NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM

Municipal Separate Storm Sewer System Discharge Permit

Permit Number MD0068306

2014 ANNUAL REPORT



Anne Arundel County
Department of Public Works
2662 Riva Road
Annapolis, Maryland 21401

February 12, 2015

2014 Annual Report for
Anne Arundel County
Storm Water National Pollutant
Discharge Elimination System

Permit Number MD0068306

Submitted to:

Water Management Administration
Maryland Department of the Environment
1800 Washington Boulevard
Baltimore, MD 21230

February 2015



Submitted by:
Anne Arundel County
Department of Public Works
2662 Riva Road
Annapolis, MD 21401



Prepared by:



Table of Contents

I. PURPOSE AND SCOPE I-1

II. IMPLEMENTATION STATUS – STORMWATER MANAGEMENT PROGRAM II-1

III. WATER QUALITY III-1

IV. STANDARD PERMIT CONDITIONS IV-1

A. Permit Administration IV-1

B. Legal Authority IV-6

C. Source Identification IV-7

1. Storm drain system IV-7
2. Industrial and commercial sources IV-8
3. Urban best management practices (BMPs): IV-9
4. Impervious surfaces IV-10
5. Monitoring locations IV-13
6. Water quality improvement projects IV-14

D. Management Programs IV-15

1. Stormwater Management IV-15
2. Erosion and Sediment Control IV-20
3. Illicit Discharge Detection and Elimination (IDDE) IV-21
4. Litter and Floatables IV-26
5. Property Management and Maintenance IV-30
6. Public Education IV-41

E. Restoration Plans and Total Maximum Daily Loads IV-54

1. Watershed Assessments IV-54
2. Restoration Plans IV-57
3. Public Participation IV-64
4. TMDL Compliance IV-65

F. Assessment of Controls IV-69

1. Watershed Restoration Assessment IV-69
2. Stormwater Management Assessment IV-75

G. Program Funding IV-77

H. Discharge Characterization (Part D of Third Generation Permit) IV-80

I. References IV-82

LIST OF TABLES

Table 1. Land Cover and Impervious Distribution by Land Ownership/Jurisdiction.....IV-12
Table 2. Bureau of Highways Facilities.....IV-33
Table 3. Deicing Material Applied IV-38
Table 4. SWPPP Training Summary for Bureau of Highways Facilities IV-41
Table 5. Watershed Assessment Schedule.....IV-56
Table 6. Waste Load Allocations (WLAs) Approved by EPA for Anne Arundel County.....IV-62
Table 7. Pollutant Load Reductions and Waste Load Allocations (WLA).....IV-66
Table 8. Physical Characterization Summary.....IV-74
Table 9. Fiscal Analysis.....IV-79

LIST OF FIGURES

Figure 1. Organization Chart for NPDES Permit Administration (7/2013 through 6/2014).....IV-2
Figure 2. MDSS Hourly Weather Forecast With Treatment Recommendations.....IV-39
Figure 3. MDSS Treatment Recommendation.....IV-40

LIST OF APPENDICES
(*Provided on the accompanying CD)*

Appendix A: Digital Data (including Attachment A Geodatabase)
Appendix B: Chemical, Biological, and Physical Characterization of the Church Creek and Parole Plaza NPDES Monitoring Stations: 2013-2014
Appendix C: Biological and Geomorphological Conditions in the Picture Spring Branch Subwatershed: 2013-2014
Appendix D: Illicit Discharge Detection and Elimination – 2014 Annual Report
Appendix E: SWPPP Compliance Documentation
Appendix F: Public Outreach Documentation
Appendix G: TMDL Restoration Plans
Appendix H: Recreation & Park IPM Program Fact Sheet
Appendix I: Title 7 – WPRP Legislation
Appendix J: Itemized Restoration Project Cost Spreadsheet

I. PURPOSE AND SCOPE

This Annual Report was assembled to detail the activities in Anne Arundel County for the County and State Fiscal Year beginning July 1, 2013 and ending June 30, 2014. These activities demonstrate compliance with the National Pollutant Discharge Elimination System (NPDES) Municipal Separate Storm Sewer System (MS4) permit terms provided by 40 CFR 122.42(c). It describes the components of the stormwater management program and the associated implementation status. The County proposes no revision to the program at this time.

This report also summarizes the monitoring programs implemented by Anne Arundel County, including data collection and analysis. Digital data and specific reports for the major programs conducted during the reporting term can be found within the Appendices. Digital data found in Appendix A is submitted in the format consistent with Attachment A to the Permit and Appendix B of the August 2014 document entitled *Accounting for Stormwater Wasteload Allocations and Impervious Acres Treated: Guidance for National Pollutant Discharge Elimination System Stormwater Permits (MDE 2014).*

On February 12, 2014 the County was issued a new, Fourth Generation, NPDES MS4 Permit. Activities described in this report, and occurring prior to February 2014, were performed in compliance with the Permit that expired on November 8, 2009. Activities occurring from February 2014 through June 2014 were performed in compliance with the new Permit. Where appropriate, this differentiation is identified in the Report narrative.

II. IMPLEMENTATION STATUS – STORMWATER MANAGEMENT PROGRAM

Components of Anne Arundel County's stormwater management program were established to address the requirements outlined in the County's NPDES MS4 permit. The major components also address stormwater Waste Load Allocations (WLAs) associated with Total Maximum Daily Loads (TMDLs), and overall water quality improvement within the County's waterways. Program components include:

- Storm Drain Infrastructure and Impervious Area Inventory;
- Erosion and Sediment Control Program;
- Stormwater Management Program;
- Illicit Connection Detection and Elimination;
- Litter and Floatables;
- Management and Maintenance of County-owned Facilities (e.g., roads, parking lots);
- Public Education and Outreach;
- Watershed Assessment;
- Watershed Restoration Plans;
- TMDL Compliance;
- Watershed Restoration Assessment;
- Stormwater Management Assessment; and
- Program Funding.

The County feels the above programs address the major water quality concerns within County watersheds. Monitoring efforts have shown that the implementation of these programs results in the improvement of water quality, which motivates the County to continue its dedication to these programs. Efforts in these program areas during the reporting period are addressed under the appropriate permit conditions in **Part IV** of this report.

III. WATER QUALITY

The NPDES MS4 Permit issued to Anne Arundel County in February 2014 requires implementation of a stormwater management program to effectively prohibit pollutants in stormwater discharges, to attain WLAs as set forth in approved TMDLs, and to comply with all provisions of the permit. Compliance with permit conditions shall constitute compliance with the Clean Water Act (§402(p)(3)(B)(iii)) and adequate progress toward compliance with Maryland's water quality standards and any U.S. Environmental Protection Agency (EPA) approved stormwater WLAs.

Anne Arundel County endeavors to manage, implement, and enforce a stormwater management program in accordance with the Clean Water Act and corresponding NPDES regulations. The activities undertaken in support of permit compliance, and documented herein, show progress toward reducing pollutants in stormwater discharges, prohibiting unauthorized discharges to the County's storm drain system, and attaining stormwater WLAs for established TMDLs.

IV. STANDARD PERMIT CONDITIONS

A. Permit Administration

Anne Arundel County shall designate an individual to act as a liaison with the Maryland Department of the Environment (MDE) for the implementation of this permit. The County shall provide the coordinator's name, title, address, phone number, and email address. Additionally, the County shall submit in its annual reports to MDE an organizational chart detailing personnel and groups responsible for major NPDES program tasks in this permit. MDE shall be notified of any changes in personnel or organization relative to NPDES program tasks.

Status:

Coordination of Anne Arundel County's NPDES MS4 Permit was performed by the Department of Public Works (DPW) Watershed Protection and Restoration Program for the 2014 reporting year (1 July 2013 – 30 June 2014). The program coordinators for this reporting year are:

Ms. Ginger Ellis
Environmental Planning Administrator
Watershed Protection and Restoration Program
Anne Arundel County Department of Public Works
2662 Riva Road, MS 7409
Annapolis, MD 21401
410-222-4240
pwelli16@aacounty.org

Ms. Janis Markusic
Program Manager/Senior Planner
Watershed Protection and Restoration Program
Anne Arundel County Department of Public Works
2662 Riva Road, MS 7409
Annapolis, MD 21401
(410) 222-4240
pwmark02@aacounty.org

Figure 1 shows the organizational chart for the 2014 reporting year. Changes in personnel during the reporting year include personnel in the DPW Director and Deputy Director positions. Additionally, a new position, Watershed Protection and Restoration Program (WPRP) Administrator, was added to the DPW Bureau of Engineering organizational structure.

