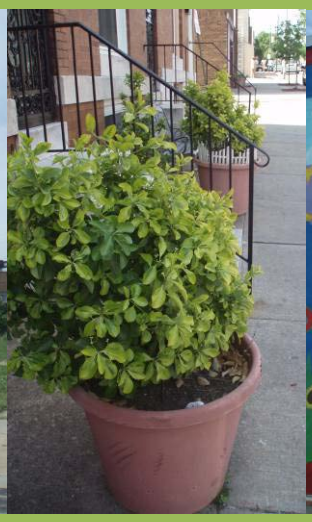
The Harris Creek Small Watershed Action Plan: Restoring and Greening a Diverse Urban Community


Developed for:
Baltimore Harbor Watershed Association

Developed by:
Center for Watershed Protection
8390 Main Street, 2nd Floor
Ellicott City, MD 21043

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Harris Creek Watershed Project Partners

Baltimore Harbor Watershed Association

Raymond D. Bahr, MD
Donna K. Kirsh
Phillip Lee

Center for Watershed Protection

Kelly Collins
Sadie Drescher
Paul Sturm

Parks and People Foundation, Inc.

Phillip Stafford
Mary Washington

Harris Creek Watershed Project Funders

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A Message from the Baltimore Harbor Watershed Association

The mission of the Baltimore Harbor Watershed Association (BWHA) is to protect and improve the environmental quality and natural beauty of the Baltimore Harbor and its tributaries. The Harris Creek Watershed 246 Project goals are to identify and address stormwater quality and trash issues. These goals relate directly to the mission. However, to address goals in an urban environment, we must first enhance the quality of life for the citizens who live in the 246 Watershed neighborhoods.

The Harris Creek Watershed Project was funded by the Department of Public Works and the Chesapeake Bay Trust to improve the stormwater quality and reduce the amount of trash entering the Baltimore Harbor. The challenge was how to bring together seventeen diverse neighborhoods to address these environmental issues. The first step was to conduct a stormwater and trash survey to identify additional concerns. According to the survey results, illegal trash dumping ranked as the number one concern throughout the watershed. This is a large systemic problem of long standing duration. Numerous vacant houses in disrepair with trash filled backyards were identified. These yards resembled mini landfills and one of the major sources of trash entering the harbor was discovered. In collaboration with the residents of the Harris Creek Watershed and the City of Baltimore Department of Public Works and Housing Authority a coordinated "Trash Sweep" was implemented throughout a targeted footprint located in the mid-section of the watershed. The Trash Sweep spanned a period of ten weeks resulting in a significant reduction of trash entering the Baltimore Harbor.

At the Harris Creek Small Watershed Action Plan (the *Plan*) workshops, the seventeen neighborhoods responded to this injustice by coming together, and began to form the solidarity required to fully engage in the process of developing not only the Plan, but more humane efforts to improve the quality of life for the residents of Watershed 246 as seen in the initiative – Humane Metropolis Baltimore by Rutherford H. Platt. Moreover, a sense of "Unity in Diversity" was fostered to facilitate the creation of a common vision.

The unifying goal of this project is to remove the trash in the Baltimore Harbor by cleaning up the city streets, while simultaneously creating community greening projects that also serve as engaging gathering spaces that will bring people together, have fun, and with a little luck even get to know each other. By engaging the community and aiming to improve their quality of life, stormwater solutions can now be addressed. Community engagement and activism are key factors for successful stormwater projects that can serve as a model for achievement throughout Baltimore City's watersheds.

The Harris Creek Watershed Community and Stormwater Project

The ***Primary Goal*** of the Harris Creek Watershed (246) Project is for its residents to reach the Humane Enriching Qualities of Baltimore City (enhanced quality of life).

Secondary Goal is to clean up the Baltimore Harbor by cleaning up Baltimore City one Block at a time,
while at the same time,
Creating Community Green Engaging Gathering Spaces
that will bring people together to rub shoulders, have fun, and with luck – even get to know each other. *If accomplished, Sustainability will have been achieved!*

The Humane Metropolis Initiative, Rutherford H. Platt

"BEST OF TIME TO WORK ON THE WORST OF PROBLEMS"

TABLE OF CONTENTS

Harris Creek Small Watershed Action Plan Executive Summary

The area that is the focus of this effort is the Harris Creek Watershed (Watershed 246 aka WS 246). This watershed is a dynamic, urban landscape located in Baltimore City (the City) that encompasses seventeen neighborhoods and two parks (Clifton Park and Patterson Park). Harris Creek is a piped underground stream located on the east side of Downtown Baltimore that drains approximately two square miles (1271 acres) of land area, houses about 44,000 people, and empties into the Baltimore Harbor in Canton.

This project identifies existing greening efforts that builds on current studies, information and recommendations, summarizes work that has been done in the watershed, compiles ongoing efforts, builds stakeholder and citizen involvement, incorporates the next steps for community involvement and vested groups to move forward through a roadmap for improved watershed management using the Harris Creek Small Watershed Action *Plan* (the *Plan).* This *Plan* is the culmination of several efforts involving numerous stakeholder community meetings and workshops, desktop and field assessments, and a background review conducted by the Center for Watershed Protection (CWP) and the Baltimore Harbor Watershed Association (BHWA). The report outlines a series of recommendations for watershed restoration, describes implementation strategies, and identifies priority projects for completion.

Trash, nutrients (nitrogen and phosphorus), sediments, metals and bacteria are pollutants of concern for the Baltimore Harbor (basin number 02130903); consequently, the Harris Creek Watershed. The recommendations included in this *Plan* (see Section 5) aim to reduce these pollutants that are a chronic problem throughout the Harris Creek Watershed.

Input from the watershed stakeholders was used to develop 6 watershed management objectives (Section 3). CWP then re-examined all data collected over the course of the project – baseline information, pollutants of concern, field observations, field assessment results, Harris Creek Watershed goals and objectives – and developed 15 key watershed recommendations, as described in Section 4. These 15 recommendations are the core of this *Plan.* They provide a framework for implementing the numerous green infrastructure and restoration practices as well as program and education related recommendations identified through stakeholder meetings and field assessments.

Based primarily on feedback from the watershed stakeholder meetings, in addition to project partner meetings, the baseline assessment, and field observations, 15 recommendations were developed for the Harris Creek Watershed. These are listed below, in order of priority:

1. **Implement neighborhood greening projects (HC-1 through HC-13)**
2. **Reduce trash through targeted clean-up efforts, outreach and education, better illegal trash dumping enforcement and collection practices, and best management practices such as storm drain screens**
3. **Develop targeted educational programs throughout the watershed**
4. **Explore links between toxicity and contamination within watershed areas**
5. **Enhance outreach to community about efforts and accomplishments, as well as needs (forum for posting problems)**

6. **Strategically locate additional park and green spaces in areas that do not have them**
7. **Implement green street designs and larger-scale retrofit projects**
8. **Identify watershed hotspot areas and develop pollution prevention strategies**
9. **Systematically identify and remove illicit discharges from the watershed**
10. **Promote Urban Farming efforts in the community**
11. **Work with community partners to make healthy foods and locally grown produce available to the community**
12. **Promote water conservation and water-wise consumption**
13. **Encourage and/or incentivize strong redevelopment criteria**
14. **Develop a "Green" microlending and entrepreneurial Support/Training Program**
15. **Link watershed efforts to the City's Sustainability Plan**

A major focus of this *Plan* is to improve the internal capacity of the Harris Creek stakeholders and community members to enact the watershed recommendations. As such, opportunities to develop stronger community leadership and provide community members with jobs, training, education, and volunteer opportunities is a high priority, where appropriate. In addition, community member involvement and feedback is crucial to the ultimate success of these recommendations and should be sought during all stages of the *Plan* implementation.

The cumulative estimate for implementing the 15 watershed recommendations is estimated to exceed 2.4 million dollars over the next 5-10 years (see Table 5.2). Project costs represent only planning level estimates and should be adapted to include more appropriate local cost estimates where available. These cost estimates should be used to guide the BHWA, the City, and other project partners in estimating annual operation and implementation budgets for the Harris Creek Watershed. The implementation costs should be distributed across implementation partners, existing programs, and responsible property owners (e.g., the City, institutions, businesses, and landowners).

Estimated pollutant load reductions for the applicable recommendations (Table 6.1) were estimated using previous studies, available data, and the Watershed Treatment Model (WTM) (Caraco, 2001). Results of this analysis indicate the great importance of implementing effective education and outreach efforts (recommendation #3), followed by illicit discharge detection and elimination, and the implementation of trash clean-ups and retrofit projects. The ability to quantify pollutant reduction is important and helps to gain implementation support (e.g., funding), reporting anticipated outcomes to the public and funders, and demonstrating the connection between water quality benefits to the *Plan's* goals and recommendations.

SECTION 1. INTRODUCTION

1.1 Plan Overview

The purpose of the *Harris Creek Small Watershed Action Plan (*the *Plan)* is to provide guidance on the restoration of the Harris Creek Watershed (a.k.a. Watershed 246). The *Plan* is the culmination of several efforts involving numerous stakeholder community meetings and workshops, a background review, desktop analyses, and field assessments conducted by the Center for Watershed Protection (CWP) and the Baltimore Harbor Watershed Association (BHWA). The report outlines a series of recommendations for watershed restoration, describes implementation strategies, and identifies priority projects for implementation. Planning level cost and pollutant removal estimates are provided where feasible and a preliminary schedule for implementation over a ten-year horizon is outlined. Financial and technical partners for plan implementation are suggested for various strategies and projects. This *Plan* is intended to assist the BHWA, the Harris Creek stakeholders, and the City of Baltimore in their efforts to measurably improve both water quality and quality of life in the watershed and surrounding neighborhoods.

1.2 U.S. EPA Watershed Planning "a-i" Criteria"

In 2003, the U.S. Environmental Protection Agency (EPA) began to require that all watershed restoration projects funded under Section 319 of the federal Clean Water Act be supported by a watershed plan that includes the following nine minimum elements, known as the "a-i criteria":

a. Identification of the causes and sources that will need to be controlled to achieve the load reductions estimated in the watershed plan
b. Estimates of pollutant load reductions expected through implementation of proposed nonpoint source (NPS) management measures
c. A description of the NPS management measures that will need to be implemented
d. An estimate of the amount of technical and financial assistance needed to implement the plan
e. An information/education component that will be used to enhance public understanding and encourage participation
f. A schedule for implementing the NPS management measures
g. A description of interim, measurable milestones
h. A set of criteria to determine load reductions and track substantial progress towards attaining water quality standards
i. A monitoring component to determine whether the watershed plan is being implemented

This *Plan* meets the a-i criteria. Table 1.1 shows where these criteria are addressed throughout this document.

Table 1.1. U.S. EPA Watershed Planning "a-i" Criteria									
Section of the report	**a**	**b**	**c**	**d**	**e**	**f**	**g**	**h**	**i**
Section 1. Introduction									
Section 2. Watershed Background and Characterization	X								
Section 3. Watershed Goals and Objectives					X				
Section 4. Field Assessments and Findings	X	X	X						
Section 5. Watershed Recommendations and Implementation Planning			X	X	X	X	X	X	X
Section 6. Estimates of Pollutant Loads and Reduction Strategies		X							

1.3 Plan Organization

The *Plan* is organized as follows:

Section 1. Introduction – provides an introduction to the Harris Creek Watershed Assessment and Management Report.

Section 2. Watershed Background and Characterization – describes the land use and cover, demographics, current conditions, and existing programs in the Harris Creek Watershed.

Section 3. Watershed Goals and Objectives – presents the goals and objectives for managing the Harris Creek Watershed using stakeholder backed strategies.

Section 4. Field Assessments and Findings – provides an overview of retrofit, stream, upland, and conservation assessment methodologies and key findings, along with the results of a green infrastructure analysis.

Section 5. Watershed Recommendations and Implementation Planning – presents 15 key watershed management recommendations for the Harris Creek Watershed along with actions that support the 15 recommendations and information on planning partners, project phasing, planning level costs, and resources for implementing watershed strategies.

Section 6. Estimates of Pollutant Loads and Reduction Strategies– presents the pollution load reduction estimated for the 15 Harris Creek Watershed recommendations.

1.4 Caveats

It is important to keep in mind that this *Plan* is limited in scope and should be updated as more information on the watershed is acquired. Recommendations are based on input from stakeholder meetings, desktop analyses, and observations made during targeted field assessments. While several neighborhood and watershed locations were assessed based on feedback from stakeholders and BHWA, the entire watershed area was not assessed. In the future, additional assessments should be conducted in key areas of concern and this *Plan* updated to reflect watershed changes and programmatic developments.

SECTION 2. WATERSHED BACKGROUND AND CHARACTERIZATION

2.1 Watershed Overview

The Harris Creek Watershed is a dynamic, urban watershed in Baltimore City, Maryland that drains approximately two square miles (1271 acres) of land area from Clifton Park to the Baltimore Harbor (the harbor) (north-south boundary) and extends from Johns Hopkins Hospital to Patterson Park (east-west boundary). The watershed encompasses seventeen intensely developed neighborhoods and two large parks, Clifton Park and Patterson Park (Figure 2.1). Harris Creek is located entirely underground, and the total watershed is connected and drained by 55 miles of storm drain pipes.

Typical of many highly urbanized urban areas, the watershed is predominantly impervious cover with little green space. The watershed has 70% impervious cover and has 0 to 8% tree canopy (Figure 2.2). Table 2.1 lists the acres of watershed by land use category (Swann, 2008). The predominant land use is row homes (56% of watershed area), followed by park space (16%) then public school properties (8%). In such a highly urbanized landscape dominated by rooftops, roadways, and sidewalks, rainfall has little to no opportunity to infiltrate into natural areas, but flows instead directly to the storm drain system and into the harbor, carrying numerous urban pollutants directly to the Baltimore Harbor and eventually the Chesapeake Bay. The amount of impervious area in the watershed is well above the 10-15% impervious cover threshold for increasing the chance for pollutant exposure and above the 20 to 30% threshold for impacting living resources (Holland et al., 2003). High impervious cover is a strong indicator of poor watershed health (Schueler, 2000), but presents an opportunity to improve the watershed through better management and restoration efforts.

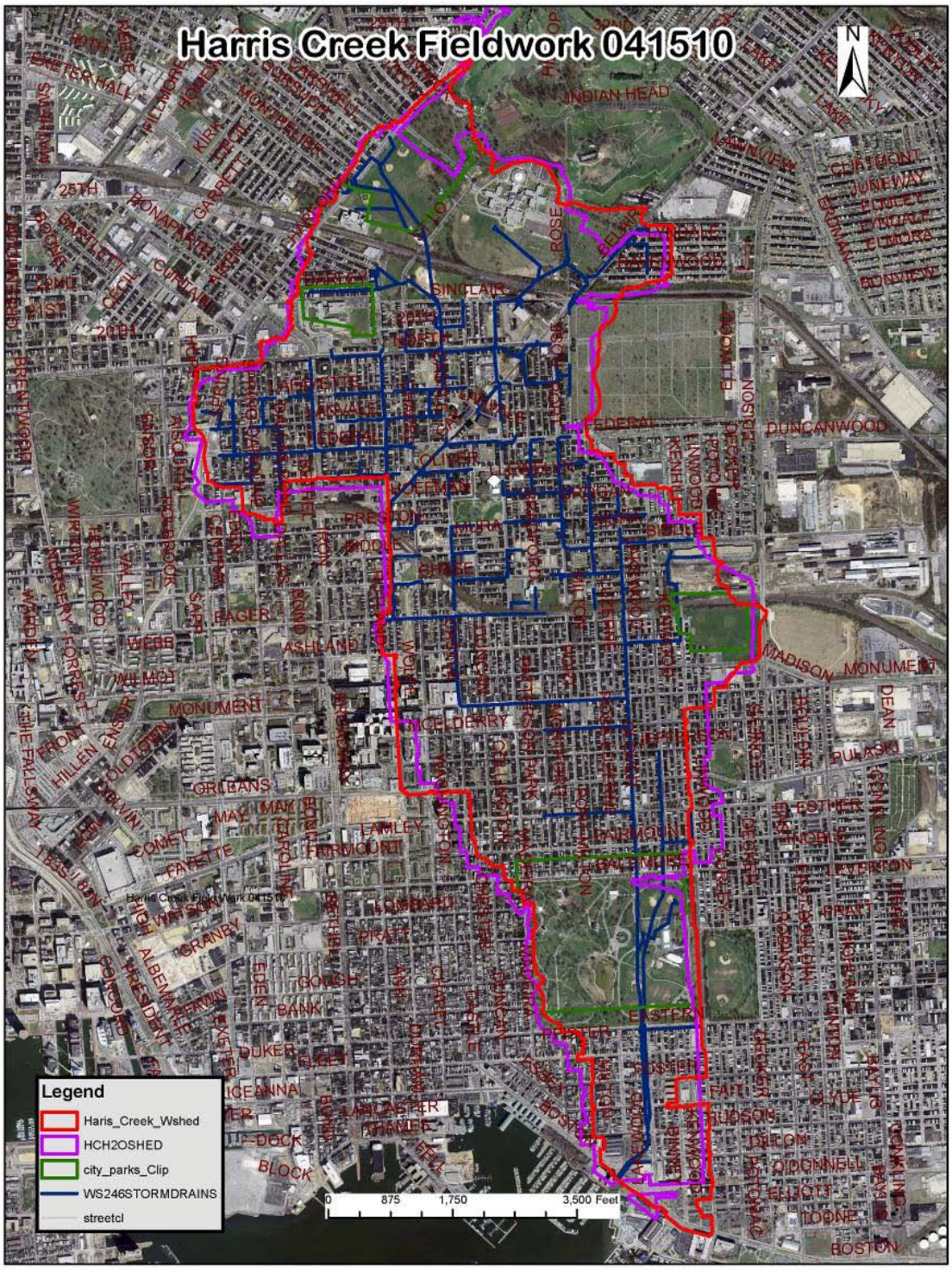


Figure 2.1. Harris Creek is an underground stream located on the east side of Baltimore that drains approximately two square miles (1271 acres) of land area and empties into the Baltimore Harbor in Canton.

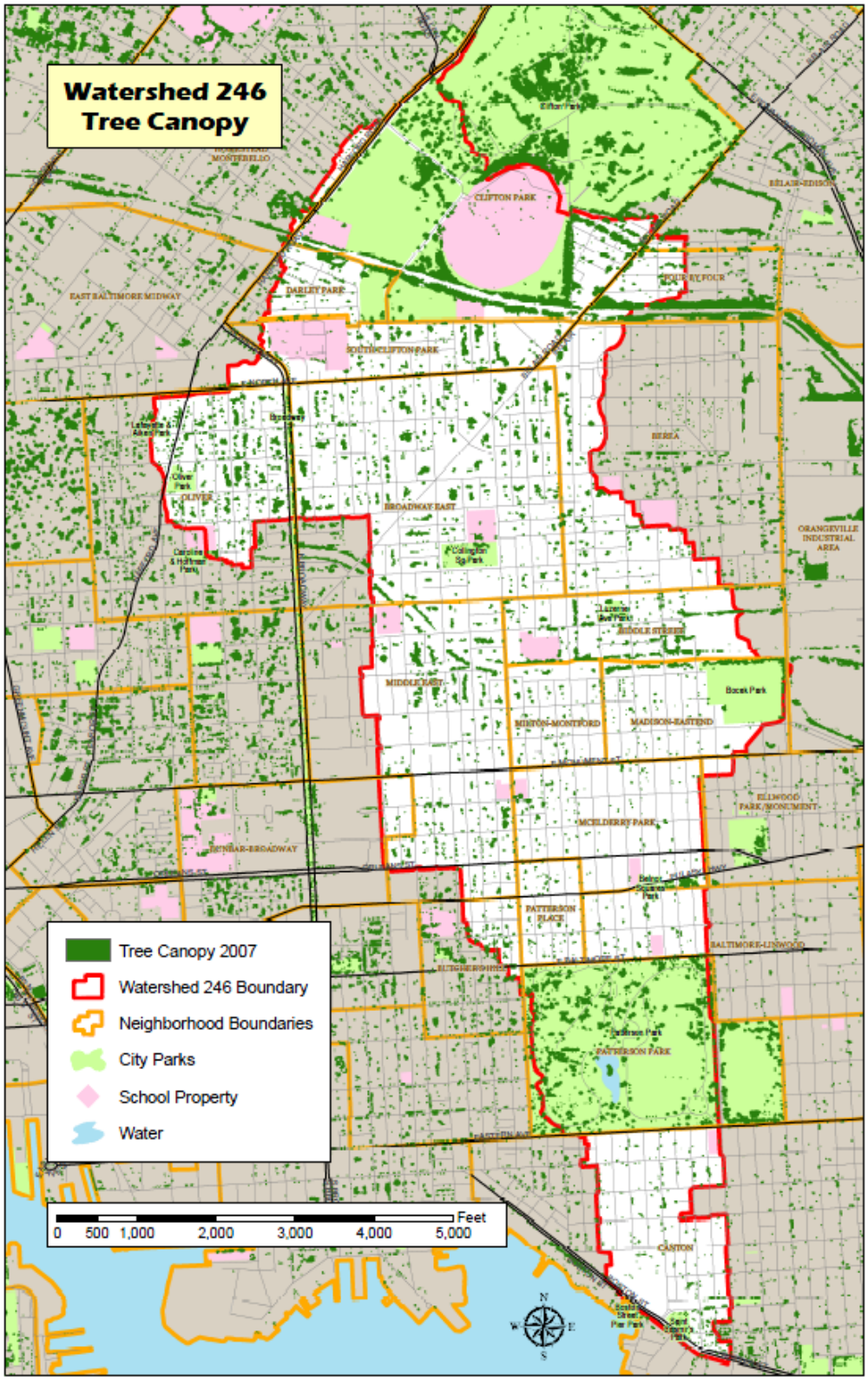


Figure 2.2. Harris Creek Watershed tree canopy (Stafford, 2009).

