-R38B)	2.30	12	2.0	1,209	\$422,625	Back River SWAP
Bioretention	Baltimore	Faring Baybrook Park (MC-11C)	2.36	12	2.0	1,240	\$470,876	Ref: Masonville Cove SWAP 2014
Streambank Stabilization	Gwynns Falls	Westport	4.00	8	7	3,000	\$258,000	NFWF grant proposal 2014
Warner Street living shoreline and wetlands	Baltimore Harbor	Middle Branch- Warner Street	2.00	4	3	1,500	\$48,230	NFWF grant proposal 2014
Stream Restoration	Back River	Herring Run East Branch: Reach A, E	9.90	12.4	11.2	4,950	\$178,329	Herring Run Stream Assessment
Stream Restoration	Back River	Herring Run: Reach J, K	9.90	12.4	11.2	4,950	\$178,329	Herring Run Stream Assessment
Stream Restoration	Back River	Armistead Run	4.95	6.2	5.6	2,475	\$89,164	Herring Run Stream Assessment
Stream Restoration	Back River	Herring Run: Reach Reach R, S, W	4.95	6.2	5.6	2,475	\$89,164	Herring Run Stream Assessment
Micro-bioretention	Baltimore Harbor	Curtis Bay ES/MS parking lot (MC-17a)	0.93	0.1	0.1	28	\$47,777	Masonville Cove SWAP 2014
Micro-bioretention	Back River	North Harford Rec Center Parking Lot (HR-R3)	1.00	0.1	0.1	30	\$183,750	Back River SWAP
Micro-bioretention	Back River	Mt. Pleasant Park at Perring Parkway (HR-R10)	0.80	0.1	0.1	24	\$147,000	Back River SWAP
Micro-bioretention	Baltimore Harbor	Fayette and Caroline streets (HA-R16)	1.20	0.1	0.1	36	\$220,500	WS 246 SWAP
Micro-bioretention	Jones Falls	Tamarind and Springarden (LJ-R3)	0.80	0.1	0.1	24	\$147,000	Lower Jones Falls SWAP
Wet Swale	Direct Harbor	Empty lot southwest of Shell Road and I-895 (MC-31)	0.77	0.1	0.1	23	\$2,564	Masonville Cove SWAP 2014
Dry swale	Back River	Woodhome ES (RE-R1A)	0.20	0.0	0.0	6	\$4,800	Back River SWAP
Micro-bioretention	Back River	Erdman Ave and Edison Hwy	0.22	0.0	0.0	7	\$38,808	BENI Green Streets projects / CWP
Rain Garden	Back River	Woodhome ES (RE-R1C)	0.35	0.0	0.0	11	\$61,740	Back River SWAP
Micro-bioretention	Back River	Brehms Lane ES (HR-R14)	0.40	0.0	0.0	12	\$70,560	Back River SWAP
Micro-bioretention	Back River	WEB DuBois HS (HR-R29C)	0.30	0.0	0.0	9	\$52,920	Back River SWAP
Permeable Paving	Back River	WEB DuBois (HR-R29B)	1.80	0.1	0.1	54	\$317,520	Back River SWAP
Permeable Paving	Back River	WEB DuBois (HR-R29D)	0.10	0.0	0.0	3	\$17,640	Back River SWAP
Permeable Paving	Back River	Woodhome ES/MS (RE-R1B)	0.50	0.0	0.0	15	\$88,200	Back River SWAP
Micro-bioretention	Baltimore Harbor	Casino Area Master Plan	5.00	0.4	0.3	150	\$882,000	Casino Area Master Plan
Permeable Paving	Jones Falls	Poly Western HS parking (LJ-R8D)	1.67	0.1	0.1	50	\$294,588	Lower Jones Falls SWAP
Permeable Paving	Jones Falls	Cross Country ES parking (WE-R4)	0.50	0.0	0.0	15	\$88,200	Lower Jones Falls SWAP
Roof Downspout Disconnect	Jones Falls	Fallstaff MS (WE-R6B)	1.25	0.1	0.1	38	\$220,500	Lower Jones Falls SWAP
Green Roofs	Baltimore Harbor	Public Roof Space	2.0	1.9	1.7	750	\$6,534,000	Estimated available public roof space for green roof

APPENDIX D: Summary of Contingency Projects

BMP Type	Watershed	Location	Eq. Imp Area Restored (ac)	Estimated Pollutant Removal (lbs / yr)			Estimated Capital Cost	NOTES
				TN	TP	TSS		
Outfall Stabilization	Jones Falls	30 outfalls	60.0	0.0	0.0	0	\$2,250,000	Stormwater Asset Management
Outfall Stabilization	Gwynns Falls	20 outfalls	40.0	0.0	0.0	0	\$1,500,000	
Outfall Stabilization	Back river	50 outfalls	100.0	0.0	0.0	0	\$3,750,000	
Total Contingency Identified:			162.85	618.32	139.60	77,047.25	\$13,627,800	