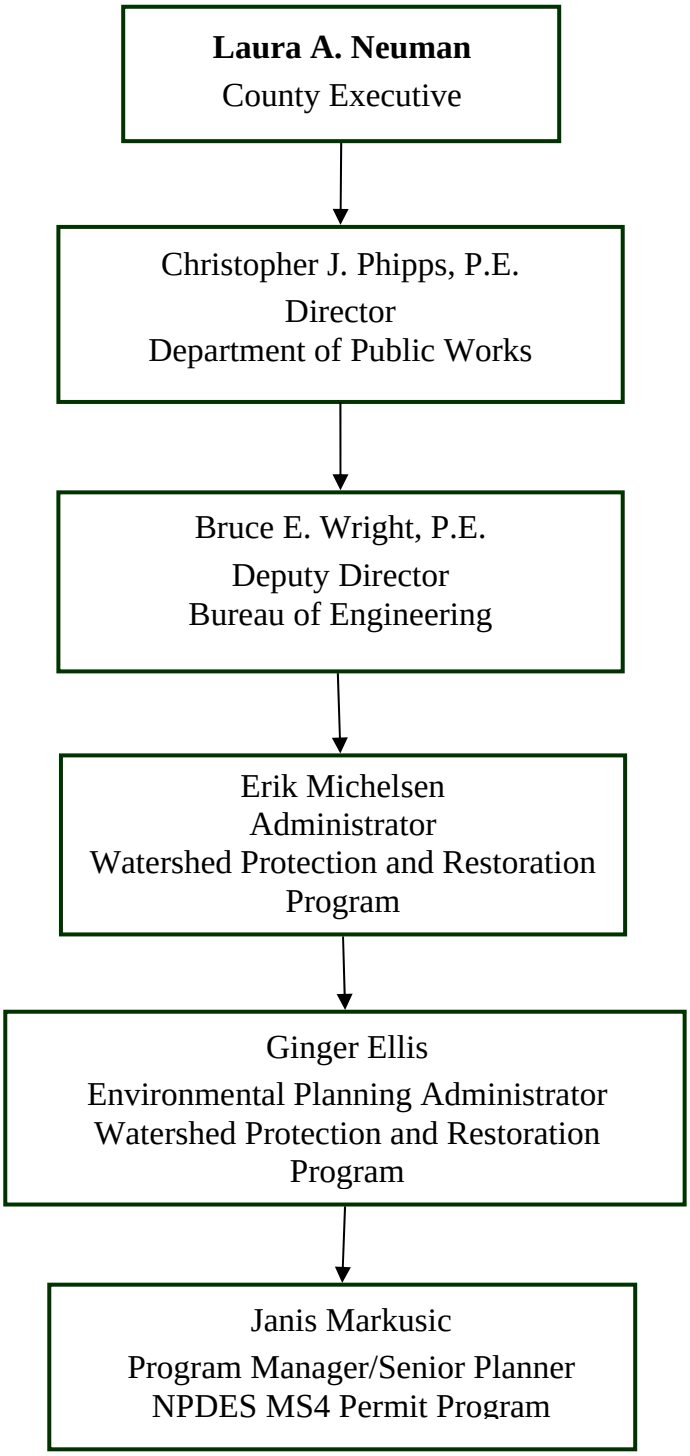


Figure 1. Organization Chart for NPDES Permit Administration (7/2013 through 6/2014)

Additional County staff members responsible for projects related to compliance with the NPDES MS4 Permit are listed below.

Department of Public Works:

- Doug Burkhardt, Engineer Manager
  Bureau of Engineering, Technical Engineering
  Provides managerial support and oversight for geographic information systems (GIS) data collection and geodatabase development activities associated with urban best management practices (BMPs) and storm drain system records.

- Ramzi Bannura, Program Manager
  Bureau of Highways, Infrastructure Management Division
  Programs and maintains GIS databases for the closed storm drain system, associated infrastructure databases, and the County's roads inventory.

- Darryl Hockstra, Engineer Manager
  Bureau of Highways, Infrastructure Management Division
  Administers the Infrastructure Management Division and oversees the capital program associated with stormwater management pond inspection and repair; and emergency storm drain and stormwater system inspection and repair.

- Andy Watcher, Engineer III
  Bureau of Highways, Infrastructure Management Division
  Inspects publicly owned storm drain infrastructure and manages storm drain system and structure repairs.

- Rich Olsen, Program Specialist II
  Bureau of Highways, Infrastructure Management Division
  Inspects and maintains a subset of urban stormwater BMPs that are the responsibility of DPW.

- Alex Baquie, Assistant Chief Road Operations
  Bureau of Highways, Road Operation Division
  Administers the County's Road Operation Division; maintains the Bureau's permit coverage under the MDE General Permit No. 12-SW (General Discharge Permit for Stormwater Associated with Industrial Activity); develops and implements Stormwater Pollution Prevention Plans (SWPPPs) associated with Road Operations district yard facilities; documents the use of pesticides, herbicides, fertilizers, and de-icing materials associated with road maintenance activities; implements the County's street sweeping and inlet cleaning programs; conducts roadside litter clean-up activities; and provides support for volunteer watershed and stream clean-up activities.

- Rick Fisher, Senior Engineer
  Bureau of Engineering, Watershed, Ecosystem & Restoration Services
  Administers the Watershed Assessment Program; manages watershed assessment contracts; manages the technical engineering and water quality models in support of NPDES MS4 Permit activities and the County's Phase II Watershed Implementation Plan (WIP); coordinates data, tracking and reporting of impervious surface reduction and pollutant load credit; manages the County's impervious surface and land cover GIS layers; and documents the locations and descriptions of watershed restoration projects.

- Jeff Cox, Engineer III
  Bureau of Engineering, Watershed, Ecosystem & Restoration Services
  Maintains, updates, and provides quality control of GIS data layers (e.g., impervious surfaces, land cover) that support the engineering and water quality models utilized for supporting NPDES activities.

- Ken Pensyl, Engineer III
  Bureau of Engineering, Watershed, Ecosystem & Restoration Services
  Manages design and construction of watershed restoration projects.

- Dennis McMonigle, Engineer III
  Bureau of Engineering, Watershed, Ecosystem & Restoration Services
  Manages design and construction of watershed restoration projects.

- Ken Weeks, Engineer III
  Bureau of Engineering, Watershed, Ecosystem & Restoration Services
  Manages design and construction of watershed restoration projects.

- Masoud Ghatineh, Senior Engineer
  Bureau of Engineering, General Engineering
  Manages design and construction of watershed restoration projects as required through the County's tidal waters dredging program.

- Chris Victoria, Planner II
  Bureau of Engineering, Watershed, Ecosystem & Restoration Services
  Provides consultant oversight for stormwater monitoring, biological monitoring, and geomorphic assessment of County stream reaches including those identified in **Part F** of this permit. Assists Program Manager with implementation of the Illicit Discharge Detection and Elimination (IDDE) Program.

- Christian Tait
  Bureau of Utility Operations
  Responsible for maintaining the Utilities Operations facilities' permit coverage under the MDE General Permit No. 12-SW (General Discharge Permit for Stormwater Associated with Industrial Activity) and the development/implementation of SWPPPs associated with Water Reclamation Facilities.

- Rhody Holthaus
  Bureau of Waste Management Services
  Responsible for maintaining the Waste Management Services facilities' permit coverage under the MDE General Permit No. 12-SW (General Discharge Permit for Stormwater Associated with Industrial Activity), and for the development and implementation of SWPPPs associated with the County's three landfill facilities.

Office of Planning & Zoning:

- Chris Soldano, Assistant Planning & Zoning Officer
  Development Division
  Oversees components of the County's Stormwater Management Program to ensure consistency with State requirements, including the updating of County stormwater legislation and of the County's Stormwater Practices and Procedures Manual.

- David Braun, Chief Engineer
  Development Division
  Oversees the review of stormwater management on new development and redevelopment projects.

Department of Inspections & Permits:

- John Peacock, Chief of Environmental Enforcement
  Environmental Programs
  Administers the County's Stormwater Management Program and the County's Erosion and Sediment Control Program to ensure compliance with State regulations. Tracks, inspects, and enforces all permits for private and public stormwater management BMPs related to new development and redevelopment projects. Oversees triennial inspection of stormwater BMPs. Tracks development projects disturbing more than one acre and reports this information to MDE as required by the Program and the NPDES MS4 Permit. Oversees staff who respond to County Environmental Compliance Hotline and provides follow-up enforcement for IDDE Program.