Table 2.1. Land Use in the Harris Creek Watershed (Swann, 2008).		
Land Use	**Area (acres)**	**% of Watershed Area**
Row Home	706	56%
Park	200	16%
Public Schools	103	8.0%
General Commercial	56	4.4%
Industrial	42	3.3%
Cemetery	35	2.8%
Railroad	30	2.4%
Religious Organization	21	1.7%
Golf Course	18	1.4%
Hospital	13	1.0%
Shopping Center	12	0.9%
Undeveloped Land	11	0.9%
Garden Apartments	10	0.8%
Public Building	6	0.5%
Transportation ROW (Right of Way)	5	0.4%
Moderate Density Mixed Use	2	0.2%
Total Area	1270	100%

2.2 Demographics

The seventeen neighborhoods in Harris Creek range in size from 2 acres to 198 acres (Figure 2.2 and Figure 2.3). According to the U.S. Census Data, as of 2000 there were 61,225 people living in the watershed. Canton and Patterson Park neighborhoods had the lowest minority population with around 8%, but most neighborhoods had over 95% minorities. Median household income ranged from $37,363 in the Canton waterfront neighborhood to $12,328 in Dunbar-Broadway neighborhood. Vacant homes were a systemic problem in several neighborhoods, and ranged from 12% in Canton to 41% in Dunbar-Broadway. (Stafford 2009; Baltimore City Department of Planning, 2000). The Harris Creek Watershed includes the 1st, 12th, 13th, and 14th Baltimore City Council Districts.

The neighborhoods and parks within the watershed are divided into Upper, Middle, and Lower sections (Table 2.2). In general, the northern watershed area is characterized by lower household income, lower education levels, higher unemployment rates, a greater number of vacant homes, and a higher minority population; whereas, the southern watershed area is characterized by greater household income, higher education levels, lower unemployment rates, less vacant homes, and a lower minority population.

The East Baltimore Revitalization Initiative addresses community deprivation and social injustices in the surrounding watershed area noting that crime nearly doubled in Baltimore City by 2004. Approximately one third of East Baltimore residents were living below the poverty

level with a 14 % unemployment rate in 16 to 64 year olds. The infant mortality rate in East Baltimore is 28 per thousand – nearly double the City's rate (East Baltimore Development Inc., 2007).

The neighborhood differences are important to address, so that better watershed advocacy and ultimately Chesapeake Bay improvement can be accomplished efficiently and holistically. These neighborhoods represent diverse stakeholder needs, socioeconomic status, stormwater management obstacles, and unique opportunities.

Table 2.2. Harris Creek Watershed neighborhoods and parks in the Upper, Middle, and Lower neighborhoods for the watershed. Also, see Figure 2.3 for map.

Harris Creek Watershed Neighborhoods and Parks		
Upper Watershed	**Middle Watershed**	**Lower Watershed**
Berea	Biddle Street	Butchers Hill
Broadway East	Ellwood Park/Monument	Canton
Darley Park	Madison Eastend	Patterson Place
Oliver	McElderry Park	Linwood
Four by Four	Milton Montford	Patterson Park
South Clifton Park	Middle East	
Clifton Park	Dunbar-Broadway	

Table 2.3. Upper, Middle, and Lower Harris Creek Watersheds based on Stafford (2010) analysis from Census 2000 data.

Social Parameter	Upper Watershed Oliver	Middle Watershed	Lower Watershed Canton
Median household income	$15,366	$22,285	$37,363
Percent minority	99%	93%	8%
Percent vacant homes	25%	28%	12%
No high school diploma	48%	44%	28%

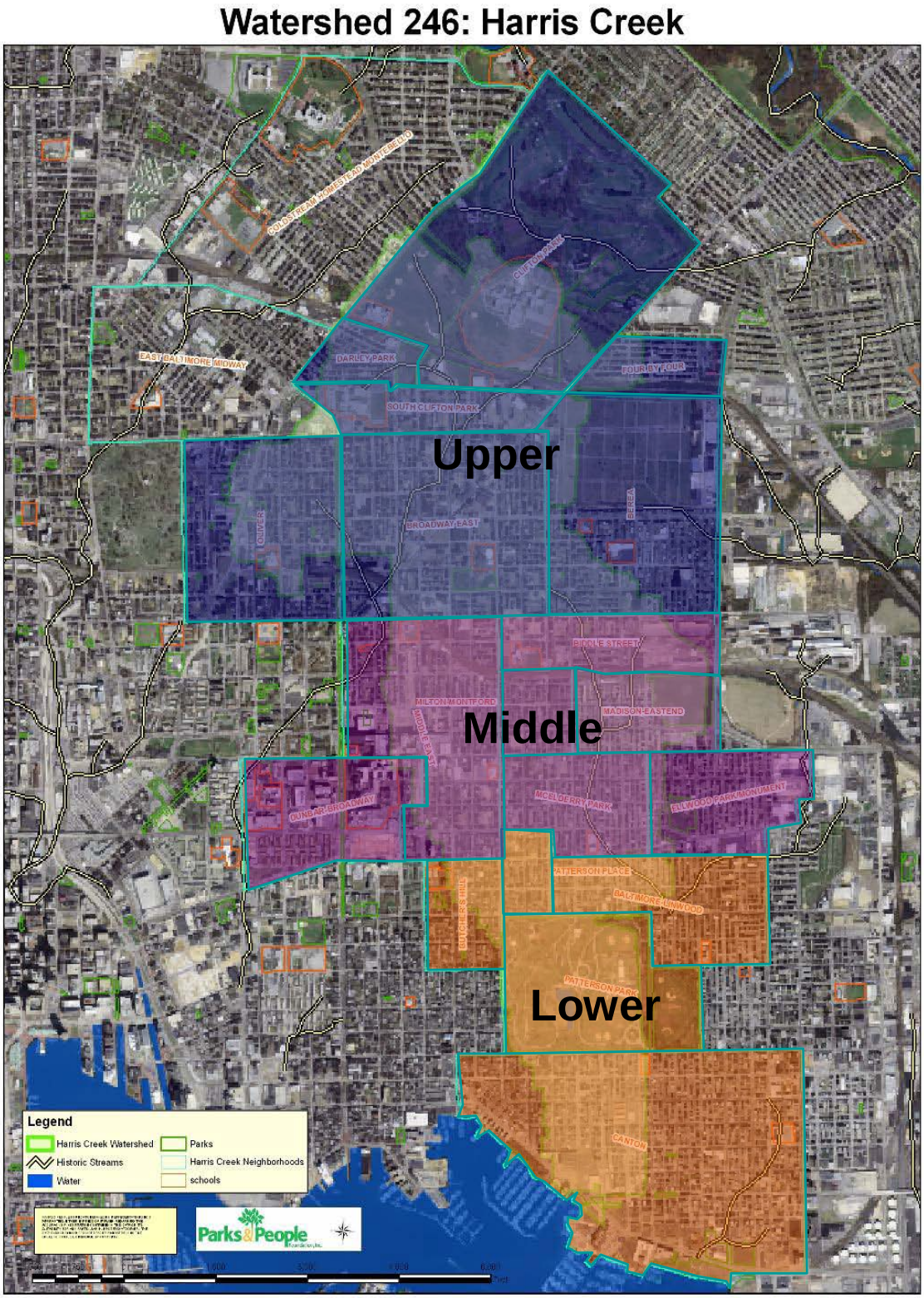


Figure 2.3. Upper, middle, and lower Harris Creek Watershed neighborhoods (Source: Parks and People Foundation).

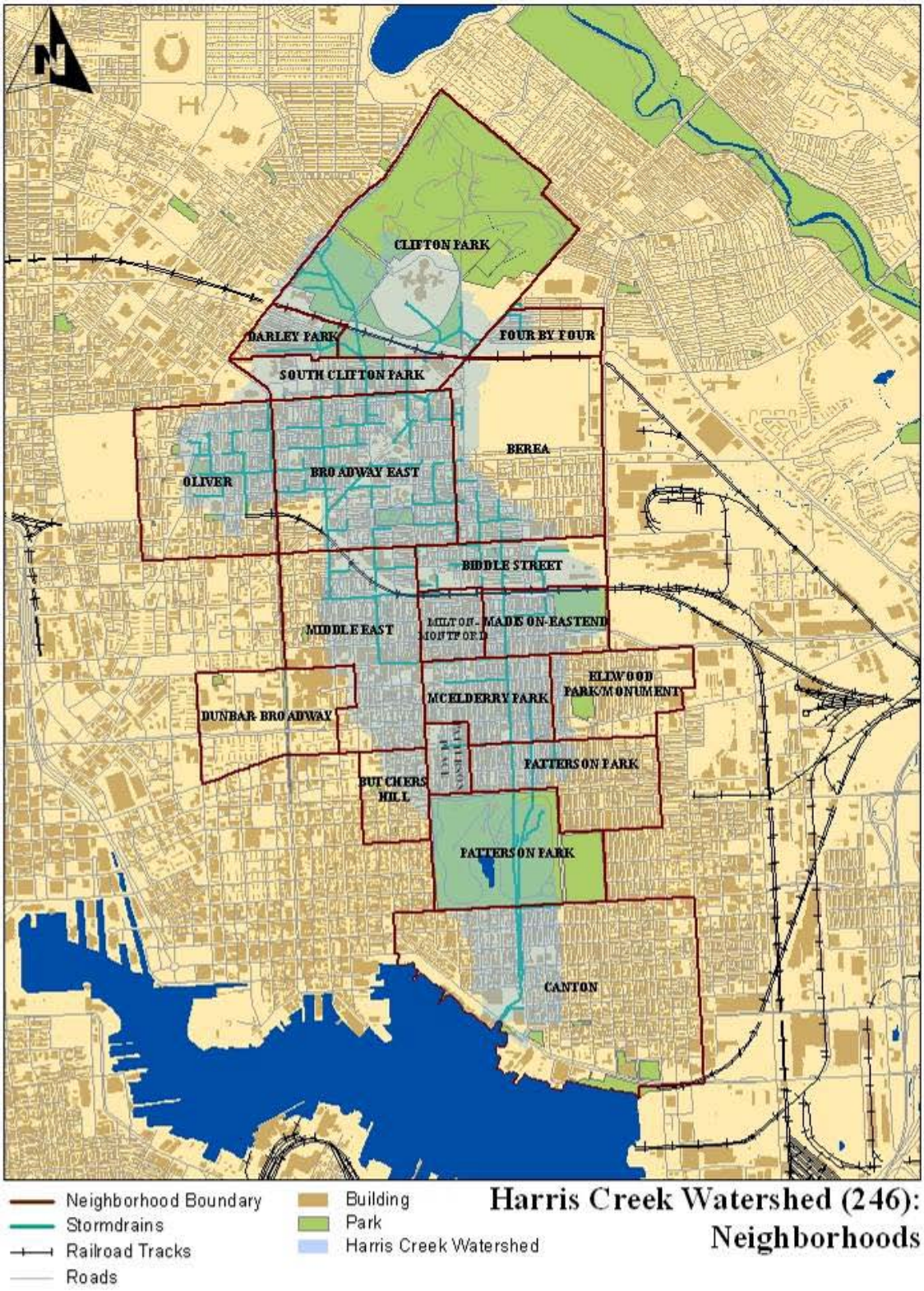


Figure 2.4. Harris Creek Watershed neighborhoods (Source: Parks and People Foundation).

2.3 Water Quality, Trash, and Soil Contaminants

Trash, nutrients (nitrogen and phosphorus), sediments, metals and bacteria are pollutants of concern for the harbor (basin number 02130903), and consequently the Harris Creek Watershed (MDE, 2006a). Harris Creek comprises less than 0.5% of the total Harbor Drainage Area (Table 2.4). However, very limited monitoring data has been collected specifically for Harris Creek. Table 2.5 lists each pollutant and concern, potential sources of contamination and the negative effects of the pollutant on the watershed and harbor. The leading contributor for most of the pollutants is urbanization. Baltimore Harbor TMDLs have been developed for nutrients (2006) and chlordane (2001). In 2008, the Integrated Reports of Surface Water Quality (IR) listed trash as an impairment for the Baltimore Harbor and a trash Total Maximum Daily Load (TMDL) is expected to be developed and implemented. Pollutant reduction of the constituents listed in this table are likely to be prioritized with soon anticipated Watershed Implementation Plans (WIPs) being developed in response to the Chesapeake Bay TMDL (initial drafts due September 1, 2010). The EPA recently released updated targeted nutrient allocations of 9.74 million pounds N and 0.46 million pounds P per year for the western shore of MD. Based on MDE's draft 2008 loads the western shore has 19.0 million pounds of N and 0.79 million pounds of P (source: http://www.epa.gov/reg3wapd/pdf/pdf_chesbay/2009mtgsummaries /Baltimore.pdf, page 25). Reducing pollution in the Harris Creek Watershed will help address the TMDL and 303(d) listings for the Baltimore Harbor Watershed.

Table 2.4 Baltimore Harbor Subwatershed Areas

Subwatersheds	Area (acres)	Area (% of Harbor Watershed)
Gwynns Falls	41,701	15.5%
Jones Falls	37,273	13.9%
Patapsco River	130,662	48.6%
Direct Baltimore Harbor (Harris Creek)	59,035 (1,271)	22.0% (0.5%)
Total	**268,671**	

Source: MDE, 2006b

In the Harris Creek Watershed specifically, five years of water quality data - Stream Impact Sampling (SIS)) have been collected with multiple parameters including, but not limited to nutrients, bacteria, ammonia, dissolved oxygen, chromium, suspended solids, and pH. Water monitoring was conducted at two watershed locations: Lakewood (the Harris Creek Watershed outfall) and Boat Lake (a stormwater pond located in Patterson Park). Both of these outfalls have been characterized as having high bacteria levels.

Data collected at Lakewood from April to December in 2009 exceeded the infrequent full body contact recreation (limit = 500 Enterococci Most Probable Number (MPN)/100 ml) 85% of the time during SIS sampling by the City Department of Public Works (data provided by Robert McAulay on 3/11/10). Further, data from the Lakewood and Boat Lake outfalls results show that

fecal coliform bacteria (*E. Coli* and *Enterococci*) levels often exceed Maryland's state full body contact and infrequent full body contact levels (State of Maryland (COMAR 26.08.02.03-3A.(1)(a)) Bacteria Indicator Criteria for Frequency of Use Freshwater). Maryland state water quality thresholds are available online at: http://www.mde.state.md.us/Programs/WaterPrograms/TMDL/wqstandards/index.asp. Finally, two known Storm Sewer Overflows (SSOs) were recorded in December 2009 just west of the Harris Creek Watershed at 1730 East Chase Street and 1820 East Eager Street after heavy rains (data provided by Robert McAulay on 3/11/10). Using Illicit Discharge Detection and Elimination (IDDE) to identify point source pollution (e.g., SSOs) and working to fix these problems is discussed in Recommendation #9.

Table 2.5. Priority Pollutants and Concerns in the Baltimore Harbor (basin 02130903).

Pollutant or Concern	Data Source/Status	Potential Sources of Contamination	Watershed Effects
1. Nutrients (Nitrogen and Phosphorus)	MD 303d list - Impaired TMDL developed 2006 Needed reductions are likely to increase with new Chesapeake Bay TMDL	• Urban runoff • Atmospheric deposition • Sewage leaks and overflows • Pet waste • Turf grass and lawns	• Eutrophication • Dead zones (low oxygen) • Contribution to Chesapeake Bay pollution • Algal blooms
2. Sediment	MD 303d list - Impaired	• Urban runoff • Construction sites	• In-stream habitat loss • Reduced depth in tidal creeks • Reduced light penetration for submerged aquatic vegetation (SAV) growth
3. Bacteria (Fecal Coliform)	MD 303d list - Impaired	• Illicit Sewer Connections/Discharges • Urban runoff • Pet waste • Wildlife • Improper disposal of boat waste	• Swimming and water contact related illnesses • Shellfish harvesting concerns
4. Trash	MD 303d list - Impaired TMDL in development	• Homeowner and business owners • Municipal policies	• Increased fecal coliform and pathogenic bacteria • Public health concerns • Localized flooding and resulting household mold impacts • Increased rats
5. Toxics (Polychlorinated Biphenyls (PCBs), Chlordane)	MD 303d list- Impaired TMDL for Chlordane developed 2001	• Old electrical transformers • Landfills • Industry	• Fish and biological contamination • Sediment contamination

Table 2.5. Priority Pollutants and Concerns in the Baltimore Harbor (basin 02130903).

Pollutant or Concern	Data Source/Status	Potential Sources of Contamination	Watershed Effects
6. Metals (Mercury, Copper, Nickel, Chromium)	MD 303d list - Impaired State of Maryland	• Past and present industrial land use • Air deposition	• Fish and biological contamination • Sediment contamination • Reduces water oxygen • Increases water temperature

Source: MDE, 2006a

A Waterwheel Powered Trash Interceptor was installed in the Harris Creek outfall Baltimore's Inner Harbor in May 2009. In 2009, over 150 cubic yards of trash and debris was sustainably prevented from entering the Harbor (Kellett, pers comm., March 22, 2010). The estimated composition of the collected material by volume of the >150 cubic yards was 60 cubic yards of organic material (e.g., plant material 55,000 Styrofoam cups, plates, and trays; 27,000 plastic soda and/or water bottles; 550,000 cigarette butts; 22,000 plastic bags; 5,500 aluminum cans; and 25,000 miscellaneous trash. From January to May 2010, the Waterwheel collected an additional 120 cubic yards of trash and debris (Clearwater Mills, LLC data received on 6/9/10) that consisted of about 40% organic material (e.g., plant material) and 60% was composed of plastic (primarily bottles and bags), Styrofoam, cigarette butts, aluminum cans, and paper litter.

Legacy sediment pollution is a common problem in the Harris Creek Watershed. A study sampled City park sediments and included Frank Bocek Park since it is a potential contaminated area from the former Allied Chemical plant (Maryland Department of the Environment Waste Management Administration, 2007). Sampling and analysis was done by Maryland Department of the Environment and confirmed by the Department of Health and Mental Hygiene Laboratory. Key findings of this report included:

- Levels of arsenic, vanadium, and chromium in soil samples exceeded the Environmental Protection Agency's (EPA's) residential soil standards for vanadium and chromium and exceeded EPA's risk based concentrations for arsenic;
- According to the EPA arsenic, vanadium, and chromium can cause problems with short term as follows: 1) Arsenic- Acute (short-term) high-level inhalation exposure to arsenic dust or fumes has resulted in gastrointestinal effects (nausea, diarrhea, abdominal pain); 2) Vanadium - Major effects from breathing high levels of vanadium are on the lungs, throat, and eyes; and 3) Chromium - The respiratory tract is the major target organ for chromium (VI) toxicity, for acute (short-term) and chronic (long-term) inhalation exposures. Shortness of breath, coughing, and wheezing were reported from a case of acute exposure to chromium (EPA's Technology Transfer Network Air Toxics Web Site).