- Vernon Murray, Inspector
  Coordinates and conducts the Sediment and Erosion Control "responsible personnel certification" classes on behalf of the County.

Anne Arundel Soil Conservation District:

- Jim Stein, District Manager
  Oversee development plan review for erosion and sediment control compliance.

B. Legal Authority

Anne Arundel County shall maintain adequate legal authority in accordance with NPDES regulations 40 CFR Part 122.26 throughout the term of this permit. In the event that any provision of its legal authority is found to be invalid, the County shall notify MDE within 30 days and make the necessary changes to maintain adequate legal authority. All changes shall be included in the County's annual report.

Status:

Anne Arundel County continues to maintain the authority to comply with the terms of this permit. As documented in prior Annual Reports, this includes implementation of the 2000 Maryland Stormwater Design Manual (MDE 2000) as well as the 2007 Stormwater Management Act. The County Code has been revised to incorporate these stormwater management requirements, and subsequently renumbered, over the past 10 years. As of November 2010, Article 16 of the County Code contains the stormwater management program and erosion and sediment control regulations. Article 17 contains the subdivision and development requirements. Article 18 contains the zoning regulations. A copy of the final approved implementing legislation and other associated documentation was provided in a prior years' Annual Report.

The County Stormwater Management Practices and Procedures Manual was updated and became effective on November 22, 2010. A letter was received from MDE in September 2011 stating that Article 16 and the County Stormwater Management Practices and Procedures Manual have been approved. There were no further revisions to the Manual during the reporting period.

No changes were made to the County Erosion and Sediment Control Code or Stormwater Management Code during the 2014 reporting period. The Department of Inspections and Permits (I&P) and the County Office of Law are currently working on the MDE required revisions to the Floodplain Code and Erosion and Sediment Control Code. Because both Codes are contained in Article 16 of the County Code, one bill will be submitted to the County Council addressing both sets of changes to Article 16.

In 2013 Anne Arundel County established a Watershed Protection and Restoration Program as mandated by §4-202.1 of the Environment Article of the State Code for the purpose of supporting compliance with the requirements of the County's NPDES MS4 permit, the Chesapeake Bay TMDL, local watershed TMDLs, and stormwater WIPs through stormwater management practices and stream and wetland restoration activities. The Program also maintains and administers the Watershed Protection and Restoration Special Revenue Fund established under Article 13. Title 7. §4-11-119 of the Anne Arundel County Code (available in **Appendix I**).

The entire County Code, including Articles 13 and 16, can be found online through the County website at http://www.aacounty.org/CountyCode/index.cfm, under the link for the County Code.

C. Source Identification

Sources of pollutants in stormwater runoff countywide shall be identified and linked to specific water quality impacts on a watershed basis. The source identification process shall be used to develop watershed restoration plans. The following information shall be submitted annually for all County watersheds within the permit area in geographic information system (GIS) format with associated tables as required in PART V of this permit.

1. <u>Storm drain system</u>: all infrastructure, major outfalls, inlets, and associated drainage areas delineated;

Status:

In 2008, Anne Arundel County completed a Countywide inventory of storm drain inlets, manholes, outfalls, culverts, and pipes for all County watersheds. In 2014, the County continued to capture updates for incorporation into the County storm drain maps and the County GIS. Furthermore, the County continues to populate the drainage area information for the County outfalls, following the watershed study schedule as presented in **Part IV.E** of this permit. To maintain accuracy of the closed storm drain system mapping, the County has been conducting a re-inspection of the Countywide system on a regular basis. The storm drain inlet and outfall database was prepared in the format required by MDE and is included in **Appendix A.**

The County is able to identify which storm drain structures are outfalls by querying the GIS for structures with no hydraulic connection to any other structure downstream. The County then focuses on these discharge points for delineation of contributing drainage area. As of June 30, 2014, there are a total of 5,526 closed storm drain outfalls in the County. As reported previously, the County has the ability to delineate drainage areas and assess hydrologic conditions at any storm drain outfall within the County. Currently, delineation of drainage areas to all storm outfalls within eight of the twelve County watersheds (Severn, South, Upper Patuxent, Magothy, Patapsco Non-Tidal, Patapsco Tidal, Bodkin Creek, and Little Patuxent) has been completed. This drainage area coverage constitutes 4,263 structures out of the total 5,526 closed storm drain outfalls.

As of June 30, 2014, there are 1,410 major outfalls in the County. According to 40 CFR 122.26, a major municipal separate storm drain outfall is defined as an outfall pipe with an internal diameter of 36 inches or greater or an outfall pipe with an internal diameter of 12 inches or greater that receives storm water from industrially zoned lands. In addition, as of June 2014, there are 34,780 storm drain inlets.

In 2010, the County completed the delineation of drainage areas to all outfalls within the Little Patuxent Watersheds. Mapping showing these outfalls and their drainage areas was submitted with a previous annual report**.** A GIS layer containing outfalls and the drainage areas for the Severn, South, Magothy, Upper Patuxent River, Patapsco Non-Tidal, Patapsco Tidal, and Bodkin Creek Watersheds was provided in the 2007, 2008, and 2009 reports. The GIS layer will be reviewed and updated on an annual basis, and as a result of re-inspections, to reflect future development and retrofits. During the last permit year, the County identified 14 new major outfalls. The drainage areas for these new outfalls have been delineated and added to the inventory of major outfall drainage areas submitted in **Appendix A**. The County's plan for the next reporting year (FY2015) is to provide outfall drainage areas for both the West and Rhode River watersheds in addition to new outfalls added to the County's inventory.

The County will continue to develop drainage areas for outfalls as the watershed assessments are completed.

2. Industrial and commercial sources: industrial and commercial land uses and sites that the County has determined have the potential to contribute significant pollutant:

Status:

The NPDES MS4 Permit requires that sources of pollutants in stormwater runoff be identified and linked to specific water quality impacts on a watershed basis. Compliance with this permit requirement includes the annual submittal, in GIS format with associated tables, of the "…industrial and commercial land uses and sites that the County has determined have the potential to contribute significant pollutants." A methodology for determining these land uses is described below. The data and GIS coverage are found in **Appendix A**.

Attachment 2 to the Basis for Final Determination to Issue Anne Arundel County's NPDES MS4 Permit (11-DP-3316; MD0068306) is a memorandum from the U.S.EPA to MDE dated November 29, 2012. This memorandum lists specific objections to draft language proposed for the 4th generation NPDES MS4 Permits. Specific to the development of the above methodology, is a paragraph on Page 4 of this memorandum that addresses Industrial/Commercial Monitoring as a component of the MS4 permit. In this paragraph, EPA objects to the permit on the basis that it does not require the permittee to maintain an inventory of industrial and commercial sites having the potential to contribute pollutants to the storm drain system. EPA proposes the language (above) included in the permit as part of the Source Identification Section (**Part IV.C.2**), further indicating that these identified sites correlate to the required visual surveys of commercial and industrial areas that are conducted under the Illicit Discharge Detection and Elimination (IDDE) program as described in the NPDES MS4 Permit (**Part IV.D.3**)

Page 6 of the Anne Arundel County NPDES MS4 Permit Fact Sheet, developed by MDE as a companion document to the Permit, describes requirements for an effective IDDE program. Included in this program description, is the requirement that the County routinely survey commercial and industrial areas, and monitor major storm drain outfalls to identify illicit discharges. Major storm drain outfalls are defined by the Clean Water Act (40 CFR 122.26) as:

> A municipal separate storm sewer outfall that discharges from a single pipe with an inside diameter of 36 inches or more or its equivalent (discharge from a single conveyance other than circular pipe which is associated with a drainage area of more than 50 acres); or for municipal separate storm sewers that receive storm water from lands zoned for industrial activity (based on comprehensive zoning plans or the equivalent), an outfall that discharges from a single pipe with an inside diameter of 12 inches or more or from its equivalent (discharge from other than a circular pipe associated with a drainage area of two acres or more).

To meet the **Part IV.C.2** requirement of identifying commercial and industrial land uses and sites that have the potential to contribute pollutants to the storm drain system, and to correlate this requirement with that found in **Part IV.D.3.b**, the County has developed a GIS coverage and geodatabase predicated on intersecting the following GIS layers and data:

- Industrial and commercial polygons from Anne Arundel County 2011 Land Cover
- County closed storm drain system inlets, pipes, and outfalls

Specifically, inlets in designated Industrial and Commercial land cover polygons were identified and the closed storm drain pipes intersecting these inlets were selected. Closed storm drain pipes connecting to the already selected pipes were also selected to provide the closed storm drain system network connected to the chosen inlets. Once this network was identified, the outfalls intersecting the closed storm drain pipes were selected. All outfalls not meeting the definition of a "major outfall" were removed from the selected set of outfalls. This resulted in 896 outfalls that would drain Commercial and Industrial lands in the County.

3. <u>Urban best management practices (BMPs):</u> stormwater management facility data including outfall locations and delineated drainage areas;

Status:

Anne Arundel County I&P maintains the Urban BMP Database, which contains information related to all stormwater management BMPs subject to inspection by the County.

The Urban BMP Database provided in **Appendix A** reflects the on-going effort to improve the quality of Anne Arundel County's BMP data. In the next permit year, the County is expected to make further progress on improving the Database quality, including making progress towards database clean-up. The total number of BMP records has increased by 273 to 10,453 in 2014. The 10,453 BMPs are BMPs that we can confirm as having either an approval date or completion date. The County updated the structure type of all existing BMPs to comply with the latest MDE guidance on urban BMP data reporting (MDE 2014).

4. Impervious surfaces: public and private land use delineated, controlled and uncontrolled impervious areas based on, at a minimum, Maryland's hierarchical eight-digit sub-basins;

Status:

During the 2014 reporting year, the County continued efforts to maintain an accurate impervious surface dataset.

- In the spring of 2014 the County initiated a contract with Axis Geospatial to update its impervious surface and land cover datasets utilizing imagery captured for the state of Maryland's High Resolution Aerial Ortho-photography captured during the spring of 2014. It is anticipated that Axis will begin the update process in early 2015 and complete the task by summer 2015. The next annual report, FY2015 will use impervious surface calculations based on the 2014 impervious surface dataset.

Impervious Cover

The impervious surface layer is crucial to the County's Watershed Management Tool (WMT). The WMT consists of many watershed analysis models for characterizing the existing conditions of the watershed. The WMT also provides predictive modeling for future conditions, restoration approaches, and preservation scenarios. These models are fully integrated with GIS and currently use the 2011 impervious layer for many different watershed and planning analyses, including hydrologic analysis, Rosgen Level 1 stream classification, pollutant loading estimates, and stream sediment loading estimates.

In 2014 the County initiated a task to update its 2011 impervious surface dataset utilizing imagery captured in the spring of 2014 as part of the statewide aerial orthophotography capture. Currently imagery is being processed and delivery of the imagery is anticipated in early 2015. Once the imagery has been delivered, the County is under contract with Axis Geospatial to update the 2011 impervious surface dataset using the 2014 imagery.

Non-Jurisdictional Land within the County

For NPDES reporting, the County is responsible for accounting for all impervious and BMP information pertaining to County-owned land and private lands directly

under the jurisdiction of the Anne Arundel County government. The City of Annapolis, the Baltimore-Washington International Thurgood Marshall Airport (BWI), Fort George G. Meade (FGGM), the Patuxent Research Refuge, State Highway and Federal Highway roads, State and Federal facilities are examples of land areas that are outside the stormwater authority of Anne Arundel County. Using the County's parcel layer along with the Consolidated Property File (CPF), a GIS layer of parcels not considered the responsibility of Anne Arundel County was developed. Data analyses indicate that approximately seven percent of the land within the County boundary is owned by the State Government, eight percent is owned by the Federal Government, 12 percent is owned by the County local government, and 72 percent is privately owned, including land within the jurisdiction of the City of Annapolis. Digging deeper into this information reveals that approximately 21 percent of the impervious acres within the entire County's impervious area are outside the jurisdictional authority of the County with respect to stormwater management. A breakdown of impervious surfaces within Anne Arundel County is listed in Table 1.

Table 1. Land Cover and Impervious Distribution by Land Ownership/Jurisdiction

Anne Arundel County Land Cover Categories	City of Annapolis	State	Federal	County	Private	City of Annapolis	State	Federal	County	Private	City of Annapolis	State	Federal	County	Private
	Land Acres					Impervious Acres					Percent Impervious				
Airport	0	1,032	0	68	105	0	844	0	48	74	0%	82%	22%	71%	70%
Commercial	978	691	1,609	1,877	7,403	636	331	810	1,233	4,946	65%	48%	50%	66%	67%
Industrial	21	512	365	424	3,919	13	285	166	192	2,420	61%	56%	46%	45%	62%
Transportation	189	3,775	928	3,057	1,688	145	2,794	528	1,982	484	77%	74%	57%	65%	29%
Pasture/Hay	0	147	565	231	5,070	0	1	4	5	18	0%	1%	1%	2%	0%
Row Crops	0	135	565	395	10,977	0	2	0	8	39	0%	1%	0%	2%	0%
Residential 1/2-acre	110	60	46	1,225	9,422	28	14	11	644	1,708	26%	24%	24%	53%	18%
Residential 1/4-acre	1,786	99	129	2,783	14,694	640	14	33	1,614	3,384	36%	14%	25%	58%	23%
Residential 1/8-acre	568	132	678	3,309	15,395	242	33	211	1,830	4,664	43%	25%	31%	55%	30%
Residential 1-acre	46	108	21	909	10,513	9	13	1	376	1,483	19%	12%	7%	41%	14%
Residential 2-acre	35	224	58	1,207	22,187	9	24	5	402	2,510	26%	11%	8%	33%	11%
Open Space	254	2,949	2,925	3,741	11,235	15	154	94	172	216	6%	5%	3%	5%	2%
Water	13	241	224	375	1,510	1	0	1	1	8	4%	0%	0%	0%	1%
Open Wetland	1	280	107	397	794	0	0	0	0	1	0%	0%	0%	0%	0%
Forested Wetland	0	64	93	53	75	0	0	0	0	0	0%	0%	0%	0%	0%
Woods	523	9,028	12,922	12,762	70,303	7	80	36	197	278	1%	1%	0%	2%	0%
Utility	0	39	216	75	1,600	0	2	1	6	30	0%	4%	0%	7%	2%
SubTotal	4,523	19,516	21,452	32,888	186,889	1,745	4,591	1,901	8,709	22,263	39%	24%	9%	26%	12%
Total	**265,268**					**39,209**					**15%**				

5. <u>Monitoring locations</u>: locations established for chemical, biological, and physical monitoring of watershed restoration efforts and the 2000 Maryland Stormwater Design Manual; and

Status:

<u>a. Parole Plaza, Church Creek, and Picture Spring Branch</u>

The County maintains three monitoring sites, Parole Plaza, Church Creek, and Picture Spring Branch, where the required chemical, physical, and biological monitoring of watershed restoration efforts and stormwater management application is conducted. A summary of the 2014 permit year monitoring efforts at these sites is found in **Part IV.F**, and the complete monitoring reports for the reporting year are included in **Appendix B** (*Chemical, Biological, and Physical Characterization of the Church Creek and Parole Plaza NPDES Monitoring Stations: 2013-2014*) and **Appendix C** (*Biological and Geomorphological Conditions in the Picture Spring Branch Subwatershed: 2013-2014*).

The feature class contained in **Appendix A** gives the location of the Parole Plaza, Church Creek, and Picture Spring Branch monitoring sites.

<u>b. Countywide Biological Monitoring Program</u>

Since 2004, the County has implemented a Countywide biological monitoring program focusing on benthic macroinvertebrates and modeled after the Maryland Biological Stream Survey (MBSS). The program uses a probability-based stratified random sampling design so that overall watershed condition can be evaluated and comparisons between different watershed units can be made. A total of 24 Primary Sampling Units (PSUs) are sampled in a five-year rotation called a Round. Round 1 began in 2004 and ended in 2008. Round 2 began in 2009 and concluded in 2013.

The results of Rounds 1 and 2 have been reported in prior years' Annual Reports. During the 2014 reporting period, there was no activity for this program. The County has, instead, chosen to review and update the program design to ensure data collected will address the current regulatory environment. It is anticipated that this program redesign will be completed during the 2015 reporting period and the program will be re-implemented during the 2016 spring index period.

<u>c. Town Center Water Quality Monitoring Program</u>

Through routine baseflow and storm event monitoring, the County characterizes receiving stream water quality from Parole Town Center and Odenton Town Center drainage areas. One continuous monitoring station is maintained by the County on the Cowhide Branch tributary of Weems Creek. As part of the Parole Town Center Area, Weems Creek has been monitored since the late 1980s.