2.4 Watershed Efforts and Programs

Several efforts have been conducted or are ongoing in the Harris Creek Watershed to help restore the watershed and improve the surrounding neighborhood areas. Local watershed organizations, community leaders, and citizens are working to improve the health of our waterways through a variety of methods, such as community surveys, monitoring efforts, and landscape revitalization projects. Despite these accomplishments, water quality in the harbor is diminished and there is a need to not only pull together previous and existing efforts and information, but also educate and involve local stakeholders to stop pollution at its source. This section describes several of these efforts and programs – highlighting key groups and initiatives involved in the watershed.

Harris Creek Watershed Trash Survey
A trash survey was conducted by CWP in the Harris Creek Watershed (Swann, 2008), to identify potential trash source areas and other pollution sources in the watershed. The survey found that trash accumulated near convenience stores and increased on the weekend. One of the key findings of the survey was that there was a need for basic education with increased efforts and City management action in trash "hot spot" neighborhoods. The seven key recommendations from this survey include:

- Further study of the Harris Creek Watershed using the established sample sites to test the effectiveness of various trash control strategies.
- Test multiple strategies in various parts of the watershed, and tailor trash solutions based on individual neighborhoods.
- Review the health of existing street trees and plant new trees in abandoned tree pits. These tree pits could act as a first line of defense in preventing trash from entering the storm drain system.
- Work with the local community (primarily through churches and community organizations) to green vacant lots throughout the watershed.
- Conduct a trash education campaign targeted to the age and demographics of the most polluted trash areas.
- Consider deputizing parking enforcement employees to enable them to write tickets to individuals for littering violations. These employees can then act as extra "eyes" on the street to help prevent illegal dumping.
- Increase street sweeping in neighborhoods receiving the highest ratings for trash.

Harris Creek Watershed Stakeholder and Community Survey
Baltimore Harbor Watershed Association and Parks and People Foundation, Inc. developed and delivered a twenty three question survey focused on health, stormwater conditions, trash conditions, and greening opportunities in the Harris Creek Watershed. The survey aimed to assess resident knowledge about the watershed and to gather information on concerns and issues within the watershed. In addition, the survey aimed to educate residents about the effort to improve the Harris Creek Watershed. There were 522 responses and 397 were Harris Creek Watershed residents. The major findings reveal that 85% of respondents were concerned about trash; this was the number one concern in the watershed. In addition, the survey identified areas of blocked or clogged storm drains (typically from trash) (Figure 2.5), and areas where improper trash disposal or illegal dumping were occurring (Figure 2.6) throughout the watershed. The final report recommended that the Harris Creek outfall be fitted with a trash interceptor, increased

environmental education/outreach, enhanced code enforcement, and advocacy for a plastic bag tax should be made (Stafford, 2010):

Community Gardens
Based on the Cooperative Extension and Civic Work's records there are over thirty community gardens in the Harris Creek Watershed (Table 2.6). These gardens are managed/owned by a variety of entities including Maryland Cooperative Extension, Civic Works, Parks and People Community Greening Resource Network (CGRN), Friends of Patterson Park, Baltimore Green Space (a land trust for community managed open space), and others. The parks are in varying states of use, management, and public availability.

Table 2.6. Harris Creek Watershed community gardens.

Cooperative Extension	Civic Works	Parks and People CGRN	Friends of Patterson Park	Baltimore Green Space
• Forrest Street Garden • Mura Street Garden • Duncan Street Garden • Madiera Street Garden	• Kirk & Homestead • Barclay and 21st Street • North and Homewood • Holbrook and Lanvale • Chase and Brentwood • Ashland and Washington • Patterson Park and Ashland • Federal St. and Hartford Ave. • E North Ave and Wolfe St. • Rutland and Lewelyn • 1200 Wolfe Street • Chase and Montford – chess garden • Montford and McElderry – new vacant lot • 2400 Eager and 900 Milton- rain garden • 600 N. Port – meditation garden • 600 N Rose-vegetable garden • 400 Madera- vegetable garden	• Hampstead Hill Academy • Banner Neighborhoods Garden • Lanvale Garden • Lake Clifton Campus Garden • Clifton Park Gaia Garden	• Patterson Park	• Faith Garden/Chess Park • St. Casimir School • Darley Park Community Garden • Garden of Eden • God's Glory to Glover Street • 500 N Duncan Block Community Garden • Milton Monford Garden

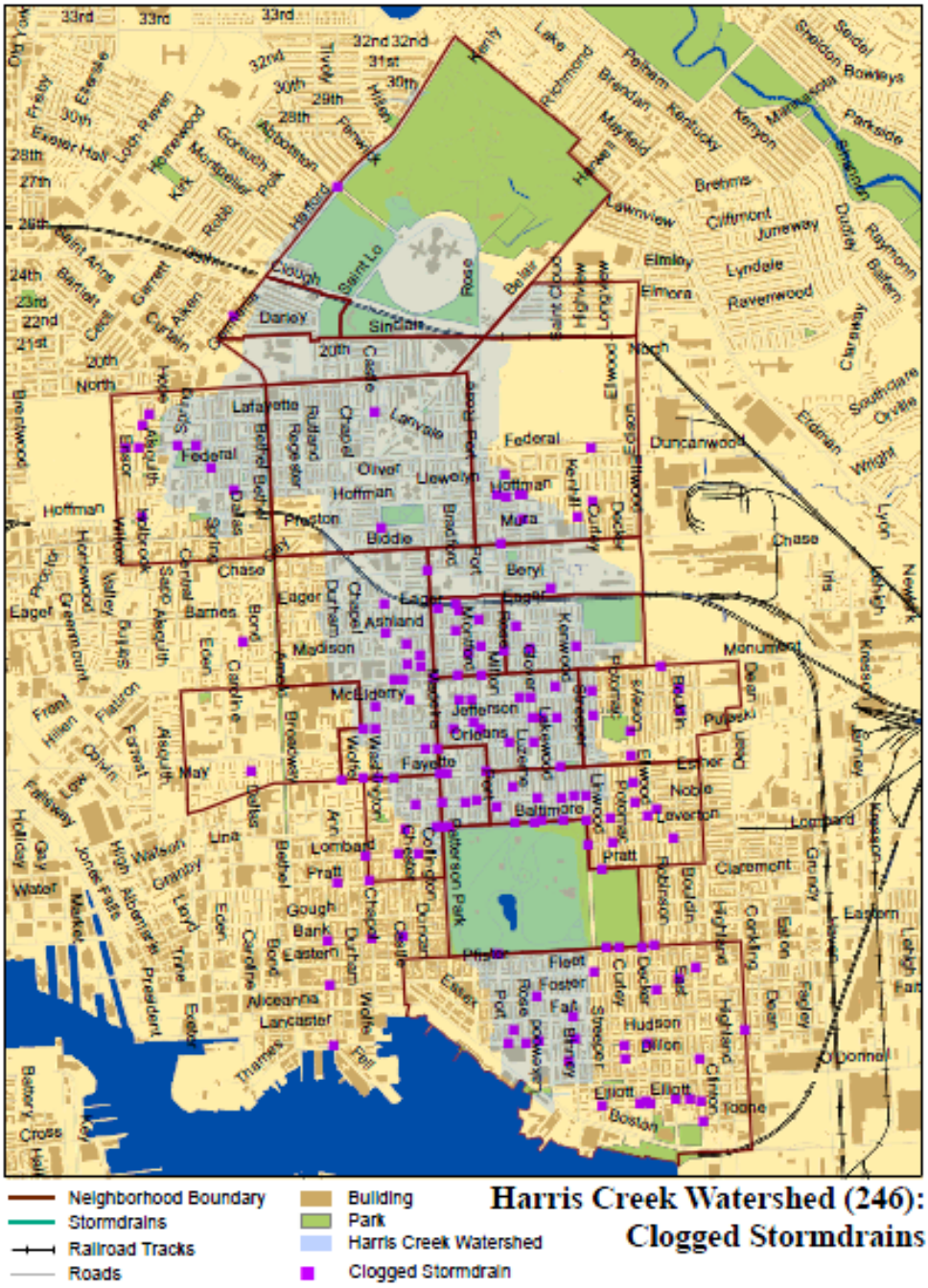


Figure 2.5. Survey conducted by Baltimore City indicates several clogged storm drains. (Source: Baltimore Harbor Watershed Association).

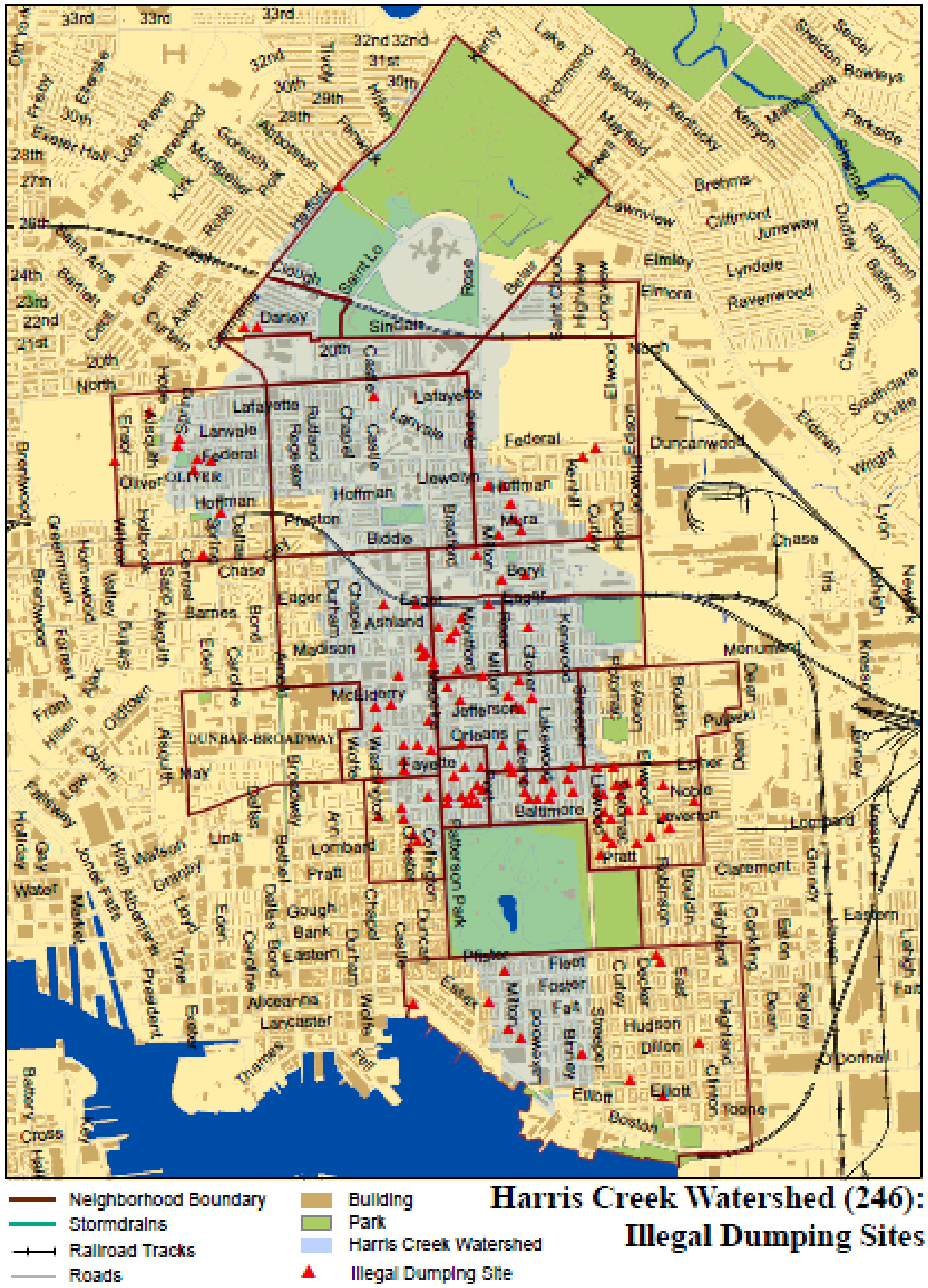


Figure 2.6. Survey conducted by Baltimore City indicates several trash dumping sites. (Source: Baltimore Harbor Watershed Association).

Additional Harris Creek Watershed Efforts and Programs

Additional Harris Creek Watershed efforts and programs have been conducted in the watershed, are ongoing, and many more are planned. Key watershed programs and neighborhood efforts are listed in Table 2.7. Below are additional efforts and programs in the watershed:

- CWP conducted a Baltimore City Stormwater Retrofit Inventory and this survey identified 11 retrofit opportunities in the Harris Creek and Baltimore Harbor Watersheds (Novotney, 2008). Three of these projects were determined to be high priority and are located in the Harris Creek Watershed. The high priority projects include Fairmont Harford HS, Patterson Park, and Lake Clifton High School. The report provides recommendations to begin implementing these projects.
- Morgan State University's Estuarine Research Center surveyed 374 African-Americans in Baltimore City, Prince Georges County, Dorchester County to determine their general knowledge and behavior (Morgan State University, 2010)
    - Major findings indicate there is an overwhelmingly positive image of the Chesapeake Bay and a direct relationship between local pollution and the health of the bay
    - The need for more and better education was a consistent theme throughout the responses
- The East Baltimore Revitalization Initiative by East Baltimore Development, Inc. (East Baltimore Development Inc., 2007) strives to stabilize and revitalize East Baltimore through healthier neighborhoods, responsible development, and better quality of life for families and children. Johns Hopkins Institutions are redeveloping and will promote local jobs, establishing an East Baltimore Family Resource Center and a new school learning campus, relocation support, family support services, and involving community members in the process.

Table 2.7. Harris Creek Watershed efforts to work together, share assets, connect, and produce "Sustainability for Stable Urban Sanctuaries."

City of Baltimore	CWP	BHWA	Parks and People Foundation	Individuals and Other Groups
▪ Cleaner, Greener Initiative- calls on each of us to take the initiative and make our home – the City of Baltimore – cleaner and greener ▪ New Department of Public Works Stormwater Division ▪ Cooperative Extension Community Gardens ▪ Coordination of water quality monitoring at Lakewood Avenue and Linwood and Boat Lake in Patterson Park ▪ RecycleMORE – trash can and recycling grants ▪ Code Enforcement and Trash Sweeps ▪ Tree Baltimore- strives to increase the urban tree canopy through the establishment, management and preservation of trees ▪ Water quality monitoring at Lakewood Avenue and Linwood and Boat Lake in Patterson Park	▪ Harris Creek Watershed Stakeholder Meetings ▪ Harris Creek Small Watershed Action Plan ▪ Watershed Assessments and Hotspot Determination ▪ Trash Survey	▪ Harris Creek Watershed Stakeholder Meetings ▪ Harris Creek Park Greenscape Restoration	▪ Community Greening Resource Network- actively helps promote green spaces and education ▪ "Green Necklace" ▪ Emerald Green Sanctuary- Vision for Baltimore to be a "City in a Park" ▪ Evaluating Solutions for Trash Pollution in Baltimore: The Harris Creek Watershed Demonstration Project report ▪ Olmstead Plan	▪ Civic Works- Hoop Gardens, Rain Gardens, Community spaces that improve the environment and reduce violence ▪ Environmental Justice Partnership, Inc. ▪ Friends of Patterson Park-Education, advocacy programs, and greening efforts to improve the "health and vitality of the diverse communities who call Patterson Park the Best Backyard in Baltimore" ▪ Patterson Park Audubon Center- Education and greening efforts ▪ Schools and education efforts ▪ Institute for Urban Research, Morgan State ▪ Clean Water Action- works to empower people to take action to protect America's waters, build healthy communities ▪ Humane Metropolis Baltimore Initiative- A new perspective on people, nature, and cities developed by the Ecological Cities Project in collaboration with he Lincoln Institute of Land Policy ▪ MICA Programs- community gardens and spaces, mural project ▪ Baltimore City Community Gardens- ▪ Maryland's Food Gardening Network-

Table 2.7. Harris Creek Watershed efforts to work together, share assets, connect, and produce "Sustainability for Stable Urban Sanctuaries."

City of Baltimore	CWP	BHWA	Parks and People Foundation	Individuals and Other Groups
▪ City of Baltimore's Sustainability Plan ▪ Baltimore City's Alley Gating and Greening program assistance				"Grow it, Eat it"- Baltimore City, ▪ University of Maryland, and Parks and People Foundation ▪ C.A.R.E. creates tolerance and social justice, where poverty has been overcome and people live in dignity and security ▪ Participation Park combines art and gardening ▪ Trashbusters ▪ Adopt-a-lot ▪ Historic East Baltimore Community Action Coalition (HEBCAC)

SECTION 3. WATERSHED GOALS AND OBJECTIVES

The mission of the Baltimore Harbor Watershed Association (BHWA) is to "protect and improve the environmental quality and natural beauty of the Baltimore Harbor and its tributaries." Part of that mission involves protecting the Harris Creek Watershed using the following strategies:

- Create a community of neighborhoods in the Harris Creek Watershed that will work as a team to clean up trash on the streets, and prevent it from going into the Baltimore Harbor.
- Improve the quality of life and health for the residents living within the Harris Creek Watershed by addressing trash and other issues that relate to environmental injustice.

In order to meet these Harris Creek Watershed strategies, feedback from a stakeholder meeting, along with input by the BHWA, was used to establish six specific watershed goals and numerous related objectives for the Harris Creek Watershed. These goals and objectives are listed below.

1. **Promote Sense of Shared Vision**

- Create a logo for Harris Creek Watershed community
- Increase watershed murals and signage
- Highlight watershed activities through newsletter
- Post information on Facebook
- Foster interracial relationships through creative events
- Engage the Hispanic community
- Develop watershed-wide projects to foster community pride and ownership
- Design a recognition program acknowledging neighborhoods that are working hard to make a difference

2. **Identify and Advocate for Better Health Practices**

- Establish a relationship between trash/health and greening/health
- Explore connections between rats/trash/pet waste/health/water quality and water/mold/asthma
- Monitor air quality
- Promote urban farming
- Increase access to healthy foods through schools and stores

3. **Reduce Trash**

- Implement neighborhood clean-ups and campaigns/competitions
- Stencil storm drains as community event
- Install storm drain screens
- Increase number of public trash cans and foot street sweepers
- Rejuvenate city trash campaign and target local areas
- Require businesses and schools to recycle
- Design recycling incentive programs
- Identify a local light construction debris disposal site
- Distribute regular and recycling trash cans to the residents, free of charge

4. Establish a Comprehensive Watershed Education Program for Adults and Children

- Begin education initiative with the children first
- Promote relationships/partnerships with local schools
- Develop watershed/environmental field trips – Harris Creek Outfall, harbor, etc.
- Engage the youth in meaningful environmental projects
- Work through churches –community strongholds
- Encourage convenience store owners to educate patrons about trash
- Make connections between communities, the environment, trash, crime, etc.
- Advertise trash pictures - postcards

5. Increase Green Space and Reduce Impervious Surfaces

- Promote alley gating and greening
- Maximize "Adopt-a-Lot" program – information distribution
- Increase tree canopy and streamline tree planting projects. Strong relationship between trees, decreased crime, reduced runoff, and increased well being
- Implement rain gardens and stormwater curb extension ("bump-out") designs
- Connect and utilize existing resources and programs
- Establish a list of available resources
- Reduce vacant houses

6. Improve Enforcement Process

- Document 311 calls and monitor the follow-up actions
- Install wireless cameras in the neighborhoods to catch illegal dumping
- Develop strong collaboration and coordination between communities and Baltimore City Housing Department and all City agencies
- Increase the number of Housing inspectors
- File complaints and civil suits to Sanitation Department
- Introduce the Housing Inspectors at Community meetings for relationship enhancement and establishment of common goals
- Empower police to write citations for illegal dumpers
- Recruit Watershed Rangers
- Establish neighborhood trash eradication program using Citizens on Patrol as a model

These 6 goals were used to direct the field efforts (Section 4) and shape the final recommendations and implementation plan (Section 5) developed for the Harris Creek Watershed.

SECTION 4. FIELD ASSESSMENTS AND FINDINGS

During the assessment period, CWP field teams assessed the Harris Creek Watershed for green infrastructure (GI) and retrofit project opportunities. The identification of projects was largely driven by community interest and support of a project idea, along with the desire to meet the overall goals and objectives of the Harris Creek Watershed described in Section 3 of this report. Table 4.1 provides a summary of general findings from the field assessments. Figure 4.1 shows a map of the field sites assessed.

Table 4.1. General Findings from the Field Assessments.

General Findings
• 13 specific green infrastructure and community retrofit projects identified • Additional general concepts developed for green street designs that can be applied to target areas of the watershed • Emphasis on community supported projects and ideas • Emphasis on projects that will help deter trash dumping and litter • Types of retrofits include rain garden park areas, vacant lot conversion to parks including rain gardens, stormwater curb extensions, street planters, tree plantings, and green streets.

According to the EPA, Green Infrastructure (GI) is defined as "an adaptable term used to describe an array of products, technologies, and practices that use natural systems – or engineered systems that mimic natural processes – to enhance overall environmental quality and provide utility services. As a general principal, GI techniques use soils and vegetation to infiltrate, evapotranspirate, and/or recycle stormwater runoff." Stormwater retrofits are structural and non-structural stormwater management practices that can be used to address existing stormwater management problems within an urbanized watershed. Retrofits are an essential element of a holistic watershed restoration program because they can help improve water quality, increase groundwater recharge, provide channel protection, and control overbank flooding. Non-structural retrofits that mimic natural processes can be encompassed within the GI terminology.

In addition to the stormwater management benefits they offer, GI and stormwater retrofit projects can be used as demonstration projects, forming visual centerpieces that can be used to help educate residents and build additional interest in watershed restoration.

4.1 Field Assessment Protocol

Potential green infrastructure and stormwater retrofit opportunities at a number of candidate project sites in Harris Creek were assessed during the watershed field assessments. Several candidate project sites were identified prior to field work using aerial photography and stakeholder input. Candidate retrofit sites identified for the assessment generally had one or more of the following characteristics:

- Situated on publicly-owned or publicly-operated lands or open spaces (e.g. right-of-way, City-owned vacant lots, parks);

- Located near a dumping hotspot;
- Located in an area with community desire for greening or improvement; and
- Could serve as a community centerpiece project.

A Retrofit Inventory field form was used to evaluate retrofit opportunities at candidate sites. Field crews looked specifically at drainage patterns, the amount of impervious cover, available space, and other site constraints to develop preliminary retrofit concepts for a site. For this stormwater field inventory, the primary objectives were to identify opportunities that had strong community support, help reduce trash, provide water quality treatment, reduce stormwater runoff volumes, and demonstrate high-visibility and aesthetically pleasing community greening projects.

4.2 General Findings

Neighborhood Greening Projects

Thirteen specific green infrastructure opportunities in the City were identified. These projects are summarized in Table 4.2 and details for all 13 retrofit opportunities are included in the attached field forms (Attachment A). General project ideas and findings are discussed below. Additionally, three generic designs for street greening opportunities were developed which are also discussed.

Application of these stormwater retrofit designs is likely to be largely driven by opportunity. In an urbanized environment, greening projects are limited by funding and opportunity.

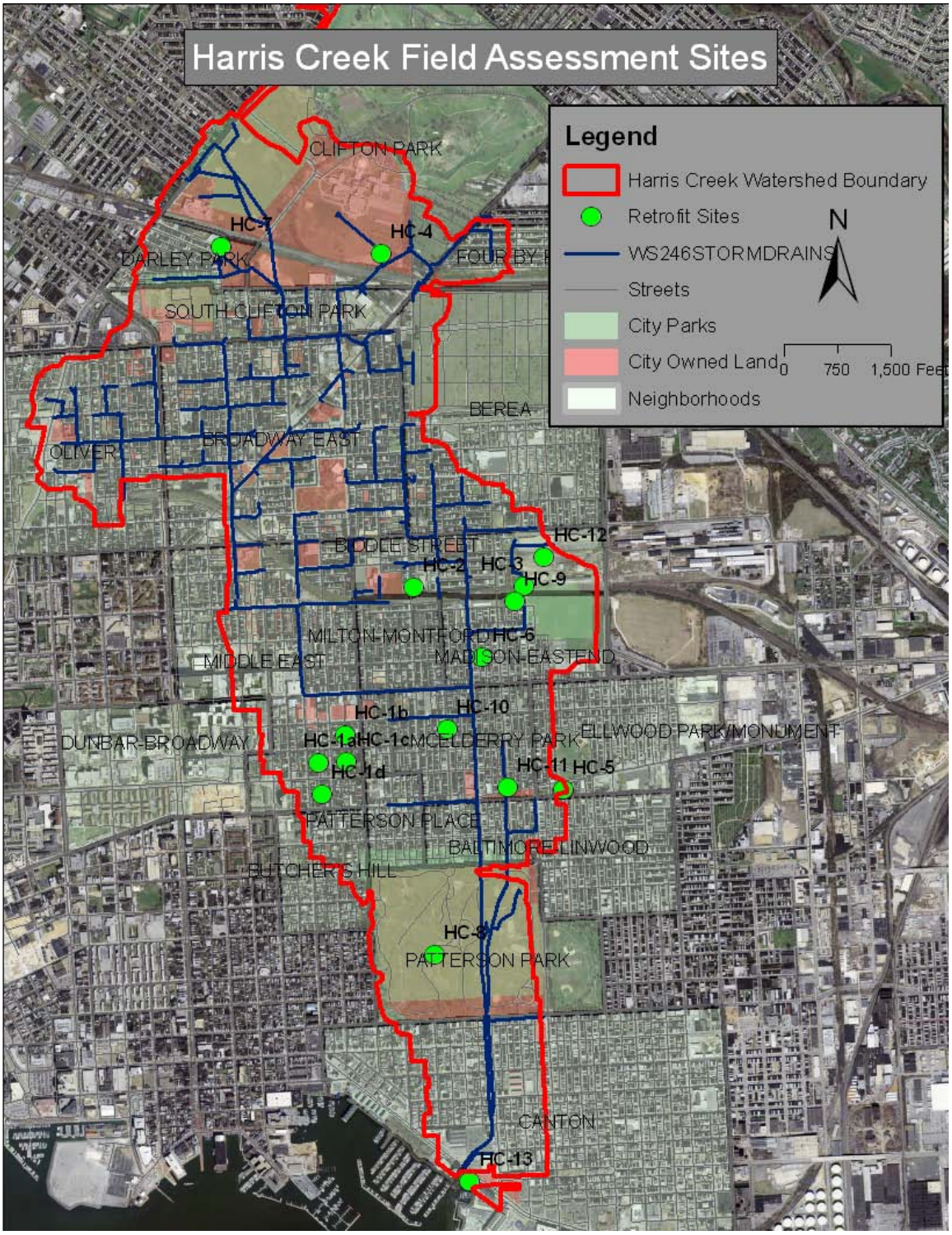


Figure 4.1. Neighborhood projects identified in the Harris Creek Watershed.

Table 4.2. Summary of Neighborhood Projects identified in the Harris Creek Watershed.

Site ID	Neighborhood (Cost Estimate)*	Location	Project Description	Neighborhood Contact Info
HC-1	C.A.R.E. Neighborhood (~$15,000 to $20,000)	Vacant Lots on 200 block N Duncan Ave, ***400 block N Duncan*(priority)**, 400 block N Madiera, and 500 block N Madiera	Convert areas to park spaces, opportunities to build rain gardens to capture street and alley runoff. Neighborhood has "vacant lot tours" where ideas for spaces are being developed. Some lots are dumping hotspots.	Caroline Brooks, Beth Myers-Edwards, Theresa Strawder
HC-2	1000 block N Milton Ave (~$25,000)	2 vacant lots and roadway beneath railway tracks	Convert areas to park/community spaces and build outdoor classroom/film studio for children. Opportunity to create rain garden to capture large portion of roadway runoff. Area is hotspot for dumping and was a former car service station. Need to conduct soil testing and possibly remediate site. Another opportunity to create stormwater curb extensions beneath railroad where no cars are parked.	Cheryl Johnson, Theresa Strawder
HC-3	1000 N Linwood Ave (near Recycling Center) (~$30,000)	Beneath rail road tracks – line of tar leads from this area directly to storm drain	Install sand filter beneath train tracks to capture and treat tar runoff from railroad.	Glenn Ross
HC-4	Clifton Park (~$20,000)	Real Food Farm	Block low-flow outlet of existing SW practice and allow this basin area to pond up to overflow elevation. Use captured stormwater to irrigate farm area.*Need to check on this design and feasibility of using captured stormwater for irrigation. **Alternative design:** rainwater harvesting from hoop-houses and re-use of water for irrigation. Treat overflow and additional site runoff with a bioswale.	John Ciekot, Civic Works

Table 4.2. Summary of Neighborhood Projects identified in the Harris Creek Watershed.

Site ID	Neighborhood (Cost Estimate)*	Location	Project Description	Neighborhood Contact Info
HC-5	Fayette and Potomac Streets (~$15,000)	Small cul-de-sac has problems with trash, parking and flooding	Opportunities for tree plantings and street greening (narrow street width). Also, area in need to yard drain installation.	Shannon Sneed
HC-6	Madison East End (~8,000)	Madison Avenue from Frank Bocek Park to edge of watershed	400-500 planters and plants to green homes along Madison Ave and neighborhood. This area is a major throughfare for people coming into the City toward Hopkins. Also identified 3 locations for tree-pits.	Mitchell Henderson
HC-7	Darley Park Neighborhood (~$5,000)	Three severe and persistent dumping sites in neighborhood.	Construct wall/mural to deter dumping of trash down hill into Clifton park. Post no dumping signs and cameras to deter and catch people dumping.	Lottie Sneed, Francis O'neal, Pauline Charles, Amy Reed
HC-8	Patterson Park (~$15,000)	Throughout Park	Perform maintenance of stormwater pond. Relocate proposed dog park area out of pond drainage area. Need to check out DPW site to see if there are options to control SW at this site.	Tim Almaguer, Friends of Patterson Park
HC-9	Proposed Hand Car Wash - 2800 Eager Street (~$5,000)	Owner is trying to get site re-zoned to install hand car wash and possible day C.A.R.E. center for the community.	Site is large and has lots of green space. Owner would like to make site good demo for environmental practices – how to treat stormwater on-site.	Dwane Bullock, Glenn Ross
HC-10	Upper McElderry Park (~$2,300)	Throughout neighborhood.	Tree plantings. Community has already conducted a survey of how many and where trees are needed. Just need funding to get trees in the ground. Would like to use cherry trees if possible. Storm drain stenciling throughout neighborhood.	Warren Street, Beth Myers-Edwards

Table 4.2. Summary of Neighborhood Projects identified in the Harris Creek Watershed.				
Site ID	**Neighborhood (Cost Estimate)***	**Location**	**Project Description**	**Neighborhood Contact Info**
HC-11	Library Square (~$30,000+)	Area has problems with flooding. Recently had green tree pits installed.	To alleviate flooding issues, this neighborhood would be a good target area for the proposed green street retrofits (types 1-3).	Kelly McPhee
HC-12	Baltimore Recycling Center (~$15,000)	1030 Edison Highway	During a site inspection, a few opportunities for improved sediment control and stormwater management were identified.	Ray Bahr, Glenn Ross, Larry Schultz of MDE, Owner of Site
HC-13	Harris Creek Park (aka Boston Street Pier Park) (~23,000+)	Adjacent to the Harris Creek outfall	Create an outdoor classroom with bayscaping, shoreline restoration, and interpretive signage.	Ashley Traut, Blue Water Baltimore
* See Section 4.4 of this Plan for more detailed cost information				

Green Spaces

Several opportunities exist to convert vacant lot areas to green spaces, which can treat and reduce stormwater runoff from adjacent impervious areas such as alleyways, streets, and rooftops (HC-1, HC-2). At many of these proposed sites, persistent trash dumping was evident. Several examples are shown in Figure 4.2 below. The community members expect that lot greening and beautification would help deter illegal dumping, and help reduce trash. Additionally, rain gardens can be incorporated around the lot perimeters to capture and treat stormwater runoff. Community members at several of the proposed green space locations are available to assist with landscaping, aesthetic design, and function of the lots. In the C.A.R.E. neighborhood (HC-1) community members have been generating ideas for several community vacant lots through their vacant lot tours and Adopt-a-Lot programs. Site HC-2 was the location of a former car and service station, so soil assessments must be conducted to determine if any remediation is necessary, and identify which parties would be responsible for site clean-up. Initial follow-up actions for project implementation include identifying lot property owners, and conducting soil testing at the potential greening sites.

(a)

(b)

(c)

(d)

Figure 4.2. Green space opportunities at (a) 400 N Duncan Street in the C.A.R.E. neighborhood (site HC-1) and (b) 1000 N Milton Street (site HC-2). Both spaces have potential to convert vacant lot areas into a greened space with a rain garden. Example community rain gardens constructed by Civic Works at (c) the 900 block of N. Milton Ave and (d) the Amazing Port Street Project.

Tree Planting and Stormwater Planters

Several neighborhood areas identified a need for greening through street tree planting or stormwater infiltration planters. In the McElderry Park and Library Square neighborhood, tree pit surveys have been completed indicating the number and location of needed trees. In the Madison East End neighborhood, the community would like to install planters with flowers or shrubs that would serve to beautify Madison Avenue and capture rainfall, preventing it from running off into the storm drains (Figure 4.3).

(a) (b) (c)

Figure 4.3. (a) Flower planters on 800 N Glover block. (b) close-up of a stormwater/flower planter that serves to capture rainfall and beautify the neighborhood. (c) Area along Madison Avenue in need of additional planters.

Pollution Hotspots

A number of pollution and trash hotspots were identified in the watershed including site HC-3, HC-12, and several areas in the Darley Park and South Clifton Neighborhoods (HC-7) (Figure 4.4). At HC-3, a thick black substance was observed to be leaking from the railroad tracks directly into nearby storm drains. For this project, it is recommended that the railroad company be contacted regarding this problem. Sand filters or similar filtration BMPs can be designed to treat runoff from highly polluted sites. At the Baltimore Recycling Center (HC-12), two existing sedimentation/stormwater ponds collect runoff from large construction recycling debris piles. During a site inspection, opportunities to further improve the sediment and stormwater controls through the installation of additional filtering devices were identified. These opportunities should be further discussed with the site owner and MDE.

In the Darley Park neighborhood (HC-7), several actions were recommended to deter dumping including the construction of a wall to keep trash from being dumped into a wetland area and installing surveillance cameras to identify illegal dumpers. Additional recommendations to reduce trash in the watershed are discussed in Section 5 of this *Plan*.

In addition to these three project sites the field team observed several areas where car wash runoff was flowing directly into the storm drain system. Recommendations to address these problems along with other illicit discharges in the watershed are also addressed in Section 5 of this *Plan.*

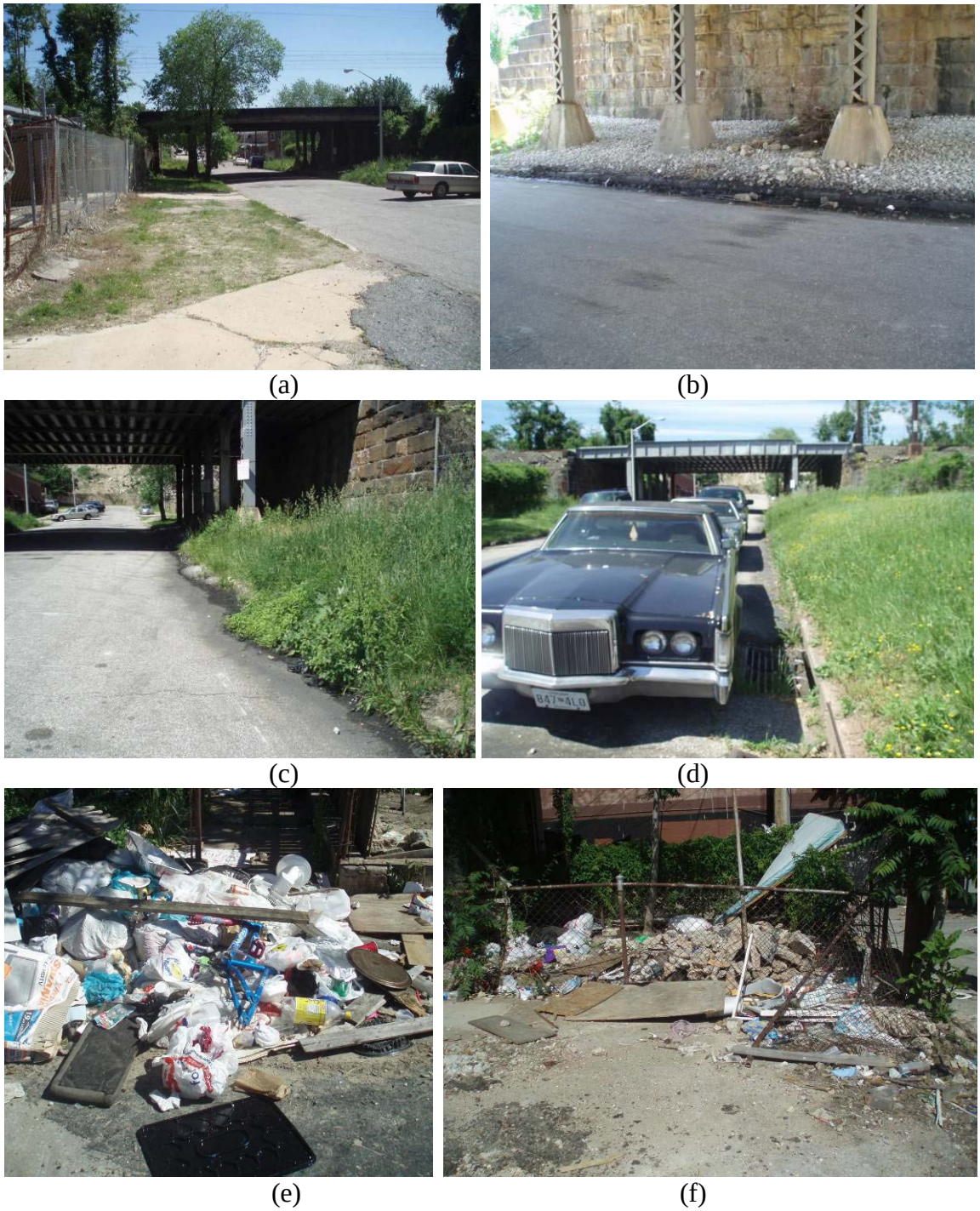
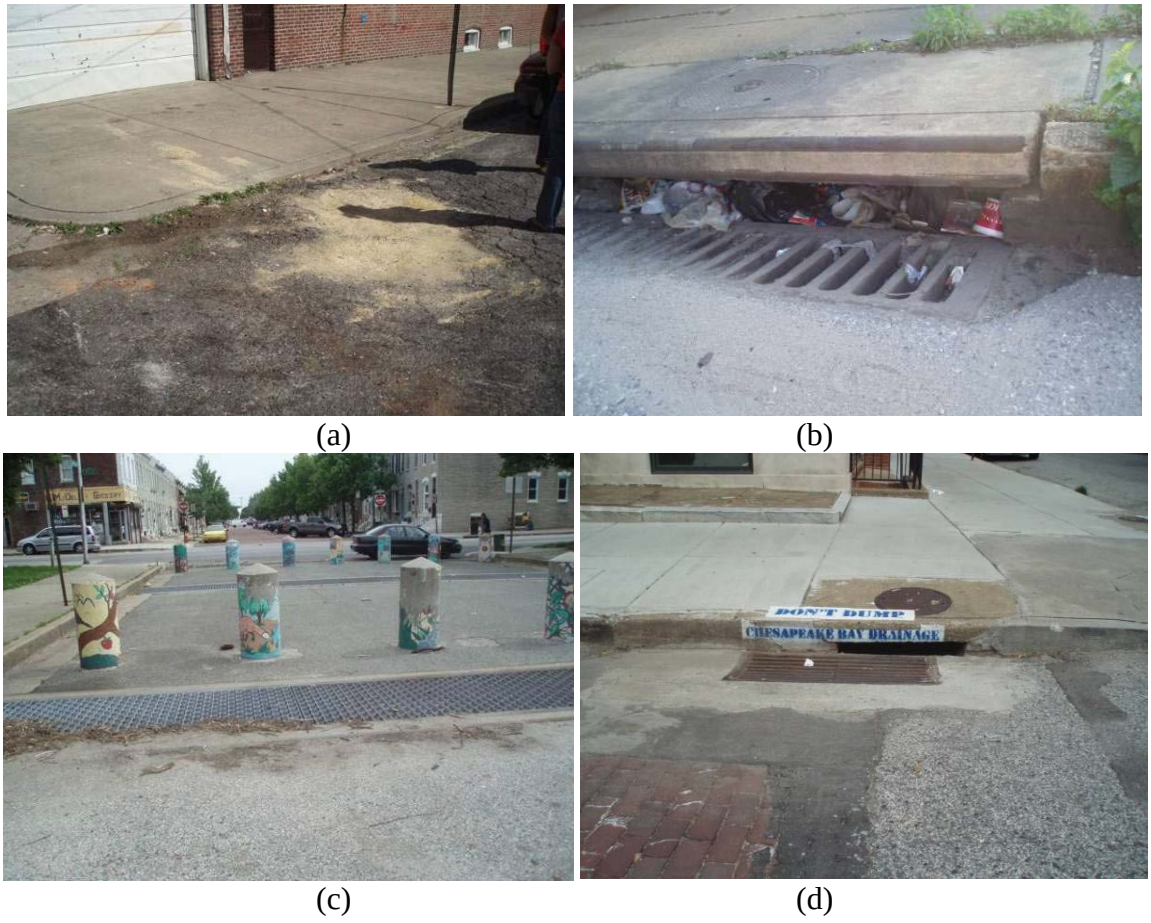


Figure 4.4. Watershed hotspot areas. (a), (b), (c) Hotspot location identified at 1000 N Linwood (HC-3) where a dark tar-like substance was leaking from the railway tracks and down the street. (d) The tar-like substance revealed an obvious flow path directly into the storm drain system. (e) and (f) Trash hotspots observed in the Darley Park Neighborhood.