Continuous flow data and rainfall are collected at this station, and monthly stormwater and baseflow monitoring is performed at this site. In addition, the County has been performing monthly baseflow monitoring at three other stations; one station is located on Broad Creek (Parole Town Center area) and the other two are located on Picture Spring Branch (Odenton Town Center area), a tributary of the Severn River. Monitoring at these three baseflow stations was discontinued in January 2014. At all stations, a total of 18 parameters are sampled, including:

Calcium	TKN	Alkalinity
Copper	NH3	Total Phenols*
Lead	TP	Oil and Grease*
Zinc	TSS	*E. coli**
Magnesiu	PO4	VOC (EPA 624)*
m	COD	*Cowhide Branch station only*
Iron	Turbidity	
BOD5	TOC	
NO_3/NO_2	Hardness	

The highlights of the program during the reporting period:

1. A total of 8 storms were sampled at Weems Creek.
2. A total of 10 baseflow samples were collected at Weems Creek. A total of 6 baseflows were collected at the three baseflow stations before sampling was discontinued in January 2014, for a total of 16 samples.

The Chemical Monitoring Site Locations Database is included in **Appendix A**.

6. Water quality improvement projects: projects proposed, under construction, and completed with associated drainage areas delineated.

Status:

Watershed restoration/retrofit activities in the design or construction phase or completed during the 2013 to 2014 fiscal years are presented in **Appendix A.** The projects listed have been constructed and provide a measured water quality benefit. It should be noted that the list of restoration projects completed by the County for the current reporting year is relatively small in comparison to past reporting years. The County has worked over the past year to establish the programmatic structure and staffing required to develop and implement restoration projects, and has moved forward with focused feasibility studies of previously identified restoration subwatersheds for purposes of identifying specific implementable restoration projects prior to project design. A decision has been made by the County to not count the list of potential restoration projects originally developed for the Watershed Implementation Plan as "Proposed" restoration projects until a feasibility study can be done to determine if an actual project can be implemented. Once the feasibility studies are completed and

schematic designs submitted, identified viable projects will be deemed "Proposed" or "In-Design" and move forward in the implementation process. It is anticipated that 275 projects will be in the design stage for the next permit reporting cycle.

Past reporting cycles of the County's NPDES permit have required the County to report various restoration activities. A requirement for reporting these practices was the ability to provide a water quality benefit as outlined in MDE's Stormwater Design Manual. In August 2014, MDE issued guidance for accounting for wasteload allocations and impervious surface treatment. As a result, the County is required to determine water quality volume treatment to account for load and treatment credits associated with restoration projects. Due to this requirement, previously reported restoration projects which did not have a reported water quality volume associated with the project cannot be credited for impervious surface treatment and pollutant load reductions until the water quality volume treatment can be determined. Therefore, until the water quality volume is determined, the County will not claim credit for these projects. It is expected that the County will make progress towards calculating water quality volumes for these projects during the upcoming reporting year and continue into the future years. The County will take impervious surface treatment and load reduction credit for these practices once the measured water quality volume has been determined. This effort is integrally tied to the ongoing Urban BMP Database improvements and the required database enhancements associated with the August 2014 guidance, which the County began implementing shortly after receipt of that guidance.

D. Management Programs

The following management programs shall be implemented in areas served by Anne Arundel County's MS4. These management programs are designed to control stormwater discharges to the maximum extent practicable (MEP) and shall be maintained for the term of this permit. Additionally, these programs shall be integrated with other permit requirements to promote a comprehensive adaptive approach toward solving water quality problems. The County shall modify these programs according to needed program improvements identified as a result of periodic evaluations by MDE

.

1. Stormwater Management

An acceptable stormwater management program shall continue to be maintained in accordance with the Environment Article, Title 4, Subtitle 2, Annotated Code of Maryland. Activities to be undertaken by the County shall include, but not be limited to:

a. Implementing the stormwater management design policies, principles, methods, and practices found in the latest version of the 2000 Maryland Stormwater Design Manual. This includes:

- ***i. Complying with the Stormwater Management Act of 2007 (Act) by implementing environmental site design (ESD) to the MEP for new and redevelopment projects;***
- ***ii. Tracking the progress toward satisfying the requirements of the Act and identifying and reporting annually the problems and modifications necessary to implement ESD to the MEP; and***
- ***iii. Reporting annually the modifications that have been or need to be made to all ordinances, regulations, and new development plan review and approval processes to comply with the requirements of the Act.***

Status:

The 2000 Maryland Stormwater Design Manual was fully implemented by the County. However, this condition was superseded by the Maryland Stormwater Management Act of 2007. During this reporting period the Office of Planning and Zoning (OPZ) continued the requirement for all proposed new stormwater management plans to comply with the new Environmental Site Design (ESD) standards in accordance with the County Code, State Code and the current edition Maryland Stormwater Management Design Manual.

Also during this reporting period, efforts to update Chapter VI (Stormwater Management) of the Department of Public Works Design Manual continued. The purpose of this effort is to:

- incorporate the new Maryland stormwater management requirements into the Department's guidance document for capital projects;
- add guidance for stormwater management associated with retrofit projects; and
- ensure that the procedures, standards and criteria within the manual are consistent with those prescribed by the State and County stormwater ordinance and with the County's Stormwater Practices and Procedures Manual.

This is a collaborative work effort between DPW, OPZ, I&P, and the Soil Conservation District (SCD). A Fact Sheet describing the purpose and goals of this project was included in the **2013 Annual Report.** Work will continue into the next annual reporting cycle to finalize this chapter of the Design Manual. The County will provide a copy of the final update for MDE review and approval prior to incorporating it into the County's Department of Public Works Design Manual.

As of September 2011 the County has an MDE-approved Stormwater Management Code, which incorporates the current edition of the Maryland Stormwater Management Design Manual. Copies of the County legislation (Bill 74-11) and the MDE approval letter were provided in the 2011 Annual Report.

During the reporting period, no modifications were required to address programmatic problems.

b. Maintaining programmatic and implementation information including, but not limited to:

- ***i. Number of Concept, Site Development, and Final plans received. Plans that are re-submitted as a result of a revision or in response to comments should not be considered as a separate project;***
- ***ii. Number of redevelopment projects received;***
- ***iii. Number of stormwater exemptions issued; and***
- ***iv. Number and type of waivers received and issued, including those for quantity control, quality control, or both. Multiple requests for waivers may be received for a single project and each should be counted separately, whether part of the same project or plan. The total number of waivers requested and granted for qualitative and quantitative control shall be documented.***

Stormwater program data shall be recorded on MDE's annual report database and submitted as required in PART V of this permit.

Status:

During the reporting period, County records indicate 92 Concept Plans, 106 Site Development Plans, and 221 Final Development Plans were received. No storm water exemptions were issued. No waivers requests were received and, subsequently, none were approved.

During the FY14 reporting period, the number of redevelopment projects submitted for review were not tracked separately from the new development projects. Efforts are now underway to provide a means for readily making this distinction within the development review project information capture and tracking systems. Data gleaned from this system for FY14 indicates 30 redevelopment projects were submitted for grading permit review.

c. Maintaining construction inspection information according to COMAR 26.17.02 for all ESD treatment practices and structural stormwater management facilities including the number of inspections conducted and violation notices issued by Anne Arundel County.

Status:

Stormwater construction inspections are conducted by the assigned area Erosion Control Inspectors in conjunction with the required erosion and sediment control plan inspections. For the reporting period the following inspections were performed:

- 860 Stormwater Construction Inspections
- 71 Stormwater Correction Notices

d. Conducting preventative maintenance inspections, according to COMAR 26.17.02, of all ESD treatment systems and structural stormwater management facilities at least on a triennial basis. Documentation identifying the ESD systems and structural stormwater management facilities inspected, the number of maintenance inspections, follow-up inspections, the enforcement actions used to ensure compliance, the maintenance inspection schedules, and any other relevant information shall be submitted in the County's annual reports.

Status:

In late 2014 (FY15), MDE conducted the field portion of their triennial evaluation of the County's Stormwater Management Program. MDE's previous triennial administrative and field review of the County's stormwater management program was completed in 2005. The County's Department of Inspections & Permits (I&P) continues to maintain all programmatic information required by MDE since that 2005 review. Program modifications resulting from the 2014 triennial evaluation will be documented in the FY15 NPDES MS4 Annual Report.

The State and County Stormwater Management Codes require preventive maintenance inspections once during the first year of operation and every three years thereafter. For the reporting period the following maintenance inspections were performed:

- 902 First Year of Operation Maintenance Inspections
- 1,252 Three Year Maintenance Inspections
- 606 Three Year Maintenance Correction Notices

The required first year inspections are performed by the Area Erosion Control Inspectors as part of the process for completing issuing grading permits. Grading permit Certificates of Completion are not issued until all construction is complete and a passing first year maintenance inspection result is obtained.