Flooding Concerns

There were watershed locations visited during field work where flooding or drainage problems persisted due to clogged storm drains, undersized storm drains, or the lack of adequate drainage infrastructure (Figure 4.5). In the Potomac Street cul-de-sac (HC-5), the installation of a catch basin is needed to improve drainage. This project can be partnered with tree-planting opportunities that were identified at this cul-de-sac. In Library Square (HC-11), persistent flooding and drainage areas have existed. This site is a low lying area of the watershed that receives an excess amount of runoff,and a large quantity of trash that is transported by both wind and runoff to the neighborhood. Several drains in the neighborhood appear to be persistently clogged or undersized, despite numerous attempts to improve the drainage in this area. It is recommended that runoff reduction practices such as green street designs and rain barrel implementation be targeted in this neighborhood, and areas immediately upstream to reduce the amount of runoff flowing to the storm drains.



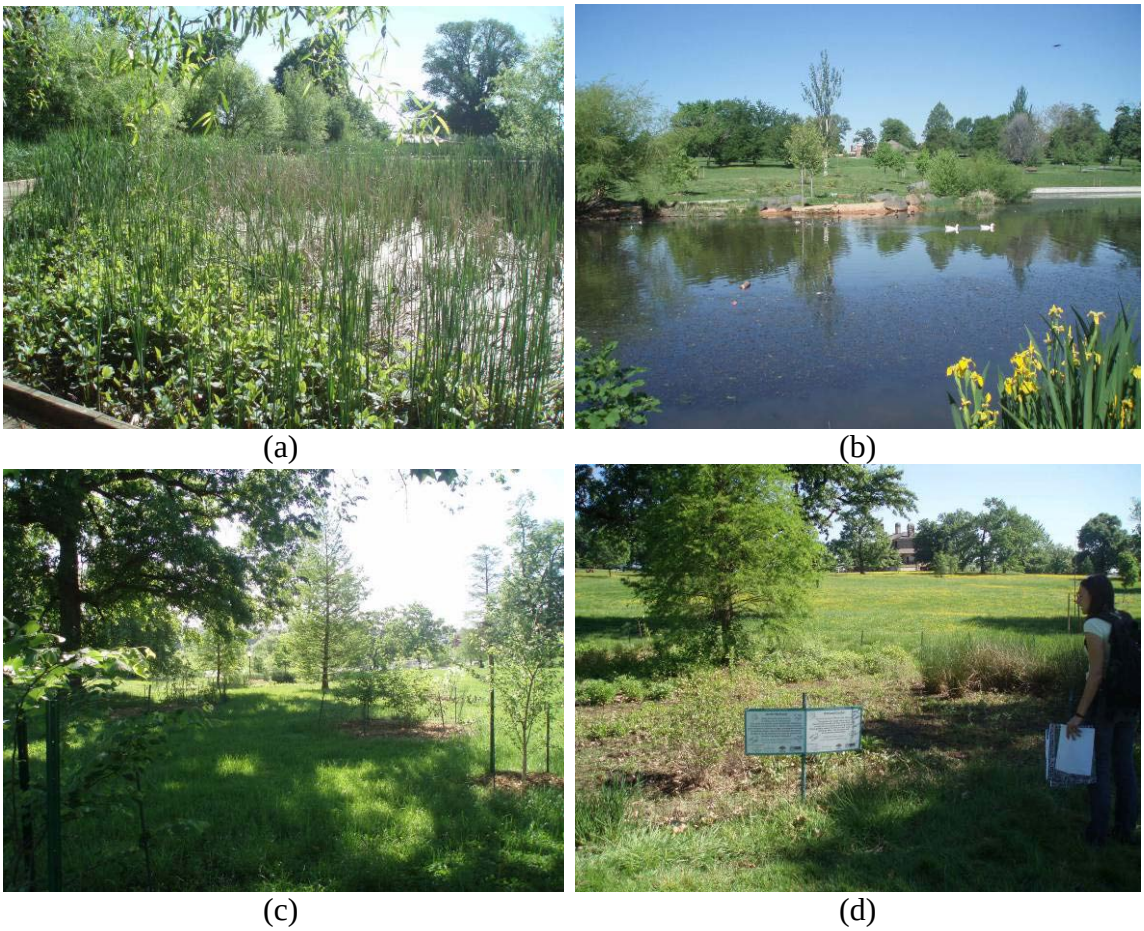
(a) (b)

(c) (d)

Figure 4.5. Watershed areas with flooding and drainage issues. (a) Ponding area at the Potomoc Street cul-de-sac. (b) Trash clogged storm drain on the 1000 N Milton block. (c) and (d) Persistent flooding areas at Library Square and at 200 N Kenwood Ave.

Park Management and Opportunities

Patterson Park and Clifton Park were assessed for greening and stormwater management opportunities. At Patterson Park (HC-8) maintenance of the Patterson Park Boat Lake was identified as high priority to improve the water quality and performance of the Lake (Figure 4.6). High bacteria loads in the Lake have recently been monitored. Current maintenance needs include sediment and cattail removal from the forebay area to increase storage, algae, sediment, and trash removal from the pond, and increased bacteria reduction. To reduce bacteria, the installation of an aquatic bench can help to deter large populations of ducks and geese that can contribute to in-lake loads. Further, the drainage area to the pond should be assessed to reduce the sources of bacteria entering the Lake. Areas draining to the Boat Lake containing native tree and planting areas should be expanded. This will help encourage pollutant removal and reduce sources of bacteria. Additionally, several playing field areas of the park were identified for pervious area restoration to improve the soil permeability and drainage throughout the park.



(a) (b)

(c) (d)

Figure 4.6. Patterson Park. (a) Forebay of the Boat Lake at Patterson Park which is in need of sediment removal. (b) Ducks at the Patterson Park Boat. (c) Tree planting area located in drainage way to the Boat Lake that provides runoff filtration. (d) Native planting area adjacent to the Boat Lake.

At Clifton Park, opportunities to treat stormwater runoff and promote on-site water re-use and conservation was explored at the Real Food Farm site (Figure 4.7). There appear to be a variety of options including rainwater harvesting, treatment of excess runoff by using a bioswale, and the potential option to use well water for site irrigation. It is recommended that funding be pursued to pilot these projects to gage their effectiveness and feasibility.

(a) (b)

Figure 4.7. Clifton Park Real Food Farm. (a) Hoophouses at the Clifton Park Real Food Farm. (b) Plowed fields at the Clifton Park Real Food Farm.

An additional park greening opportunity was identified at the Harris Creek Park (HC-13) adjacent to the Harris Creek outfall (a.k.a. Boston Street Pier Park). The proposed project involves creating an outdoor educational classroom with interpretive signage about the project and the Harris Creek Watershed, outfall, and trash interceptor. Two gardens in the park will be created with native plants in a bayscaping design. In addition, a shoreline improvement project is proposed to remove the phragmites and create a stable shoreline with native vegetation to provide additional water quality improvements. The projects will also help create a wildlife habit for birds and butterflies in the watershed.

4.3 Stormwater Retrofits for Streets ("Green Streets")

There are four types of stormwater retrofits that are applicable to streets in the Harris Creek Watershed. They are, in order of increasing complexity, catch basin inserts, tree plantings, stormwater curb extensions, and biofiltration:

- *Catch basin inserts and screens.* Catch basin inserts capture litter and sediment and can provide a filtering function for other pollutants (Figure 4.8(a)). They are installed directly into inlets and require quarterly maintenance at a minimum. This retrofit is invisible to the public. Applicable at most inlet structures, inserts have the advantage of not impacting private property or requiring any construction.

- *Tree plantings.* Tree plantings can reduce runoff by soaking up rainfall, filter stormwater pollutants, and provide a host of additional community benefits including improved air quality, air cooling, and wildlife habitat (Figure 4.8.(b) and 4.9). There were a number of streets identified in the watershed appropriate for additional tree plantings. In addition, tree planting opportunities were identified at watershed sites HC-5 and HC-6 and HC-10.
- *Stormwater curb extensions (a.k.a. "bump-outs").* Stormwater curb extensions improve water quality and pedestrian safety (Figure 4.8(c) and Figure 4.10). Installed in the parking lane immediately upstream of a storm drain inlet, the curb extension has a curb cut to allow the first flush of stormwater to enter the island area, while overflows proceed downstream to the existing inlet. These curb extensions can be landscaped like a bioretention cell, incorporated with a tree pit, or constructed like a filtration trench with a grate. Stormwater curb extension opportunities were identified at watershed sites HC-2 and HC-3.
- *Bioretention / biofiltration.* Bioretention or biofiltration practices are landscaped areas that receive stormwater runoff from adjacent impervious areas (Figure 4.8 (d)). The runoff is filtered through a soil medium, and either infiltrated into the ground or collected by an underdrain system. Biofiltration is an effective means to improve water quality and promote infiltration. When vacant lots exist adjacent to the street right-of-way at the downstream end of the block, it is feasible to divert flows under the sidewalk to a properly sized bioretention cell. Diverting flows from the street to vacant lots alters the hydrology to decrease the runoff from small storms and increase infiltration. There are several vacant lots in the Harris Creek Watershed that are sufficiently large to construct a bioretention cell that will treat the water quality volume. Biofiltration opportunities were identified at watershed sites HC-1 and HC-2.

(a)

(b)

(c)

(d)

Figure 4.8. Street retrofit designs. (a) Proprietary catch basin insert installed at the Naval Station in Mayport, FL. (b) Recommended tree planting design in Canton, Baltimore. (c) Example of a street stormwater "bump-out" in Watershed 263, Baltimore. (d) A bioretention practice in a city park in Charlottesville, VA.

(a) (b)

Figure 4.9. Examples of tree plantings and opportunities in Baltimore, MD (a) New tree planting and impervious cover project on the 200 block of N Kenwood Avenue (b) Watershed street needs tree planting.

(a) (b)

(c)

Figure 4.10. Examples of a stormwater curb extensions and opportunities in Baltimore, MD. (a) Typical curb and gutter system for an urban street. (b) Impervious cover replaced with a curb extension that slows down stormwater runoff and reduces pollution before the water enters the storm drain down gradient in the street. (c) Opportunity for a curb extension at site HC-2. Photos (a) and (b) courtesy of Baltimore City Department of Public Works.

4.4 Cost Data and Pollutant Removal

Cost data for the 13 community greening projects were estimated using information from Schueler et al. (2007), Wright et al. (2005), and Kitchell and Schueler (2005). Pollutant removal estimates were developed using information from Hirschman et al, 2008 and Caraco, 2001. Project costs and pollutant removal values represent only planning level estimates and should be adapted to include more appropriate local cost estimates prior to construction. In highly urbanized areas such as the Harris Creek Watershed, it is likely that utility constraints, contaminated soils, and other factors may increase the actual implementation costs of these projects.

Table 4.3. Planning level costs and stormwater benefits for the thirteen identified Harris Creek projects.

Project ID	Project Type	Estimated Cost	Runoff Reduction (cubic feet)	TN Removal (lb/yr)	TP Removal (lb/yr)	TSS Removal (lb/yr)
HC-1	Greening	$6,233	415	2	0.27	46.2
	Rain Garden	$9,450	360	2.8	0.32	70.4
HC-2	Greening	$14,370*	960	4.6	0.63	106.5
	Rain Garden	$10,479	400	3.1	0.36	77.6
HC-3	Sand filters	$30,880	0	2.24	0.6	102.9
HC-4	Rainwater Harvesting	$7,125	356	0.96	0.06	4.1
	Rain Garden	$14,250	190	0.94	0.06	4.3
HC-5	Tree Plantings	$10,000	1080	Unknown	Unknown	Unknown
	Inlet Replacement	$5,000	0	0	0	0
HC-6	Planters	$8,000	40	0.30	0.04	7.70
	Tree Plantings	$60	160	Unknown	Unknown	Unknown
HC-7	Trash Abatement	$4,870	0	Unknown	Unknown	Unknown
HC-8	Pond Maintenance	$15,000	0	4.17	1.13	191.7
HC-9	Rain Garden	$5,000	158	1.2	0.14	30.8
HC-10	Tree Plantings	$2,300	6200			
HC-11	Green Streets	$27,820	428	3.3	0.38	105.6
HC-12	ESC Controls	$15,000	0			50
HC-13	Bayscape Gardens	$3,000	40	0.04	0.35	8.9
	Shoreline Restoration	$10,000	Unknown	Unknown	Unknown	Unknown
	Interpretive Signage	$10,000	0	0	0	0
TOTAL		**$185,837**	**10747**	**25.6**	**4.4**	**806.7**
* Cost may increase significantly if site soil remediation is required at site HC-2						

4.5 Additional Retrofit Projects

Although, some specific locations for "green street" retrofits are identified above, these practices can also be applied at many additional locations throughout the watershed. During the field work, the teams classified three general types of streets throughout the watershed and developed greening templates that can be loosely applied to any of these streets. Field forms were developed for greening these three Type 1, Type 2, and Type 3 streets and are included in the appendix. Some example green street renderings from San Mateo, CA are shown in Figure 4.11. It is recommended that a green-street master plan be developed to identify high priority "greening corridors" throughout the watershed. These streets can be used to create connectivity between Clifton Park, Patterson Park, the Waterfront, and various neighborhoods in the watershed. This recommendation is discussed further in Section 5 (watershed recommendation #7) of this *Plan*.

Eleven retrofit opportunities had previously been identified in the Harris Creek and Baltimore Harbor Watersheds. Of the projects listed in Table 4.4, three were determined to be high priority and are located in the Harris Creek Watershed (R-5A, R-16, R-22). Specific details about these retrofit projects can be found in the Baltimore City Retrofit Inventory Memo (Novotney, 2008).

(a)

(b)

(c)

Figure 4.11. Renderings of green streets. (a) Green gutter design that can be applied to narrow and space constrained streets. (b) Green designs for commercial areas using bioretention. (c) Green street applications incorporating bike lanes. Photos from San Mateo County Sustainable Green Streets and Parking Lots Guidebook, 2009 (Nevue Ngan Associates and Sherwood Design Engineers, 2009).

Table 4.4. Baltimore Harbor retrofit projects previously identified by Novotney, 2008.

Retrofit ID	Location	Retrofit Type	Stormwater Management Practice	Description	Contributing Drainage Area (acre) *
HA-R2	Canton Waterfront Park below Boston St. at Ellwood Ave.	On-Site	Bioretention Area, Underdrain	Bioretention area in existing landscaping area to treat stormwater runoff from small impervious area	1.6
HA-R3	Canton Waterfront Park below Boston St. at Linwood Ave.	On-Site	Bioretention Area, Underdrain	Bioretention area in existing landscaping area to treat stormwater runoff from small impervious area	0.7
HA-R5A	Patterson Park	On-Site	Bioretention Area, Underdrain	Bioretention area in existing landscaping area to treat stormwater runoff from disturbed pervious area	1.5
HA-R5B	Patterson Park	Storage	Underground Detention System	Underground detention to provide extended detention and partial treatment of stormwater runoff from upstream drainage area	872.4
HA-R6	Patterson Park Adjunct	Storage	Dry Swale	Dry swale in existing landscaping area at toe of slope to treat stormwater runoff from disturbed pervious area	11.9
HA-R8	Unnamed Park, at Orleans St. and Ellwood Ave.	On-Site	Bioretention Area, Underdrain	Dry swale/bioretention area in existing open space area to treat stormwater runoff from disturbed pervious area	2.4
HA-R16	Fayette St. and Caroline St.	On-Site	Bioretention Area, Underdrain	Bioretention area in existing depression/open space area to treat parking lot and roadway runoff	1.4
HA-R19	Harford Heights ES	Storage	Bioretention Area, Underdrain	Bioretention area in existing open space area to treat stormwater runoff from small impervious area	0.7
HA-R20	Clifton Park Adjunct, W. of St. Lo Dr. at Sinclair Ln. and Wolfe St.	Storage	Stormwater Pond/Wetland System	Stormwater pond/wetland system to treat stormwater runoff from upstream drainage area	5.8
HA-R22	Fairmont Harford HS	Storage	Stormwater Pond/Wetland System	Stormwater pond/wetland system to treat stormwater runoff from upstream drainage area	34.4
HA-R23	Clifton Park, Harford Rd., and St. Lo Dr.	On-Site	Bioretention Area, Underdrain	Bioretention area in existing landscaping area to treat roadway runoff	2.8

Notes: *Estimated contributing drainage area, based on available mapping data.

SECTION 5. WATERSHED RECOMMENDATIONS AND IMPLEMENTATION PLANNING

Watershed restoration is a major, long-term commitment that requires dozens or even hundreds of individual stormwater retrofit and green infrastructure projects along with targeted and focused community educational efforts to be implemented over a multi-year timeframe. The process can also be quite costly. As such, careful planning is needed to prioritize practices and actions that will result in an efficient and cost-effective protection strategy. This section details 15 key watershed recommendations and provides information on effective implementation of those recommendations.

A major focus of this *Plan* is to improve the internal capacity of the Harris Creek stakeholders and community members to enact the watershed recommendations. As such, opportunities to develop stronger community leadership and provide community members with jobs, training, education, volunteer opportunities is a high priority, where appropriate. In addition, community member involvement and feedback is crucial to the ultimate success of these recommendations and should be sought during all stages of the *Plan* implementation.

5.1 Harris Creek Recommendations and Implementation Strategies

Based primarily on feedback from the 2nd and 3rd watershed stakeholder meetings, in addition to project partner meetings, the baseline assessment, and field observations, 15 recommendations were developed for the Harris Creek Watershed. These are listed below, in order of priority:

1. **Implement neighborhood greening projects (HC-1 through HC-13)**
2. **Reduce trash through targeted clean-up efforts, education, better trash dumping enforcement and collection practices, and better management practices such as storm drain screens.**
3. **Develop targeted educational programs throughout the watershed**
4. **Explore links between toxicity and contamination and watershed areas.**
5. **Enhance outreach to community about efforts and accomplishments, as well as needs (forum for posting problems)**
6. **Strategically locate additional park and green spaces into areas that do not have them**
7. **Implement green street designs and larger-scale retrofit projects**
8. **Identify watershed hotspot areas and develop pollution prevention strategies**
9. **Systematically identify and remove illicit discharges from the watershed**
10. **Promote Urban Farming efforts in the community**
11. **Work with community partners to make healthy foods and locally grown produce available to the community**
12. **Promote water conservation and water-wise consumption**
13. **Encourage and/or incentivize strong redevelopment criteria**
14. **Develop a "Green" microlending and entrepreneurial Support/Training Program**
15. **Link watershed efforts to the City's Sustainability Plan**

Each of these recommendations is discussed in more detail below. Further, implementation recommendations are summarized in Tables 5.1 and 5.2. Table 5.1 outlines the responsible parties and implementation milestones for each of the 15 watershed recommendations. Table 5.2 lists the short-term, mid-term, and long-term actions for meeting each of these watershed recommendations, the entity responsible for leading each action, and the estimated costs associated with meeting these goals.

It is important to note that implementation is by far the longest and most expensive step in the watershed management process. In fact, restoration and protection costs for a single suburban subwatershed can easily range in the million dollars depending on the extent of restoration and protection activities, land costs, available open space, and other factors. Salaries, land acquisition and construction of projects often account for a majority of these costs. In highly urbanized areas, cost will likely increase. A minimum of ten years is usually needed to design and construct all the necessary projects, which are normally handled in several annual "batches." Sustaining progress over time and adopting the plan as more experience is gained are vital aspects of implementation.

Preliminary cost estimates and responsible partners have been identified so that financial resources can be allocated and staff roles can be defined. Table 5.1 provides the objectives met, location, responsible parties, and long-term milestones for implementation of each strategy. Table 5.2 provides a draft implementation schedule and associated costs for implementing each short term, mid term and long term action.

The cumulative estimate for implementing the 15 watershed recommendations exceeds 2.4 million dollars over the next 5-10 years (Table 5.2). Project costs represent only planning level estimates and were determined based on guidance provided in Schueler et al. (2007), Wright et al. (2005), and Kitchell and Schueler (2005). These estimates should be adapted to include more appropriate local cost estimates where available. These cost estimates should be used to guide the BHWA, the City, and other project partners in estimating annual operation and implementation budgets for the Harris Creek Watershed. The implementation costs should be distributed across implementation partners, existing programs, and responsible property owners (e.g., the City, institutions, businesses, and landowners).

Table 5.1 Recommendations, Responsible Party and Desired Outcomes for Restoration in the Harris Creek Watershed.

Stakeholder Goal Met	Recommendation	Location	Suggested Partners	Implementation milestones (5 years)
5	1. Implement neighborhood greening projects	HC-1, HC-2, HC-3, HC-4, HC-5, HC-6, HC-7, HC-8, HC-9, HC-10, HC-11, HC-12, HC-13 (see Figure 4.1)	• BHWA • Respective neighborhood groups and community liaisons (see table 4.2) • Civic Works • City of Baltimore • CWP • Parks and People Foundation	• All 13 projects constructed • Identification of 5 additional projects
3	2. Reduce trash through targeted and focused efforts	McElderry Park, Darley Park, then watershed wide	• City of Baltimore Housing, BSW, DPW, Code Enforcement • BHWA	• Reduce loads to interceptor by 20% in five years, 50% in ten years • Reduce bacteria loads in the Lakewood Avenue outfall by 50% • Add an additional 50 public trash receptacles • Distribute free trash cans to 5,000 residents • Install 200 inlet screens on stormwater catch basins
1, 3, 4	3. Develop targeted educational programs throughout the watershed	Watershed Wide	• Parks and People Foundation • BHWA • Community Non-profits • Baltimore City Health Department • Johns Hopkins Center in Urban Environmental Health • Watershed Libraries, Churches, and Schools • Girl scouts and boy scouts and similar organizations	• Complete stenciling of all storm drains throughout watershed • Install 15 pet-waste pick-up stations in the watershed • Develop multi-lingual educational materials and identify a bi-lingual community liaison • Develop outreach campaign with messages and materials for use on buses, billboards and other media • Implement the campaign and track awareness through surveys • Reach 500 residents through continued workshops and meetings

Table 5.1 Recommendations, Responsible Party and Desired Outcomes for Restoration in the Harris Creek Watershed.

Stakeholder Goal Met	Recommendation	Location	Suggested Partners	Implementation milestones (5 years)
2	4. Explore links between toxicity and contamination and watershed areas.	Watershed Wide	• MD Dept of Environment • BHWA • City of Baltimore • John Hopkins University, Morgan State University • Environmental Justice Board • Baltimore Ecosystem Study • Parks and People Foundation • Glenn Ross – Toxic Tours	• Conduct 300 Soil Tests with results logged by BHWA • Implementation of enhanced pollution prevention measures at the Recycling Plant (HC-12)
1	5. Enhance outreach to community about efforts and accomplishments, as well as community needs	Watershed Wide	• BHWA • Community outreach coordinators	• Launch of a interactive watershed map as an online tool • Launch of a database to track persistent trash and watershed issues from the community members • Launch of a watershed newsletter • Hire a community watershed coordinator or recruit a watershed ranger for the watershed
5	6. Strategically locate additional park and green spaces into areas that do not have them	Watershed Wide	• BHWA • Parks and People • Office of Sustainability • Baltimore City Parks and Recreation • Tree Baltimore	• Creation of 20 additional community green spaces and parks throughout the watershed. • Addition of 5 watershed murals • Plant an additional 1000 trees in the watershed
5	7. Implement Green Street Designs and retrofit projects	Target critical areas then watershed wide	• City of Baltimore DPW and DOT • Civic Works • BHWA • CWP • Tree Baltimore • Chesapeake Bay Trust	• Implementation of 3 green street designs

Table 5.1 Recommendations, Responsible Party and Desired Outcomes for Restoration in the Harris Creek Watershed.

Stakeholder Goal Met	Recommendation	Location	Suggested Partners	Implementation milestones (5 years)
6	8. Identify watershed hotspot areas and develop pollution prevention strategies	Watershed Wide	• City of Baltimore DPW, BSW • BHWA • CWP	• Implement pollution prevention strategies at 20 hotspot locations • Reduce bacteria loads in the Lakewood Avenue outfall by 50% • Reduce nutrient loads throughout the watershed
6	9. Systematically identify and remove illicit discharges from the watershed	Watershed Wide	• City of Baltimore DPW • BHWA • CWP	• 25+ illicit discharges identified and corrected throughout the watershed • Increased citizen awareness of illicit discharges • Reduce bacteria loads in the Lakewood Avenue outfall by 50% • Reduce nutrient loads throughout the watershed
2	10. Continue to promote Greening, Urban Farming efforts in the community	Clifton Park, Patterson Park, community gardens	• Parks and People Foundation • BHWA • Civic Works • Baltimore City Parks and Recreation	• Launch of 2 farmer's markets in the watershed • Plant an additional 1000 trees in the watershed
2	11. Work with community partners to make healthy foods and locally grown produce available to the community	Watershed Wide	• Friends of Patterson Park • Civic Works • Office of Sustainability • Convenience stores • City Food Czar • Center for Livable Futures (John Hopkins Bloomberg School of Public Health) • BHWA	• Presence of locally grown foods in 1 corner store per community • Launch of 2 farmer's markets in the watershed

Table 5.1 Recommendations, Responsible Party and Desired Outcomes for Restoration in the Harris Creek Watershed.

Stakeholder Goal Met	Recommendation	Location	Suggested Partners	Implementation milestones (5 years)
2,4	12. Promote water conservation and water-wise consumption	Watershed Wide	• BHWA • Community outreach coordinators • Office of Sustainability • Parks and People Foundation • Baltimore Ecosystem Study • Center for Water and Health at John Hopkins School of Public Health	• Installation of 300 rain barrels throughout watershed
5	13. Encourage/ incentivize strong redevelopment criteria	Watershed Wide	• Office of Sustainability • City of Baltimore DPW • Maryland Department of the Environment • CWP • BHWA	• Redevelopment incentives are used for 10 projects • Track redevelopment incentive projects
1	14. Green Microlending/ Entrepreneurial Support/Training Program	Watershed Wide	• Office of Sustainability • US Small Business Administration • Maryland Small Business Development Center (MDSBDC) Network • Maryland Department of Business and Economic Development • Watershed community groups and individuals • BHWA	• Develop a Core Team to guide the entrepreneurial support and training • Create a guidance document for short, mid, and long term goals and objectives • Organize at least 20 small businesses • Post small business success stories on the community website (Recommendation #5)
1	15. Link watershed efforts to the City's Sustainability Plan	Watershed Wide	• BHWA • Parks and People Foundation • Office of Sustainability	• Development of a "green infrastructure" map for the watershed

Table 5.2. Implementation Actions and Costs.*			
Strategy	**Year 1 Actions[1]**	**Year 2-4 Actions [1]**	**Year 5-10 Actions [1]**
1. Implement neighborhood greening projects	• Work with community members to pursue grant opportunities for the 13 identified green infrastructure projects (BHWA) ($5,000) • Work with community leaders, Civic Works, designers, and partners to come up with final designs for the community projects (BHWA) ($10,000)	• Implement community projects HC-1 through HC-13 (Community Groups) ($185,000) • Pursue additional greening projects identified and supported by watershed community residents (Watershed Coordinator) • Conduct additional field assessments as necessary (BHWA) ($5000)	• Continue to pursue additional greening projects that are identified and supported by watershed community residents (Watershed Coordinator)
#1 Costs	$15,000	$190,000	
2. Reduce trash through targeted and focused efforts	• From a Community subcommittee focused on this issue (BHWA) • Begin a round-table discussion with City officials focused on this issue (BHWA) • Update the Geographical Information System (GIS) trash data layer to include additional areas identified during field assessments, trash sweeps, and clean-ups (Watershed Coordinator) ($5,000) • Use this GIS layer to identify targeted enforcement and trash sweep areas (BHWA) ($5,000) • Install cameras in Darley Park and other areas supported by residents in neighborhood to deter dumping (local contractors) ($4,000) • Conduct initial cleanout of clogged catch basins (City) ($10,000) *Cleaning out a basin costs about $100 each • Distribute free trashcans and recycling bins to watershed residents (BHWA) ($10,000) • Fundraise for bulk trash removal efforts (Watershed Coordinator) • Conduct watershed-wide education and stenciling (Community Organizations) (See recommendation #3)	• Install public trash cans particularly in areas near markets and convenience stores (City) ($10,000) • Develop and implement a pilot study to install trash grates on storm drains to capture trash (BHWA, City) ($25,000) • Work with City of Baltimore to empower police and trash collectors to cite illegal dumping (Watershed Coordinator) ($5,000) • Require businesses and schools to recycle (City) • Increase housing inspectors and street sweepers (City) ($100,000) • Explore the development of a “Benefits District” to target additional trash reduction in focused neighborhood areas	• Continue to update the watershed trash map and document progress (Watershed Coordinator) • Continue to have semi-annual meetings with the city to address remaining issues and resident concerns (BHWA) • Install additional trash grates and public trash cans (BHWA, City) ($25,000)
#2 Costs	$34,000	$140,000	$25,000

Table 5.2. Implementation Actions and Costs.*			
Strategy	**Year 1 Actions[1]**	**Year 2-4 Actions [1]**	**Year 5-10 Actions [1]**
3. Develop targeted educational programs throughout the watershed	• Form a Community Subcommittee focused on this issue (BHWA) • Create list of available community resources and partnership organizations (BHWA) • Conduct a trash education program that addresses trash disposal, recycling, greening, rats, and pet waste (Watershed Coordinator/local groups) ($25,000) • Develop and distribute educational materials for pollution prevention and source control for businesses (Watershed Coordinator/local groups) ($10,000) • Launch pilot programs in high priority neighborhoods and areas (Watershed Coordinator) • Begin a storm drain stenciling design competition between neighborhoods (Watershed Coordinator, local communities) ($1,000) • Provide community training opportunities during implementation of additional watershed recommendations, where appropriate (Watershed Coordinator, local communities, Parks and People) • Provide local food benefit education to corner convenience stores and community (Watershed Coordinator, contract with local community members) ($7,500) • Develop educational materials on water-wise use and conservation (Watershed Coordinator)	• Begin a watershed education program in schools (K-12) and libraries that brings awareness to the Harris Creek Watershed, trash and recycling, and community greening efforts (City, local schools, community groups) ($50,000) • Engage teenagers in greening efforts and green job opportunities • Engage churches in educational outreach efforts • Complete storm drain stenciling throughout the watershed (local communities, Watershed Coordinator) ($7000) *Storm drain stenciling equipment costs $400 per neighborhood • Implement pet-waste pick-up education program and install pet clean-up stations (Watershed Coordinator, local contractors) ($5,000) • Publicize educations efforts (e.g., television, bus ads, billboards, etc.) ($36,000) *Billboards cost about $1000 per month, bus ads cost about $1000 per month, radio ads cost about $50 per announcement, and television ads cost about $3000 to $4000 per announcement	• Develop multi-lingual educational materials to outreach to the Hispanic and other minority populations in the watershed (local contractor) ($10,000)
#3 Costs	$42,500	$98,000	$10,000

Table 5.2. Implementation Actions and Costs.*

Strategy	Year 1 Actions[1]	Year 2-4 Actions [1]	Year 5-10 Actions [1]
4. Explore links between toxicity and contamination and watershed areas	• Coordinate watershed efforts with research institutions and advocacy groups (BHWA, Environmental Justice Partnership) ($5000) • Conduct residential soil testing (BHWA, local communities) ($15,000) • Map brownfield and industrial sites (Watershed Coordinator) ($5000)	• Work with industrial sites to minimize community health effects and use the Recycling Site (HC-12) as a pilot (BHWA, Environmental Justice Partnership) ($15,000) • Explore links between rats, trash, pet waste, health, and water quality (Environmental Justice Partnership, JHU, Morgan State) ($50,000) • Investigate the impact of railway traffic on the watershed (Morgan State or JHU) ($40,000)	• Monitor air quality near brownfield and industrial sites (MDE) ($25,000) • Present findings to local officials (BHWA)
#4 Costs	$25,000	$105,000	$25,000
5. Enhance outreach to community about efforts and accomplishments, as well as community needs	• Identify neighborhood leaders for community stewardship (BHWA) • Hire a full-time watershed coordinator from the Harris Creek Watershed community (BHWA) ($35,000 per year) • Connect community groups to grant workshops and grant opportunities (Parks and People Foundation, BHWA)	• Fund full-time watershed coordinator for three years ($105,000) • Launch a website where community members can post complaints, problems, and track follow up actions (local contractor) ($10,000) • Launch interactive website to track green projects and ongoing watershed efforts (local contractor) ($2,000) • Highlight individual community efforts and accomplishments in a watershed newsletter (Watershed Coordinator) • Form a trash education study to document the effectiveness of outreach efforts (Environmental Justice Partnership, Morgan State, JHU, community groups) ($75,000)	• Fund full-time watershed coordinator for five years ($175,000) • Continue to liaison between community and City of Baltimore to address persistent problems and achieve results (BHWA)
#5 Costs	$30,000	$192,000	$175,000

Table 5.2. Implementation Actions and Costs.*			
Strategy	**Year 1 Actions[1]**	**Year 2-4 Actions [1]**	**Year 5-10 Actions [1]**
6. Strategically locate additional park and green spaces into areas that do not have them	• Create and update green space GIS map to distinguish between vacant lots and community gardens (Watershed Coordinator) ($5,000) • Identify key areas lacking green spaces that will promote greater watershed green space connectivity (BHWA, Parks and People) • Develop greenway strategy (master plan) that promotes pedestrian and bike trails while connecting industries, neighborhoods, and people (City, Parks and People, local communities) ($25,000) • Incorporate the goal that "everyone should live ¼ mile from a park"	• Work with communities find funding for high priority project identified (Watershed Coordinator, local communities) • Update map as additional community greening projects are implemented (Watershed Coordinator) • Implement high priority projects (community groups, local contractors, community volunteers) ($75,000)	• Increase watershed tree canopy (BHWA) ($50,000) • Where possible, remove excess or unused impervious cover and convert to green open space (local contractors) ($75,000) • Continue to implement high priority projects (community groups, local contractors, community volunteers) ($100,000)
#6 Costs	$30,000	$75,000	$225,000
7. Implement Green Street Designs and retrofit projects	• Identify long term funding sources for retrofits (BHWA, Watershed Coordinator) • Prioritize key areas for green street design implementation (See Recommendation #6) • Focus on the Library Square neighborhood for implementation and additional areas that will promote watershed connectivity (BHWA) • Hold a design contest to get community involvement and partners (Watershed Coordinator, BHWA) ($10,000)	• Finalize design and construct a pilot green street project (local contractors, City) ($145,000) • Engage the public with project implementation (e.g. planting, educational campaign, and volunteer opportunities) (Watershed Coordinator, local volunteers)	• Implement additional green street projects and the three high priority stormwater retrofits (local contractors, City) ($300,000)
#7 Costs	$10,000	$145,000	$300,000
8. Identify watershed hotspot areas and develop pollution prevention strategies	• Conduct a hotspot assessments of local businesses in the watershed to identify high pollution generating areas (Watershed Coordinator) ($20,000) • Create interactive map for hotspot areas (e.g., Google maps) (Watershed coordinator, local contractor) ($5,000)	• Provide pollution prevention education to targeted businesses (Watershed Coordinator) (See recommendation #3) • Implement stormwater retrofits and pollution source control measures ($150,000)	
#8 Costs	$25,000	$150,000	

Table 5.2. Implementation Actions and Costs.*			
Strategy	**Year 1 Actions[1]**	**Year 2-4 Actions [1]**	**Year 5-10 Actions [1]**
9. Systematically identify and remove illicit discharges from the watershed	• Coordinate IDDE monitoring and identification program (City, BHWA, local groups and volunteers) ($25,000) • Track these areas on interactive map for hotspot areas (e.g., Google maps) (Watershed Coordinator) (see recommendation #8)	• Provide illicit discharge education by creating and distributing fact sheets to homeowners and businesses (Watershed Coordinator) (See recommendation #3) • Continue IDDE project (City, BHWA) ($40,000) • Ensure timely repair of SSOs (City) • Develop IDDE white paper detailing current status and trends along with IDDE project findings (BHWA, City)	• Track IDDE project results and assess progress (BHWA) • Identify new IDDE funding mechanisms for monitoring and fixing identified problems (BHWA)
#9 Costs	$25,000	$40,000	
10. Continue to promote Urban Farming and Park Greening efforts in the community	• Form a Community Subcommittee focused on this issue (BHWA) • Work with Civic Works to support the efforts of the Real Food Farm in Clifton Park (BHWA) • Offer support for the planned children's garden in Patterson Park (BHWA) • Work with Friends of Patterson Park to identify a maintenance plan for the Patterson Park Boat Lake (Watershed Coordinator) • Identify vacant lots for park transition opportunities (Watershed Coordinator, local communities)	• Secure vacant lot properties and begin designs of additional park areas (Watershed Coordinator, local designers and community groups) ($10,000) • Assist with the development of long term (>5 years) solutions and maintenance plans for the parks (BHWA, City) • Work to transfer maintenance and sustainability plans to additional community spaces in the watershed (Watershed Coordinator)	• Secure funding for 3-5 local farming efforts (BHWA, Civic Works, Parks and People) ($50,000)
#10 Costs		$10,000	$50,000
11. Work with community partners to make healthy foods and locally grown produce available to the community	• Conduct educational efforts to encourage local, healthy foods and to promote health benefits to eating fruits and vegetables (see recommendation #3 and #4) • Conduct a survey to gage local store interest in stocking fresh, local foods (Watershed Coordinator)	• Establish a network between neighborhood community gardens, farms, and farmers markets and convenience stores (Civic Works, Watershed Coordinator, local garden managers) • Form partnerships with local schools, stores, and groups (Civic Works, Watershed Coordinator)	
#11 Costs			

Table 5.2. Implementation Actions and Costs.*			
Strategy	**Year 1 Actions[1]**	**Year 2-4 Actions [1]**	**Year 5-10 Actions [1]**
12.Promote water conservation and water-wise consumption	• Develop educational materials on water-wise use and conservation (See recommendation #3) • Determine baseline watershed water consumption (local contractor) ($7,500)	• Disconnect residential downspouts to rain barrels allow for harvesting and re-use along with a reduction in overall water demand (BHWA, local contractors and volunteers) ($50,000) *Downspout disconnection to a rain barrel costs about $25	• Determine change in watershed water consumption (local contractor) ($7,500) • Form and initiate next phase of the program (BHWA)
#12 Costs	$7,500	$50,000	$7,500
13. Encourage/ incentivize strong redevelopment criteria	• Coordinate effort with developers, local, and state agencies (City, BHWA)	• Create redevelopment incentives for better management practices (e.g., LID) (City, BHWA) ($25,000)	
#13 Costs		$25,000	
14. Green Microlending/ Entrepreneurial Support/Training Program	• Search for funding and partners (BHWA)	• Form a microlending mechanism (BHWA, City) • Provide 3-10 entrepreneurial training sessions (BHWA, local contractor) ($15,000) • Provide 5-20 microloans to small and green businesses (BHWA) ($50,000)	• Provide MD with business model for microlending and green businesses (BHWA, City)
#14 Costs		$65,000	
15. Link watershed efforts to the City of Baltimore's Sustainability Plan	• Coordinate with the Baltimore City Office of Sustainability to link greening projects to City-wide efforts (City, BHWA) • Generate major goals and objectives to link watershed efforts with the Sustainability Plan (BHWA) • Coordinate this watershed plan with Planning Commissioner and City Council (City, BHWA)		• Implement 1-3 watershed goals in cooperation with City of Baltimore using the Sustainability Plan and Harris Creek Small Watershed Plan (BHWA, Watershed Coordinator)
#15 Costs			

Table 5.2. Implementation Actions and Costs.*			
Strategy	**Year 1 Actions[1]**	**Year 2-4 Actions [1]**	**Year 5-10 Actions [1]**
Additional Monitoring Recommendations (see Section 5.2)		• Expand the water quality monitoring program to include nutrients, heavy metals, and toxic materials within the Harris Creek Watershed (City, BHWA, volunteers) ($100,000) • Conduct soil testing in park and residential areas (see recommendation #4)	
Additional Costs		$100,000	
Sub Totals	**$244,000**	**$1,385,000**	**$817,500**
Grand Total	**$2,446,500**		

*Note: These cost estimates are planning level estimates and include staff time, materials, supplies, and construction costs where applicable. Cost estimations are provided in parentheses and additional information is provided where appropriate.