Triennial inspection dates that occurred during this reporting cycle are only included for 485 of the BMPs in the Urban BMP database in **Appendix A,**

submitted with this report. The County is not taking credit for the remaining BMPs and they are not included in **Appendix A** due to a lack of complete data related to these BMPs. As part of the County's on-going data cleanup, the records for these BMPs will be further researched and they will be included in future reporting.

For the months of July 2013 through November 2013 there was one dedicated Stormwater Management Maintenance Inspector position, which was responsible for performing the 3-year maintenance inspections and Illicit Discharge inspections. The incumbent inspector retired November 30, 2013. By February 2014 the vacancy was filled and five additional Stormwater Maintenance Inspectors and an Inspections Supervisor had been hired. There is one additional inspection position to be filled and then the full time dedicated staff will consist of seven Inspectors and an Inspections Supervisor. These positions are responsible for performing the required triennial maintenance inspections and associated enforcement as well as Illicit Discharge inspections and enforcement. They will also be responsible for the construction inspection of stormwater management and stream channel restoration projects funded under the County Watershed Protection and Restoration Program.

I&P coordinates with the County Office of Law on the enforcement of violations where the field-generated Maintenance Correction Notices have been ignored. A formal Violation Notice Letter was developed by the Office of Law to be sent by certified mail to the appropriate property owners when a Maintenance Correction Notice goes unheeded. If the Violation Notice Letter does not result in compliance action, the Office of Law will take the appropriate legal actions to enforce violations and obtain compliance.

At last count the Department of Public Works, Infrastructure Management Division is responsible for the maintenance of over 800 public stormwater management BMP's. The Department of Inspections and Permits does not perform regular maintenance inspections or maintain maintenance inspection records on these BMP's. At last count there are approximately 300 publicly owned stormwater management BMP's that are maintained by the Department of Central· Services, the Anne Arundel Board of Education and the Department of Recreation and Parks. While I&P does perform maintenance inspections on these public BMP's, the County agency "owning" the BMP is responsible for any follow-up maintenance requirements.

During this reporting period, and while the County hired additional staff for the Stormwater Maintenance Inspection Program, the triennial maintenance inspection schedule was based on the following priority system. This prioritization scheme will be modified in FY15.

1. On a weekly basis, schedule triennial maintenance inspections by using the SWM Urban BMP Database. Review the proposed weekly inspection schedule with the assigned supervisor and adjust accordingly. A priority is to be placed on the following BMPs:

    - Large BMPs serving commercial and industrial projects;
    - Large BMPs serving single-family subdivisions with private stormwater management; and
    - Large BMPs serving multi-family subdivisions.

2. Triennial maintenance inspections for private BMPs serving single-family residential lots or public devices not maintained by DPW shall be given a secondary scheduling priority. These should only be inspected if an inspection request is received by the responsible agency or a complaint is received.

2. <u>Erosion and Sediment Control</u>

An acceptable erosion and sediment control program shall continue to be maintained and implemented in accordance with the Environment Article, Title 4, Subtitle 1, Annotated Code of Maryland. Activities to be undertaken by the County shall include, but not be limited to:

a. Implementing program improvements identified in any MDE evaluation of the County's erosion and sediment control enforcement authority;

Status:

MDE conducts the Sediment and Erosion Control Delegation evaluations every two years, with the last evaluation conducted in the Fall/Winter of 2012. The Department has submitted an application to retain MDE's delegation of enforcement authority for the years 2015-2016. MDE has begun the administrative review and will schedule the field portion of the evaluation in the very near future.

Additionally, and as reported earlier in **Part IV.B.** Legal Authority, the County is in the process of incorporating MDE's most recent Erosion and Sediment Control Code changes into the County Code (Article 16). MDE's final review comments on the proposed updated language have been addressed by the County. Because the County is also working on required revisions to the Floodplain Code, and because both Codes are contained in Article 16 of the County Code, the County will introduce one legislative bill before County Council to address these changes to Article 16.

a. ***At least three times per year, conducting responsible personnel certification classes to educate construction site operators regarding erosion and sediment control compliance;***

Status:

During the reporting period the County conducted five Green Card training sessions as noted below. Environmental Control Supervisor Vernon Murray has been certified by MDE to provide the training, administer exams, issue Green Cards, and provide MDE with spreadsheets of all successful participants in the Green Card training.

- September 6, 2013 (101 students)
- November 7, 2013 (39 students)
- March 31, 2014 (38 students)
- June 13, 2014 (37 students)
- June 20, 2014 (38 students)

b. Program activity shall be recorded on MDE's annual report database and submitted as required in PART V of this permit; and

Status:

Green Card certification information is provided in **Appendix A**.

c. Reporting quarterly, information regarding earth disturbances exceeding one acre or more. Quarters shall be based on calendar year and submittals shall be made within 30 days following each quarter. The information submitted shall cover permitting activity for the preceding three months.

Status:

Information regarding grading permits from the County's Construction General Permit Activity Database is provided in **Appendix A.** Based on previous guidance from MDE, quarterly reports were not required providing the Construction General Permit Activity Database continues to be submitted with the annual report.

3. <u>Illicit Discharge Detection and Elimination (IDDE)</u>

Anne Arundel County shall continue to implement an inspection and enforcement program to ensure that all discharges to and from the MS4 that are not composed entirely of stormwater are either permitted by MDE or eliminated. Activities shall include, but not be limited to:

a. Field screening at least 150 outfalls annually. Each outfall having a discharge shall be sampled using a chemical test kit. Within one year of permit issuance, an alternative program may be submitted for MDE approval that methodically identifies, investigates, and eliminates illegal connections to the County's storm drain system;

Status:

Anne Arundel County developed and continues to maintain an extensive program designed to detect and eliminate illicit discharges into the municipal storm drain system and upland pollutant sources resulting from dumping, poor housekeeping, and other non-permitted activities.

The program includes the inspection of a minimum of 150 storm drain outfalls annually. This inspection records the presence of dry weather flow, the structural integrity of the outfall, and other maintenance issues. During this reporting period, illicit discharge screening targeted Hanover, Linthicum Heights, and Glen Burnie; 152 outfalls were evaluated. No complaint-driven outfall inspections were performed during this reporting period.

Anne Arundel County's GIS coverage of storm drains and closed storm drain utility grids were used to create maps for field activities. These maps were used in the field to identify the extent of the storm drain systems, locations of outfalls, and contributing businesses or facilities. Only commercial and industrial storm drain systems were identified on the maps for screening efforts, per the guidance provided by MDE (MDE 1997). Outfalls with primarily residential drainage were not inspected.

The water chemistry, physical condition of each outfall structure, and the conditions surrounding the outfall were recorded on field datasheets. When a dry-weather discharge was found, the field crew tested the discharge using a Chemetrics color comparator test kit (detergents, phenols, copper, chlorine, and ammonia), an Extech single analyte tester (fluoride), and a YSI sonde (water temperature and pH). Physical parameters noted at each outfall include structural condition, vegetative condition, erosion, floatables, algae growth, discharge odor, and discharge clarity.

If an outfall's discharge was found to have a concentration above the action criteria for any of the analytes, it was revisited within 24 hours, but at least four hours after the first test. The second visit helps determine if the initial result was an anomaly or confirms the result of the chemical test conducted on the first visit. Any outfall with dry weather flow that was found to have a concentration above the action criteria during both inspections was recorded as a possible illicit connection. Possible illicit connections also included situations where an

observable pollutant had been discharged through a storm drain system, but at the time of inspection the system was not flowing or the discharge did not contain the pollutant.

To identify the source of any illicit discharge, the field crews followed the storm drain systems upstream, testing flows through manholes and inlets as necessary and practical, until the source was identified or the discharge could not reasonably be tracked further. Evidence of illicit discharges, including the probable cause(s) was photo-documented. Site-specific reports were prepared for each identified illicit discharge and/or structural issue found in the field and were submitted to the Anne Arundel County MS4 Program Manager. The potential illicit discharge reports were then forwarded to I&P for further investigation and enforcement.

Seven structural issues associated with storm drain outfalls (e.g., in-pipe sedimentation, headwall concerns, deteriorating corrugated metal piping) were also reported to the County MS4 Program Manager. These site specific reports were then forwarded to the County's Infrastructure Management Division (IMD) for appropriate action. In some instances, the identified structural issues can be associated with non-County-owned infrastructure. In these instances the reports were generally forwarded to I&P for follow-up site visits, inspections, and appropriate enforcement.