[1]Included in parentheses are the recommended partners to lead each action. For most recommendations, collaborative partnerships with additional watershed partners will be necessary to ensure success.

1. **Implement neighborhood greening projects (HC-1 through HC-13)**
   The BHWA should work with community members to pursue grant opportunities for each of the neighborhood projects identified in Table 4.2. Grant opportunities may exist through the Chesapeake Bay Trust, Parks and People Foundation, Neighborhood Community Development Greening Grants, HEBCAC, National Fish and Wildlife Foundation, and additional Foundations and grant opportunities. Furthermore, City funds may be pursued for larger community stormwater projects. It is recommended that Parks and People Foundation host a grant writing workshop to assist the neighborhoods in their efforts to secure funds for the greening projects and other neighborhood environmental initiatives.

   Once funding opportunities have been identified, the BHWA should work with community leaders, Civic Works, designers, community groups (e.g., girl scouts and boy scouts), public libraries, and landscape architects to come up with final designs for the community projects. The communities should be continued to be engaged in the final design and implementation of the projects. Upon project implementation, BHWA should continue to pursue additional greening projects that are identified and supported by watershed community residents and conduct additional field assessments as necessary.

   The implementation of this and other watershed recommendations should be used as opportunities to provide community education and training in order to enhance community leadership and job work force development in the watershed. Also, incentives should be explored to encourage community members to maintain, manage and take ownership of the greening sites.

   Resources
   - Civic Works: Baltimore's Service Corps. Civic Works' has assisted with building community parks and gardens and rehabilitating abandoned houses for low-income residents. http://www.civicworks.com/
   - Baltimore Green Space. Baltimore Green Space can assist communities by acquiring community-managed open spaces and providing support to those who care for them. http://www.baltimoregreenspace.org/
   - Community Greening Resource Network (CGRN). Founded by the Parks & People Foundation and Maryland Cooperative Extension, CGRN provides a comprehensive and consistent support network to help communities maintain their valuable green spaces. CGRN provides access to the materials, education, and community resources, and also sponsors greening grant opportunities. http://www.parksandpeople.org/greening/resource-network/
   - TreeBaltimore. TreeBaltimore is a mayoral initiative spearheaded by the Baltimore City Department of Recreation and Parks. This program strives to increase the urban tree canopy through the establishment, management and preservation of trees. http://baltimorecity.gov/Default.aspx?TabID=454
   - Baltimore Mural Program. http://www.promotionandarts.com/index.cfm?page=artscouncil&id=9

2. Reduce trash through targeted clean-up efforts, education, better trash dumping enforcement and collection practices, trash can distribution, and better management practices such as storm drain screens.

A Trash Survey Memo (Swann, 2008) was recently conducted by CWP, which outlines key recommendation for reducing trash throughout Harris Creek (Attachment D). In addition to these recommendations, key action items were identified which are in the following concept points.

- BHWA should work with the City to better address trash issues and identify solutions to persistent trash problems. BHWA should serve as a liaison between the communities and the City to voice residents' concerns and work toward effective follow-up and solutions. A focused round-table effort with the City should be coordinated to with trash all appropriate City of Baltimore departments (Solid Waster, Housing, DPW, Mayoral Office, Police) to address trash dumping, collection, and enforcement. All of the recommendations included below and in the Trash Survey Memo (Swann, 2008) should be discussed.

- Carry out the recommendations from "Evaluating solutions for trash pollution in Baltimore: The Harris Creek Watershed Demonstration Project recommendations (Stafford, 2010)
    - Harris Creek Watershed mitigation strategy using a combination of the trash interceptor, a bag tax, limited environmental education, and increased enforcement
    - Adoption of a stormwater fee and scheduled increases of that fee would be a logical source for the funds needed to pay for expansions of the alternatives

- Engage the community through education and outreach, including programs involving schools, churches, libraries, girl scouts and boy scouts (see Recommendations #3 and #5). Implement a high-visibility ad-campaign using billboards, buses, radio and television media.

- The information gathered from the Harris Creek Watershed Stakeholder and Community Survey (Stafford, 2010) (see Section 2.4) is a good indicator for problem areas in the Harris Creek Watershed; however, the maps currently only highlight areas that have been reported by residents and any status updates for these areas are unknown. The trash dumping map (Figure 2.6) and clogged storm drain map (Figure 2.5) should be continuously updated to identify additional problem areas and track resolved issues. Further, the severity or quantity of trash or clogging at each site should be recorded in order to prioritize clean-up efforts. Development of an interactive map that can be easily updated should be explored.

- Install trash grates on inlets and develop a program for inlet maintenance. Develop a pilot study to gauge the cost effectiveness of installing these practices in priority trash areas. Trash basin insert and screen cover are shown in Figure 5.1.

- Provide free trash can distribution and education to residents in the 17 Harris Creek Neighborhoods. Install public trash cans in commercial and high traffic areas near markets and convenience stores. Explore the development of a "Benefits District" potentially in the neighborhoods surrounding Johns Hopkins to target additional trash reduction in focused neighborhood areas. A similar program exists in the Charles Village Neighborhood (http://www.charlesvillage.org).

- Install cameras and/or mirrors and 'No Dumping' signs in problematic dumping hotspots where this action is supported by residents. Several location identified in the Darley Park neighborhood should be explored for this action.

- Continue to coordinate between housing and bureau of solid waste to conduct regular and effective trash clean-up. During trash sweeps, residents should be provided clear guidance on the laws and fee structure and ample notification about the sweep. It is recommended that first time violators be issued violation warnings, and follow-up inspections be conducted at these locations within 1-2 weeks to ensure appropriate action was taken. Careful tracking of violation locations will be needed.

(a) (b)

Figure 5.1. (a) Catch basin insert and (b) opening screen cover (Photo source: Magallanes et al., 2008). The Los Angeles Regional Water Control Board reports that the catch basin inserts and opening screen covers used were successful at retaining 85% and 100% of the trash , transported by the 1-year, one-hour storm (Magallanes et al., 2008).

Resources

- Stafford, Phillip. 2010. Evaluating solutions for trash pollution in Baltimore: The Harris Creek Watershed Demonstration Project. Parks and People Foundation. Baltimore, MD.
- Los Angeles River Trash TMDL. http://www.ci.la.ca.us/san/wpd/Siteorg/program/TMDLs/tmdl_lariver_trash.htm
- The AFRO's Clean Block Campaign. Helps communities beautify city streets through cleaning and greening each year. AFRO can be reached at 410-554-8243
- Anacostia Watershed Trash Reduction Strategy. http://www.anacostia.net/Archives/download/AnaTrashStrategy_final.pdf

3. Develop targeted educational programs throughout the watershed

A watershed wide educational campaign is a critical element to affect watershed improvements by decreasing negative behaviors and encouraging positive behaviors. The first component of this recommendation is to establish a living document to list available community resources and partnership organizations in order to identity resources and maximize community resources. The second part of this effort is to develop a watershed-wide education program that first addresses proper disposal and management of trash and proper recycling. This program should be piloted in high priority neighborhoods and in areas where trash dumping is of highest concern. A high-visibility ad-campaign should be implemented using billboards, buses, radio and television media to create wide-spread awareness about trash throughout the watershed and additional areas of the City. Additionally, a pet-waste pick-up program should be implemented to target residents and pet-waste stations should be installed in high pet traffic watershed park spaces. Educational materials for pollution prevention and source control should be developed for watershed businesses to reduce watershed pollutant loads.

The Harris Creek stakeholders strongly support watershed youth, teen, and school programs. A transferrable school environmental program should be developed to bring awareness to the Harris Creek Watershed and community greening by promoting field trips and constructing demonstration projects in addition to providing educational information on the watershed and better environmental behaviors. Organizations that promote greening efforts and green job opportunities should be encouraged to outreach to young adults. The Trashbusters program (Figure 5.2), which is assisted by staff of the Department of Juvenile Services, is an excellent example of the grassroots, effective, and spirited campaign that will be successful in this watershed. Finally, churches represent a nexus of community strongholds in the neighborhoods and should be engaged in educational outreach efforts.

Figure 5.2. Trashbusters clean trash from alleys in the McElderry neighborhood (Source: Kenneth K. Lam, Baltimore Sun / June 11, 2010).

Additional educational efforts should involve watershed wide storm drain stenciling to prevent the dumping of material down the storm drains. Stakeholders recommended that a design contest be held between neighborhoods to come up with an effective design and slogan to be stenciled on the storm drains (e.g., "Do not Dump, Drains to Harris Creek" or "Trash kills Crabs"). These specific designs can be unique to each neighborhood community. It was also recommended that pictures of trash in the harbor be posted to light poles in the neighborhoods.

Moreover, due to the high Hispanic population in the watershed, multi-lingual educational materials should be developed to better outreach to non-English speaking watershed residents and a community bilingual liaison should be identified and used.

Resources

- Civic Works: Baltimore's Service Corps. The mission of Civic Works is to build a future for Baltimore's youth through community service and skills development. Civic Works' trains and helps 200 Baltimore residents each year find employment through their Health Care Careers Alliance partnership and their Baltimore Green environmental technician training and certification program. http://www.civicworks.com/
- The East Baltimore Revitalization Education Initiative. http://www.ebdi.org/educational_initiative.html
- Friends of Patterson Park. http://www.pattersonpark.com/
- Patterson Park Audubon Center. http://pattersonpark.audubon.org/
- Maryland Green School Program. http://www.dnr.state.md.us/education/greenschools.html

4. Explore links between toxicity and contamination and watershed areas.

There are several known areas of environmentally toxic material in the Harris Creek Watershed; however, a better and more comprehensive understanding of these areas and any associated health risks is needed in the community. Information on public health and environmental issues in the watershed should be explored and better linked to projects and people within the Harris Creek Watershed. Watershed efforts should be coordinated with research institutions and advocacy groups. Some examples of recommended research topics and efforts include:

- Set up backyard soil testing programs with viable partners (see Section 5.2 on Monitoring)
- Map contaminated sites, brownfields, and industrial sites in the watershed and focus future efforts to minimize their effect on the communities as much as possible
- Work with industrial sites to minimize community health effects and use the Recycling Site (HC-12) as a pilot.
- Monitor storm drains near hotspot sites (Recycling Plant)
- Monitor air quality near brownfield and industrial sites
- Explore links between rats, trash, pet waste, health, and water quality. Pilot a project to monitor rats, waste, and bacteria load relationships in the watershed.
- Investigate human health and quality of life links and opportunities for improvement
- Investigate trash and quality of life links and opportunities for improvement

Resources

- Morgan State Institute for Urban Research: A social science research and training institute that seeks to improve the response of governmental, non-governmental, private, and other institutions to the challenges of poverty, unemployment, poor health, truancy, and other urban and regional problems. http://iur.morgan.edu/
- Environmental Justice Partnership, Inc. The Mission is to address public health problems that impact East Baltimore residents by building a partnership of community-based organizations that educate residents, advocate for environmental justice, and represent the East Baltimore community's interests to governmental agencies, academic institutions, and private organizations. http://www.environmentaljusticepartnership.org/home.htm

5. **Enhance outreach to community about efforts and accomplishments, as well as needs.**
It is highly recommended that a community liaison from the Harris Creek Watershed is hired to assist with community outreach and restoration projects.

   Further, it is important to document the major activities and findings in the Harris Creek Watershed to keep all parties updated and involved in the process to improve the environment and health of the watershed. It is recommended that an interactive and user-friendly website be developed that serves as an open forum and communication exchange for community events, efforts, and watershed needs. Website tools should include a forum for posting problems, complaints (BHWA can track persistent problems and direct to appropriate City Departments or additional agencies and partners), community events, networking opportunities, and education and training opportunities.

   Finally, it is recommended that a watershed newsletter be distributed to highlight watershed projects, model community efforts, provide recognition to outstanding community members, and link to available community resources.

6. **Strategically locate additional park and green spaces into areas that do not have them**
A greenway strategy (master plan) should be developed that promotes pedestrian and bike trails while connecting industries, neighborhoods, and people. This plan can be used to create connectivity between Clifton Park, Patterson Park, the Waterfront, and various neighborhoods in the watershed. The BHWA has been cataloguing vacant lots, community gardens, and identifying existing greening efforts in the watershed which can be tied into this master plan. Targeting areas where there is community support, available partners with resources, and a high water treatment value is a win-win strategy. Additionally, pairing these greenway planning efforts with community walking and biking routes increases capacity and makes sense from the watershed scale to connect and compliment efforts in the area. A goal of the master plan should be to ensure that “everyone should live ¼ mile or less from a park.”

   This plan should also identify key areas where entire green street designs and larger retrofit projects should be located (Recommendation #7)

Resources

- Alley Gating and Greening: Baltimore City provides legal tools for neighborhoods to gate and create quiet green space in the alleys. http://www.baltimorecity.gov/government/alleyGating.php
- Community Greens. Helps advocate and promote alley gating and greening greens@ashoka.org or call 410-925-0166
- Community Greening Resource Network (CGRN). Founded by the Parks & People Foundation and Maryland Cooperative Extension, CGRN provides a comprehensive and consistent support network to help communities maintain their valuable green spaces. CGRN provides access to the materials, education, and community resources, and also sponsors greening grant opportunities. http://www.parksandpeople.org/greening/resource-network/
- Civic Works: Baltimore's Service Corps. Civic Works' has assisted with building community parks and gardens and rehabilitating abandoned houses for low-income residents. http://www.civicworks.com/
- Baltimore Green Space. Baltimore Green Space can assist communities by acquiring community-managed open spaces and providing support to those who care for them. http://www.baltimoregreenspace.org/
- Baltimore City Department of Planning Office of Sustainability http://www.baltimorecity.gov/Government/AgenciesDepartments/Planning/OfficeofSustainability.aspx
- Fruit Tree Planting Foundation. Provides resources for fruit tree and other planting programs. http://www.ftpt.org
- Irvine Nature Center. Works with city schools to plant native gardens and trees. http://www.ExploreNature.org

7. Implement green street designs and larger-scale retrofit projects

The implementation of green street designs and larger scale retrofit projects not only reduces impervious cover but is also extremely beneficial in terms of improving stormwater water quality, increasing groundwater recharge, and controlling flooding. In addition, these project opportunities clearly align with the Cleaner, Greener Baltimore Initiative. It is recommended high priority streets that provide connectivity and better access to community green spaces (e.g. Gay St-Belair Rd, Madison St, Patterson Park Ave, and Milton Ave) be identified throughout the watershed to be targeted for large-scale "green street" retrofit designs (See Section 4 of this Plan for additional information on "green street" designs). These efforts can be conducted as part of the greenway master plan development (See recommendation #6).

These larger scale street design and retrofit projects will provide much greater watershed benefits, but will also be much more costly than the smaller community or greening projects. These designs will need to be implemented more systematically, so it is recommended that more sustainable funding sources, such as the City's capital improvement budget, Trust Fund money, or money potentially generated through the development of a stormwater utility.

Specific recommendations to implement green street designs and stormwater retrofit projects include:

a. Treat stormwater water quality and also link to the City's bike plan and pedestrian routes with a connectivity focus;
b. Implement the three additional high priority Harris Creek Watershed retrofits (Novotney, 2008);
c. Develop a long term maintenance plan for projects to ensure long-term performance; and
d. Explore creating and using a stormwater utility or stimulus funding needed to implement these projects.

Resources

- Chicago Green Streets Manual. http://egov.cityofchicago.org/city/webportal/portalContentItemAction.do?topChannelName=HomePage&contentOID=536946345&Failed_Reason=Invalid+timestamp,+engine+has+been+restarted&contenTypeName=COC_EDITORIAL&com.broadvision.session.new=Yes&Failed_Page=/webp
- Philadelphia Long-Term Control Plan Update. http://www.phillywatersheds.org/ltcpu/
- San Mateo County Sustainable Green Streets and Parking Lots Design Guidebook. http://www.flowstobay.org/ms_sustainable_streets.php
- Baltimore City Water Resources Element- Capital Improvement Water Projects. http://www.baltimorecity.gov/Government/AgenciesDepartments/Planning/ComprehensiveMasterPlan/WaterResourcesElement/CIPWaterProjects.aspx

8. Identify watershed hotspot areas and develop pollution prevention strategies

A hotspot assessment should be conducted in the Watershed to identify and control high pollution generation areas (e.g., trash, nutrients, toxic chemicals). Commercial, industrial, and residential hotspots should be targeted for pollution prevention and/or remediation strategies. Stopping pollution at its source is an effective strategy to clean up receiving waters.

Commercial and industrial hotspots tend to produce higher concentrations of polluted stormwater runoff than other land uses and have a higher risk for spills. Examples of these sites include auto repair shops, department of public works yards, trash and recycling centers, restaurants and take-out places, and car washes. Specific on-site operations and maintenance combined with pollution prevention practices can significantly reduce the occurrence of "hotspot" pollution problems.

Further, residents and businesses engage in behaviors and activities that can influence water quality. Some behaviors that negatively influence water quality include poor housekeeping practices such as inappropriate disposal of paints, household cleaners, automotive fluids or vehicle washwater, dumping into storm drains, having overflowing or uncovered trashcans or dumpsters, improper storage of materials, or using excessive amounts of pesticides and fertilizers. Alternatively, positive good housekeeping behaviors such as proper material storage, treatment and proper disposal of waste products, tree plantings, and picking up pet waste can help improve water quality. Whether a pollution prevention program is designed to discourage negative behaviors or encourage positive ones, identification of pollution source

hotspots and targeted education is needed to deliver a specific message that promotes behavior changes.

Local watershed organizations and other civic groups and neighborhood associations are in a position to influence these changes using pollution prevention education and outreach to teach citizens and businesses how to properly care for the watershed. Further, the City should work to target the implementation of storm drain grates and green streets to hotspot areas that have specific pollution and trash issues.

Resources

- Urban Subwatershed Restoration Manual Series Manual 8: Pollution Source Control Practices. (CWP, 2005). Contains detailed information on identification and management of pollution hotspots. http://www.cwp.org/index.php?option=com_docman&task=cat_view&gid=68&Itemid=118

9. Systematically identify and remove illicit discharges from the watershed

Illicit Discharge Detection and Elimination (IDDE) targets dry weather flows that contain significant pollutant loads. Examples include sewage overflows and industrial and transportation spills. These discharges can be continuous, intermittent, or transitory, and depending on the volume and type, can cause extreme water quality problems in a stream. Sewage discharges can directly affect public health (e.g. bacteria), while other discharges can be toxic to aquatic life (e.g., oil, chlorine, pesticides, and trace metals). Discharge prevention focuses on four types of discharges that can occur in a subwatershed, described in Table 5.3 and discussed in detail in *Illicit Discharge Detection and Elimination* (Brown et al., 2004).

Table 5.3. Types of Discharges	
Illicit Sewage Discharges	Sewage can get into urban streams when septic systems fail or sewer pipes are mistakenly or illegally connected to the storm drain network. In other cases, “straight pipes” discharge sewage to a stream or ditch without treatment, while sewage from RVs or boats might be illegally dumped into the storm drain network.
Commercial and Industrial Illicit Discharges	Some businesses mistakenly or illegally use the storm drain network to dispose of liquid wastes that can exert a severe water quality impact on streams. Examples include shop drains that are connected to the storm drain system; improper disposal of used oil, paints, and solvents; and disposal of untreated wash water or process water into the storm drain system.
Industrial and Transport Spills	Tanks rupture, pipelines break, accidents cause spills, and law-breaking individuals dump pollutants into the storm drain system. It is only a matter of time before these events occur in most urban subwatersheds, allowing potentially hazardous materials to move through the storm drain network and reach the stream.
Failing	Sewer lines often follow the stream corridor, where they may

Sewage Lines	leak, overflow or break, sending sewage directly to the stream. The frequency of failure depends on the age, condition and capacity of the existing sanitary sewer system.