Of the screened outfalls containing dry-weather flow, six yielded a result above the action criteria limit for one or more of the tested contaminants. Three of the six outfalls had concentrations that were above at least one action level when retested, and one outfall exhibited above action criteria concentrations for two retests. The County inspectors performed follow-up site visits and inspections for the reported problem outfalls. Further details, including site-specific reports, are included in the *Illicit Discharge Detection and Elimination – 2014 Annual Report* (**Appendix D**).

b. Conducting annual visual surveys of commercial and industrial areas as identified in PART IV.C.2 above for discovering, documenting, and eliminating pollutant sources. Areas surveyed shall be reported annually;

Status:

Field personnel perform a visual inspection of all accessible commercial and industrial sites within the target areas. The inspections are designed to identify poor housekeeping, dumping and other non-permitted discharges (e.g., vehicle wash water) that may be intercepted by the County's storm drain system.

This reporting period's inspections identified 24 upland pollutant sources with the potential to discharge pollutants into County storm drains or Waters of the United States. Follow-up compliance investigations and compliance actions were taken

for these sites or are underway. A full report of the procedures and data collected from the illicit detection and elimination field investigation can be found in the *Illicit Discharge Detection and Elimination – 2014 Annual Report* (**Appendix D**). Digital data are included in **Appendix A**. The report includes a discussion of the enforcement actions taken in 2014.

c. Maintaining a program to address, and if necessary, respond to illegal discharges, dumping, and spills;

Status:

There are two departments within the County that address reports of illegal dumping and spills. I&P is the County agency primarily responsible for enforcing spills and illegal dumping into both public and privately-owned storm drain systems. The County Department of Health addresses complaints specifically relating to food service facilities (e.g., overflowing dumpsters, waste grease containers), as well as noting violations during their regular facility inspections.

I&P received over 30 illicit discharge, dumping, and/or storm drainage complaints during this reporting period, including referrals from DPW as part of their IDDE Program. Illicit Discharge complaints and referrals are logged into the I&P Compliance Case Database, which is used to track cases from the receipt of a complaint or referral to closure. The Compliance Database is available for public viewing on the I&P page of the Anne Arundel County website. The page has a Quick Link to the Compliance Database. Case numbers can be used to track the progress of any individual Illicit Discharge complaint or referral received by I&P.

Compliance case data pertinent to the complaints received during the reporting year are documented in Appendix F of the *Illicit Discharge Detection and Elimination – 2014 Annual Report* (**Appendix D**). All complaints and referrals were investigated and enforced as appropriate.

I&P utilizes a phased approach to eliminating and enforcing illicit storm drain discharges. Phase I Enforcement consists of a Violation Notice sent by first class and certified mail to the property owner. The Phase I Violation Notice includes an explanation of the violation and requests a written commitment to immediately cease and desist the illicit discharge. Upon written receipt of the commitment to comply, the Department monitors the site for up to 60 days and if compliance is maintained the violation is considered abated. Should the Department fail to receive the written commitment to comply or if further violations are observed, the Department proceeds to Phase II enforcement.

At the Phase II level of enforcement I&P posts a Stop Work Order on the property and issues $1000 civil citations to the property owners. The civil citations must be paid and the violation abated or the civil citations are litigated in court. For the

reporting period, it was not necessary to issue any civil citations for the failure to abate illicit discharges at the Phase 2 level of enforcement. If a violation were to remain unabated by the court date, the Department requests the full payment of the fines and an abatement order from the District Court judge. The failure to comply with any Court issued abatement order results in Contempt of Court charges being filed by the County Office of Law.

Significant violations are screened with the County Office of Law for possible criminal enforcement as authorized in the County Code or for referral to MDE for enforcement under the State Code. During the reporting period it was not necessary to issue any civil citations for the failure to eliminate any illicit storm drain discharges.

As described in the 2013 Annual Report, as part of its general activities associated with food service facilities, the Department of Health is including protocols for leaking or overflowing dumpsters. Enforcement is conducted under State of Maryland Regulations Dealing with Food Service Facilities (COMAR 1 0.15.03.19), which requires refuse containers capable of holding all garbage from a facility between periods of removal and containers which do not leak. Violation of this regulation would be marked on the food facility inspection report and would require correction typically within 30 days of the investigation. Failure to comply by the second re-inspection would result in $175 re-inspection fees until compliance is achieved.
For the reporting period, 17 identified dumpster and/or waste grease bin issues, and general debris issues were referred to the Health Department for further inspection and enforcement. Please refer to the *Illicit Discharge Detection and Elimination – 2014 Annual Report* (**Appendix D**) for details.

d. Report significant illicit discharges to MDE

Status:

For the reporting period all illicit discharge complaints and referrals received were successfully enforced by I&P without the need for any referrals to MDE.

e. Reporting illicit discharge detection and elimination activities as specified in PART V of this permit.

Status:

All activities completed as part of the County's 2014 IDDE program are included in the *Illicit Discharge Detection and Elimination – 2014 Annual Report* and accompanying database submitted in December 2014 (**Appendix D**). Additionally, IDDE data are reported according the Attachment A requirements,

and are included in **Appendix A.** The County makes no request to modify its IDDE program.

4. <u>Litter and Floatables</u>

This section of the permit requires Anne Arundel County to address problems associated with litter and floatables in waterways that adversely affect water quality. Increases in litter discharges to receiving waters have become a growing concern both nationally and within Maryland and cannot be ignored. Anne Arundel County needs to evaluate current litter control problems associated with discharges from its storm drain system and develop and implement a public outreach and education program as needed on a watershed by watershed basis.

a. As part of Anne Arundel County's watershed assessments under PART IV.E.1 of this permit, Anne Arundel County shall document all litter control programs and identify potential sources, ways of elimination, and opportunities for overall improvement.

Status:

As watershed assessments continue per the schedule found in Part IV.E.1, information on litter control programs in those watershed areas, potential litter sources, and opportunities for eliminating litter and floatables will be examined. During the reporting period, no watershed assessments were initiated. In FY15, a watershed assessment project will be initiated for the Herring Bay watershed. This assessment will include documentation of potential sources and opportunities for control and elimination of litter and floatables.

b. Within one year of permit issuance, as part of the public education program described in PART IV.D.6., Anne Arundel County shall develop and implement a public education and outreach program to reduce littering and increase recycling. This shall include:

- ***i. Educating the public on the importance of reducing, reusing, and recycling;***
- ***ii. Disseminating information by using signs, articles, and other media outlets; and***
- ***iii. Promoting educational programs in schools, businesses, community associations, etc.***

c. Evaluating annually the effectiveness of the education program.

d. Submit annually, a report which details progress toward implementing the public education and outreach program. The report shall describe the status of public outreach efforts including resources (e.g., personnel and

financial) expended and the effectiveness of all program components.

Status:

Litter Cleanup, Waste Management, & Recycling

The County's Waste Management Services (WMS) developed and operates a robust public education and outreach program targeted to waste reduction and recycling, as well as household hazardous waste disposal.

WMS recognizes the importance of keeping adults educated about its programs, particularly in regards to its changes and advancements, and to encourage residents to recycle more often. Program specialists attend fairs, festivals, HOA meetings, community outreach events, and more. WMS also provide technical assistance with recycling at larger-scale events such as the County Fair, Annapolis Greek Festival; staff were present at over 20 fairs and festivals this year, and WMS provided recycling assistance to 15 events.

The County provides support to citizens working to better their own communities. Each year WMS, upon written request from a local community association, dispatches 40 roll-off dumpsters to aid in community and watershed cleanup activities. This service is available March thru November. Additional information is available on the County's website at:
http://www.aacounty.org/dpw/WasteManagement/commClean.cfm.

The County Bureau of Highways (BOH) is responsible for all maintenance activities associated with County roads. Litter is collected from County roadways on a routine basis. Additionally, BOH conducts weekend roadside litter and trash removal throughout the year, using supervised inmate labor, in partnership with the Department of Detention Facilities. The program was first started in 2007 with a focus on high litter count road segments, dump sites and illegal roadside signs that were proliferating across the County. The goal of the weekend program is to realize an improvement in the condition of roadsides in Anne Arundel County without a reduction to other Highways services. Weekend litter removal activities follow a programmed frequency throughout the year.

A total of 6,910 thirty-gallon bags of litter were removed from roadsides from July 1, 2013 to June 30, 2014, with 3,709 bags collected during our routine work week and 3,201 bags collected by our weekend litter removal program. This represents a 26% decrease from the last reporting period in which 9,393 bags of litter were removed.