BHWA and the City should coordinate on IDDE monitoring and identification in the Harris Creek Watershed. Residents should be educated on illicit discharges by creating and distributing fact sheets to homeowners and businesses. Finally, BHWA should coordinate with City to ensure timely repair of sanitary sewer overflows (SSOs).

Resources

- Illicit Discharge Detection and Elimination: A Guidance Manual for Program Development and Technical Assessments (CWP; R. Pitt, University of Alabama, 2004). Outlines practical, low cost, and effective techniques for Phase II NPDES MS4 communities and others seeking to establish Illicit Discharge Detection and Elimination (IDDE) programs and investigate non-stormwater entries into storm drainage systems. http://www.cwp.org/index.php?option=com_docman&task=cat_view&gid=78&Itemid=118
- Stormwater Effects Handbook: A Toolbox for Watershed Managers, Scientists, and Engineers. http://www.epa.gov/ednnrmrl/publications/books/handbook/index.htm

10. Continue to promote Greening and Urban Farming efforts in the community

Urban farming and greening efforts should be supported throughout the watershed at both large scale (Clifton Park and Patterson Park) and smaller scale (neighborhood coalitions) sites. These efforts can be supported by partnering with schools, master gardeners, volunteer groups, Baltimore City, and community leaders, and through efforts to educate communities on the importance of buying fresh, local foods (recommendation #11).

It is important to consider and support long-term maintenance for these efforts to insure fiscal, environmental, and social sustainability of these projects. Partnering with the Sustainability Office to develop a park master plan is recommended. Incentives should be explored to encourage community members to maintain, manage and take ownership of their local greening sites. It is also recommended that Clifton Park and Patterson Park partner with Parks and Recreation to develop a sustainable park management plan that outlines current efforts and provides guidance for managing the park space to keep fields and public areas in working order, provide adequate stormwater management, coordinate and improve education efforts, and manage the environmental resources more efficiently.

Resources

- Community Greening Resource Network (CGRN). Founded by the Parks & People Foundation and Maryland Cooperative Extension, CGRN provides a comprehensive and consistent support network to help communities maintain their valuable green spaces. CGRN provides access to the materials, education, and community resources, and also sponsors greening grant opportunities. http://www.parksandpeople.org/greening/resource-network/

- Civic Works: Baltimore's Service Corps.Civic Works' has assisted with building community parks and gardens and rehabilitating abandoned houses for low-income residents. http://www.civicworks.com/
- Baltimore Green Space. Baltimore Green Space can assist communities by acquiring community-managed open spaces and providing support to those who care for them. http://www.baltimoregreenspace.org/
- Participation Park Baltimore Development Cooperative. http://www.baltimoredevelopmentco-op.org/index.php?/ongoing/participation-park/
- US Department of Agriculture (USDA) Farms and Community Resources. http://afsic.nal.usda.gov/nal_display/index.php?info_center=2&tax_level=2&tax_subject=301&topic_id=1447
- University of Maryland, Cooperative Extension Service. http://extension.umd.edu/

11. Work with community partners to make healthy foods and locally grown produce available to the community

Coordinate existing efforts with identified community partners such as "Grow it, Eat it," Baltimore Green Space, Slow Food Baltimore, Civic Works, the Baltimore Sustainability Office, and John Hopkins Center for a Livable Future
and others identified below and in recommendations #3 and #10 to provide healthy foods that are locally grown to the watershed residents. The watershed community should work to improve local food distribution and accessibility to fresh foods within the watershed.

Partners involved with this effort should advocate for the development of additional grocery stores within the Harris Creek Neighborhoods. Where this is not possible, the local corner stores should be targeted to stock more fresh, local and healthy foods in the neighborhoods.

Resources

- Baltimore Office of Sustainability's Greening Food Systems. http://www.baltimoresustainability.org/greening/foodSystems.aspx
- Baltimore Urban Agriculture Task Force. http://baltimoreurbanag.org/
- John Hopkins Center for a Livable Future. http://baltimoreurbanag.org/
- Baltimore City Community Gardens "Grow it, Eat it". http://www.growit.umd.edu/Community%20Gardens1/Baltimore%20City%20Community%20Gardens.cfm
- Civic Works: Real Food Farm. Real Food Farm seeks to decrease the "food deserts" of Northeast Baltimore by supplying fresh, delicious food for residents. http://www.real-food-farm.org/
- Slow Food Baltimore. http://www.slowfoodbaltimore.org/
- Baltimore City Farmer's Market. http://www.americantowns.com/md/baltimore-local-food

12. Promote water conservation and water-wise consumption

Develop educational materials on water-wise use and water conservation (see also recommendation #3). This should include information on residential downspout disconnection to rain barrels that allow for harvesting and re-use, sustainable urban

gardening, and reducing overall water demand. In addition, community stakeholders have suggested that education and outreach is needed to warn about potential contamination from street pollution during the summer months when kids play in water hydrants or walk around barefoot in the streets.

Resources

- Maryland Department of the Environment Water Conservation. http://www.mde.state.md.us/Programs/WaterPrograms/Water_Conservation/index.asp
- Baltimore City Department of Planning Office of Sustainability. http://www.baltimorecity.gov/Government/AgenciesDepartments/Planning/OfficeofSustainability.aspx

13. Encourage and/or incentivize strong redevelopment criteria

Encourage redevelopment projects to manage stormwater runoff using the low impact development (LID) treatment practices identified in this Plan. Reducing the runoff volume and associated pollutants makes sense from an environmental standpoint and economic revenue. Maryland's new stormwater redevelopment rules (See Stormwater Management Act 2007, Md. Code Ann., Envir. §§ 4-201 and 4-203) require 50% of impervious cover to be reduced for redevelopment. The Harris Creek Watershed redevelopment projects should be targeted to reduce pollution to the receiving waters by reducing hard surfaces and replacing them with plants, soil, and pervious surfaces to provide better stormwater treatment. In addition, redevelopment stormwater management can be less costly than urban retrofitting and is an excellent opportunity to partner with development companies and provide incentives for better stormwater management now and in the future.

Resources

- Maryland Stormwater Manual. http://www.mde.state.md.us/programs/waterprograms/sedimentandstormwater/stormwater_design/index.asp

14. Develop a "Green" micro-lending and entrepreneurial Support/Training Program

Community partners should work to develop goals and objectives to support small businesses and green business in the watershed. Funding organizations and mechanisms should be identified to support this effort. A core group can be initiated to pursue funding and develop the green micro-lending program. Establish an entrepreneurial training program that identifies training and support needs in the watershed, provides training and support, and coordinates with the Core Group to link businesses with economic opportunities. Promoting small business owners empowers residents and brings enterprise and capital to the area. See the James Rouse Entrepreneurial Foundation (j-ref) for Howard County, Maryland, who have provided $5 million to 60 businesses and created 500 new jobs.

Resources
- Baltimore Development Corporation. http://www.baltimoredevelopment.com/
- Maryland Department of Business and Economic Development. http://www.msa.md.gov/msa/mdmanual/12dbed/html/12agen.html
- Maryland Small Business Assistance. http://www.business.gov/states/maryland/assistance.html
- Maryland Economic Development Corporation. http://www.medco-corp.com/
- James Rouse Entrepreneurial Foundation. http://www.jref.org/index.php
- Green Biz. http://www.greenbiz.com/

15. Link watershed efforts to the City's Sustainability Plan

The City of Baltimore was recently named one of the nation's Top 10 Sustainable cities and has developed a comprehensive Sustainability Plan (City of Baltimore, 2009). Baltimore's Sustainability Plan was adopted in spring 2009 and is centered on seven priority areas: Cleanliness, Pollution Prevention, Resource Conservation, Greening, Transportation, Education & Awareness, and Green Economy. There are 29 Sustainability Plan goals with recommended strategies, timeframes, funding sources, implementation partners identified, and timeframes. This *Plan* should be integrated into the City's Sustainability Plan in order to streamline efforts, identify additional project partners and resources, and promote better information sharing.

Further, efforts should be made to share this *Plan* with the Planning Commissioner and City Council to increase awareness about the Harris Creek Watershed and to prioritize watershed restoration and greening efforts in the watershed.

Resources
- Baltimore's Sustainability Plan. http://www.baltimoresustainability.org/uploads/files/Sustainability_Plan.pdf
- Baltimore City Department of Planning Office of Sustainability. http://www.baltimorecity.gov/Government/AgenciesDepartments/Planning/OfficeofSustainability.aspx

5.2 Monitoring Plan

The City, BHWA, and other watershed partners have a vested interest in measuring whether the projects they implement are successful. Success can be measured in a number of ways including direct improvements in watershed indicators (e.g. reduced pollutant loading) or indirectly (e.g. number of greening projects installed, number of volunteers, number of trash cans distributed). Currently, the City monitors bacteria at the Lakewood outfall and trash load at the interceptor. In order to better estimate watershed runoff quality, to target pollutant load reductions, and to measure water quality improvements, more sampling sites are needed.

The monitoring plan includes the assessment of individual restoration projects, expanding the City water quality monitoring program, and illicit discharge monitoring. Guidance on developing

monitoring studies is provided in Law et al. (2008). Information can be input to a tracking system and then used to revise or improve the restoration plan over a five to ten-year cycle. Each part of the monitoring plan is described in the following concept points:

- Project monitoring at a small scale (small catchment or single lot) to illustrate benefits of individual neighborhood restoration efforts. As community greening projects, stormwater retrofits and green streets, neighborhood and business pollution prevention and education strategies such as downspout disconnection and trash reduction programs are implemented, monitoring should be conducted to show effectiveness.

- Expand City water quality monitoring program. Major water quality concerns in the Harris Creek Watershed are trash, nutrients, sediments, bacteria, toxics, and metals (Table 2.4) Total suspended solids are an indicator of sediment and fecal coliform is an indicator of bacteria. The City of Baltimore monitors Boat Lake outfall and Lakewood Avenue outfall (at base of watershed). BHWA and the City of Baltimore should review monitoring data monthly and coordinate with MDE quarterly to share information and discuss current trends and future strategies. The Chesapeake Bay TMDL will impact monitoring requirements and this should be discussed with project partners. A rapid response and public response mechanism should be implemented. For example, when chlorophyll a concentrations are high (>60 µg/L and/or bacteria levels are high (fecal coliform > 2000 CFUs/100mL) warnings should be posted at the sampling point. Coordinating with upstream sampling efforts and nearby subwatersheds is recommended.

- Illicit discharge monitoring will be used to facilitate identifying and tracking down inappropriate discharges. Illicit discharge detection and investigation are critical elements of watershed restoration and planning. Illicit discharges are often a significant source of pollution in a watershed that occurs repeatedly in association with specific polluting behaviors. Monitoring and keeping watch on individual outfalls and heading up the pipe to determine possible entry points for illicit discharge connections are critical to removing them. Illicit discharges were not investigated as part of this Plan development process; however, there have been obvious indicators and observations of numerous illicit discharges throughout Baltimore City and in the Jones Falls and Herring Run Watersheds and it is assumed that these problems are extended to the Harris Creek Watershed. As part of the illicit discharge monitoring, nutrients, bacteria, and flow should be measured in order to estimate the water quality benefits of addressing the discharges.

- Source tracking and watershed monitoring to better identify watershed pollutant loads. To date, no detailed sourcing studies have been completed in the watershed, so it is difficult to quantify load reductions that should be targeted. Research should be conducted to better identify sources of watershed impairment and target future watershed actions to address these sources. In hotspot areas where high levels of pollution are expected, storm drain monitoring should be conducted to help determine the need for pollution source control.

- Soil Testing to investigate potential contamination in Patterson Park, Clifton Park, existing and proposed community green spaces, and residential areas. This action will help to identify areas with high levels of toxicity throughout the watershed. Should areas of high

toxicity be revealed, remediation efforts and projects should be implemented in an effort to improve health within the watershed.

Table 5.4. Monitoring Recommendations for the Harris Creek Watershed

Monitoring Location	Parameters Assessed	Monitoring Frequency	Status of Monitoring	Recommendation
Boat Lake	Nutrients, Bacteria, Ammonia, Dissolved Oxygen, Chromium, Suspended Solids, Chlorine, Conductivity and pH.	1-2 times monthly	Ongoing	Continue to monitor and review data and track watershed changes
Lakewood Avenue	Nutrients, Bacteria, Ammonia, Dissolved Oxygen, Chromium, Suspended Solids, and Chlorine, Conductivity and pH.	1-2 times monthly	Ongoing	Continue to monitor and review data and track watershed changes
Lakewood Avenue	Trash, PCBs, hydrocarbons	Monthly	Recommended	Conduct monitoring of trash and toxic materials at the Harris Creek outfall.
IDDE and Hotspot locations	Nutrients, Bacteria, Ammonia, Dissolved Oxygen, Chromium, Suspended Solids	Annual	Recommended	Systematic monitoring at all target watershed outfalls
Select Watershed Locations	Gross Solids	One time study	Recommended	Conduct a pollution sampling analysis of gross solid material collected either by street sweepers or several storm drain inlets throughout the watershed.
Soil Testing at Residential and Park Locations	Arsenic, Vanadium, Lead, Chromium, Phosphorus	One time study	Recommended	Conduct at Patterson Park, Clifton Park, existing and proposed community green spaces, and residential areas

5.3 Project Tracking

Managing the delivery of a large group of restoration projects within a subwatershed can be a complex task. Creating a master project spreadsheet linked to a Geographical Information System (GIS) system can help track the status of individual projects through final design, permitting, construction, inspection, maintenance and any performance monitoring. For non-structural efforts, tracking systems will include measures such as number of alley clean-ups, trash cans distributed, residents educated, or number of dedicated volunteers. By tracking the delivery of watershed projects, implementation progress can be assessed over time, which in

turn, helps explain future changes in water quality. Project tracking can also improve the delivery of future projects, and creates reports that can document implementation progress for key funders and stakeholders.

The Harris Creek Watershed coordinator (see recommendation #5) should manage implementation tracking. This person will setup project information in spreadsheet and/or GIS format and report on the status of implementation. The tracking system will account for all watershed practices undertaken in the subwatershed plan regardless of their type or size, and track the progress of outlined milestones.

5.4 Long-term Goals

Long-term goals have been set to mark progress to ensure the implementation of the *Plan* adheres to a schedule to meet the defined outcomes.

- Meet interim milestones from Table 5.1 for each strategy
- Meet ½ of the load reduction goals for neighborhood projects, trash outreach, street sweeping, green street implementation, reduced water consumption, illicit discharge elimination, and additional recommendations listed in Table 6.1. These load reduction values are presented in Section 6 of this *Plan*.
- Reduce trash loads in the watershed by 50% in the next 5-10 years and reduce concentrations of bacteria at monitoring stations by 50%.
- Track improvements in the water quality of Harris Creek using the existing monitoring sites and recommended additional monitoring sites. Evaluate at five years any improvements in trends that may have occurred due to implementation efforts.

AFTER 5 YEARS TIME, THIS *PLAN* SHOULD BE UPDATED TO INCLUDE RECENT WATERSHED DEVELOPMENTS AND MONITORING RESULTS. SECTION 6. POLLUTANT LOAD REDUCTIONS

The *Plan's* 15 recommendations are a wide range of practices, programs, and initiatives that support the Harris Creek Watershed goals (Section 3). Estimated pollutant load reductions for the applicable recommendations (Table 6.1) were estimated using previous studies, available data, and the Watershed Treatment Model (WTM) (Caraco, 2001). The WTM is a pollutant load spreadsheet model that assesses the relative contribution of pollutants from various land uses and watershed areas. The pollutant load benefit was calculated using this tool by comparing pollutant loads for current land use conditions with conditions after recommendation implementation (e.g., neighborhood greening projects, reduced trash through targeted efforts and outreach, and/or street sweeping). Each restoration practice in Table 6.1 is followed by the strategies that it meets, the implementation goal, the assumption leading to the load reduction shown in parentheses. Using the WTM demonstrates which strategies will reduce the highest watershed pollution load. Results of this analysis indicate the great importance in implementing effective education and outreach efforts (recommendation #3), followed by illicit discharge detection and elimination and the implementation of trash clean-up and retrofit projects.

Watershed planners use the WTM to evaluate specific actions or recommendations and the associated estimated watershed pollutant loads. The ability to quantify pollutant reduction is important and helpful to gain implementation support (e.g., funding), reporting anticipated outcomes to the public and funders, and demonstrates the connection between water quality benefits to the *Plan's* goals and recommendations.

Table 6.1. Recommendations that result in a quantifiable pollutant load reduction.

Recommendation	Project Goal	TN Reduction	TP Reduction	TSS Reduction	Citation
1. Neighborhood Greening	Implementation of the 13 neighborhood greening projects	(25.6 lbs/yr)	(4.0 lbs/yr)	(0.4 tons/yr)	Hirschman et al, 2008
2. Reduce trash through targeted efforts and outreach	Reduce loads to trash interceptor by 20% in 5 years and 50% in 10 years	Trash Reduction to < 1 ton a month from an existing just over 2 ton per month average in 2009: Note a TMDL for trash may be set which gives a more specific and binding target			Clearwater Mills, LLC data received on 6/9/10
	100 acres weekly additional street sweeping and storm drain inlet protection in hotspot trash areas	5% reduction (81.5 lbs/yr)	5% reduction (11.3 lbs/yr) Trash/gross solid Removal (209 lbs/yr)	10% reduction (2.7 tons/yr)	Law, 2008 City of Baltimore, 2008
3. Targeted educational programs throughout the watershed including pet waste education and storm drain stenciling	Reach 10,000 residents through multi-lingual materials	60% willing to change behavior (3,191 lbs/yr)	60% willing to change behavior (416 lbs/yr)		Caraco, 2001
4. Explore the links between toxicity and contamination in the watershed.	Enhanced pollution prevention at HC-12, 300 soil tests	40% N reduction (60 lbs/yr)	40% P reduction (10 lbs/yr)	85% Sediment reduction (2.56 tons/yr)	CWP, 2008
6. Promote water conservation and stewardship	Install 300 rain barrels = 1.4 acres treated	Volume Reduction (11.2 lbs/yr)	Volume Reduction (1.7 lbs/yr)	Volume Reduction (0.36 tons/yr)	CWP, 2008
7. Implement Green Streets and other retrofits	Implement 3 green streets and retrofit designs totaling 10 acres of IC*	65% Bioretention (104.4 lbs/yr)	55% Bioretention (15.6 lbs/yr)	55% Bioretention (2.8 tons/yr)	CWP, 2008

8. Identify watershed hotspot areas and develop pollution prevention strategies	Pollution prevention strategies at 20 hotspots	To be determined			
9. Systematically identify and remove illicit discharges	Reduce sewage illicit discharges by 1 million gal/yr over 5 years	30mg/l reduced to 0 mg/l (249.4 lbs/yr)	10mg/l reduced to 0 mg/l (83.2 lbs/yr)	225mg/l reduced to 0 mg/l (0.92 tons/yr)	Brown et. al., 2004
	Reduce wash water illicit discharges by 3 million gal/yr over 5 years	10mg/l reduced to 0 mg/l (249.6 lbs/yr)	5mg/l reduced to 0 mg/l (124.6 lbs/yr)	175mg/l reduced to 0 mg/l (2.18 tons/yr)	Brown et. al., 2004
10. Continue to promote greening and urban farming	Two Farmers markets or delivery service, plant 1000 trees	2.2mg/l to 0 (volume reduction) (170 lbs/yr)	0.3mg/l to 0 (volume reduction) (23 lbs/yr)	80mg/l to 0 (volume reduction) (2.6 tons/yr)	CUFR, 2001
12. Strategically locate additional park and green spaces	Additional 20 urban green spaces (additional 5 acres)	10lbs/acre reduced to 1.8lbs/ac (40 lbs/yr)	0.8lbs/acre reduced to 0.08lbs/ac (3.6 lbs/yr)		CWP & MD DNR, 2005
14. Encourage/ incentivize strong redevelopment criteria	Treat an additional 5 acres of IC through redevelopment criteria and incentives	65% Bioretention (52.2 lbs/yr)	55% Bioretention (7.8 lbs/yr)	85% Bioretention (1.4 lbs/yr)	CWP, 2008
15. Green Microlending/ Entrepreneurial Support/Training Program	Set up and fund micro- lending program - increase opportunities for small and green biz				

*IC= impervious cover.

Figure 6.1. Urban farming at Clifton Park in the Harris Creek Watershed.

SECTION 7. REFERENCES

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