Education should not stop once you've received your diploma! It's important to keep adults educated about our programs, particularly in regards to its changes and advancements, and to encourage residents to recycle more often. Our

program specialists also attend fairs, festivals, HOA meetings, community outreach events, and more. We also provide technical assistance with recycling at larger scale events such as the County Fair, Annapolis Greek Festival, and more. We attended over 20 fairs and festivals in FY 13 as well as provided recycling assistance to 15 events.

The County's efforts to promote recycling begin with their own employees through the County Office Recycling Program (CORP). CORP was developed to assist in providing our offices and facilities with the necessary tools behind an effective recycling program (*e.g.*, containers, signage, and pick-up service); all offices/facilities have a Recycling Coordinator that directly communicates with our office. There are about 250 sites (County offices, parks, pools, etc.) that collected 1,221 tons of single-stream recycling.

Anne Arundel County promotes its recycling program to the public through a number of methods: increased customer base to include providing services to small business and multifamily units; improve communication with customers by maximizing the use of various media including direct mail, broadcast media, newspaper advertisements, attendance at civic and community meetings, workshops, displays, special promotions; and a specially designed program for school aged children; and educate customers on new programs, schedule changes and holiday collections. The County's Small Business program has signed up 205 customers; 1303 tons of single-stream recycling was collected. This extensive outreach effort has proven to be very successful. Since its inception in 2008, the Countywide recycling rate has increased from 31% to 44%.

Stream Cleanups

BOH has supported several stream cleanup initiates during the reporting period. This includes Project CleanStream 2014, sponsored by the Severn River Association and involving the headwaters of Clements Creek and Luce Creek in Annapolis, Maryland during April 2014. Significant support was also provided to The Friends of the Patapsco Valley & Heritage Greenway who sponsored several watershed clean-ups in Patapsco State Park off of Race Road in Hanover, Maryland. Additionally, the Bureau of Highways removed in excess of 10 loads of trash, tires, chemicals, metal, and glass dumped illicitly along roadsides and reported by these and other volunteer organizations.

In total, stream cleanup efforts removed 32,298 pounds (16.2 tons) of material from local waterways. Specific events and locations are listed here.

Magothy River

April 5, 2014 - Project Clean Stream, 1265 Green Holly Dr., removed 66 lbs. of trash.

April 5, 2014 - Watershed Clean-up Sandy Point SP, removed trash from beaches, no weight or amount provided for materials removed.

Middle Patuxent

April 12, 2014 - Patuxent River Clean-up by Canoe, removed trash along the shoreline in and around Jug Bay, no weight or amount provided for materials removed.

Patapsco Non-Tidal

Fall 2013 - Holly Creek in Linthicum Heights, removed 25 tires and cleared 4 fallen tree obstructions.

Fall 2013 - Patapsco River Clean-up, removed trash and debris from illegal dump sites, no weight or amount provided for materials removed.

April 5, 2014 - Project Clean Stream, 5526 Belle Grove Rd, removed 7,760 lbs. of trash.

Patapsco Tidal

April 5, 2014 - Project Clean Stream, 490 Chalet Dr., removed 500 lbs. of trash.

Severn River

September 7, 2013 - Jonas Green Park, removed trash and invasive plants from rain gardens and swales near park building, no weight or amount provided for materials removed.

April 5, 2014 - Severn Run Stream Clean-up, removed trash along the Severn Run, no weight or amount provided for materials removed.

April 5, 2014 - Project Clean Stream. 8318 Telegraph Road, removed 11,620 lbs. of solid waste and tires.

April 5, 2014 - Project Clean Stream, 351 Dubois Road, removed 66 lbs. of trash

April 5, 2014 - Project Clean Stream, 1901 Lawrence Ave. North, removed 6,560 lbs. of debris, trash, and metal.

April 5, 2014 - Project Clean Stream, 17 Washington Dr., removed 5,760 lbs. of litter and debris.

April 5, 2014 - Project Clean Stream, 1443 River Road, removed 66 lbs. of trash.

South River

April 5, 2014 - Project Clean Stream South River Federation, various sites throughout watershed, no weight or amount provided for materials removed.

April 5, 2014 - Aberdeen Creek Trash Clean-up, no weight or amount provided for materials removed.

April 12, 2014 - Woodhaven Community Clean-up, removed trash and debris from Bell Branch, no weight or amount provided for materials removed.

West River

May 3, 2014 - Hot Sox Field Trash Clean-up, cleaned up historic dump site, no weight or amount provided for materials removed.

5. <u>Property Management and Maintenance</u>

a. Anne Arundel County shall ensure that a Notice of Intent (NOI) has been submitted to MDE and a pollution prevention plan developed for each County- owned municipal facility requiring NPDES stormwater general permit coverage. The status of pollution prevention plan development and implementation for each County-owned municipal facility shall be reviewed, documented, and submitted to MDE annually.

Status:

Anne Arundel County's Water Reclamation Facilities (WRFs) NPDES discharge permits are current or continue in force pending MDE issuance of a revised permit. The County-owned WRFs with NPDES discharge permits are:

Annapolis WRF, permit number 07-DP-0838, effective August 1, 2009 to July 31, 2014. A renewal package was submitted as per the permit requirement.

Broadneck WRF, permit number 06-DP-0677, effective June 1, 2010 to May 31, 2015. A renewal package was submitted as per the permit requirement.

Broadwater WRF, permit number 06-DP-0813, effective March 1, 2010 to February 28, 2015. A renewal package was submitted as per the permit requirement.

Cox Creek WRF, permit number 07-DP-0698, effective January 1, 2010 to December 31, 2014. A renewal package was submitted as per the permit requirement.

Maryland City WRF, permit number 02-DP-2393, effective August 1, 2008 to July 31, 2013. A renewal package was submitted as per the permit requirement.

Mayo Large Communal WRF, permit number 02-DP-2291, effective October 1, 2013 to September 30, 2018.

Patuxent WRF, permit number 02-DP-0132, effective August 1, 2008 to July 31, 2013. A renewal package was submitted as per the permit requirement.

The State's General Discharge Permit for Storm Water Associated with Industrial Activities, Permit 12-SW, became effective January 2014. County-owned facilities requiring general discharge permit coverage have submitted NOIs to MDE.

During this reporting period, Anne Arundel County's Bureau of Utilities developed and submitted the required compliance information for the WRFs and the Utility Operations Center facilities listed below.

Annapolis WRF, permit number 12-SW-0756: Notice of Intent submitted on May 20, 2014, coverage effective June 16, 2014 to December 31, 2018.

Broadneck WRF, permit number 12-SW-0758: Notice of Intent submitted on June 27, 2014, coverage effective July 30, 2014 to December 31, 2018.

Broadwater WRF, permit number 12-SW-0757: Notice of Intent submitted on June 18, 2014, coverage effective June 26, 2014 to December 31, 2018.

Cox Creek WRF, permit number 12-SW-0760: Notice of Intent submitted on June 30, 2014, coverage effective August 11, 2014 to December 31, 2018.

Maryland City WRF, permit number 12-SW-0761: Notice of Intent submitted on June 11, 2014, coverage effective July 14, 2014 to December 31, 2018

Patuxent WRF, permit number 12-SW-2459: Notice of Intent submitted on June 27, 2014, coverage effective August 6, 2014 to December 31, 2018

Anne Arundel County Utility Operations Center, permit number 12-SW-2345: Notice of Intent submitted on July 16, 2014, coverage effective September 8, 2014 to December 31, 2018.

SWPPPs, developed for each of the above facilities, were updated as required by the new permit and submitted with the Notice of Intent. In support of the NOI and in compliance with the SWPPP, WRF staff performs monthly inspections, quarterly dry weather inspections, quarterly wet weather inspections, annual

comprehensive site inspections, annual record review, and annual training. These records are maintained at each facility.

The State's General Discharge Permit 12-SW also applies to the three County-owned facilities managed by Waste Management Services (WMS) noted below. During this reporting period, facilities developed and submitted the required compliance documentation to MDE:

- Northern Recycling Center (formerly known as Glen Burnie Convenience Center) and closed Landfill,, permit number 12-SW-0298: Notice of Intent submitted on June 17, 2014, coverage effective August 15, 2014 to December 31, 2018.
- Millersville Sanitary Landfill and Resource Recovery Center, permit number 12-SW-1304: Notice of Intent to renew submitted on June 17, 2014, coverage effective August 15, 2014 to December 31, 2018; and
- Southern Recycling Center (formerly known as Sudley Convenience Center) and closed Landfill, permit number 12-SW-0297: Notice of Intent submitted June 17, 2014, coverage effective August 18, 2014 to December 31, 2018.

Documentation submitted to MDE included review of and updates to the SWPPPs for each facility. Annual Comprehensive SWPPP Compliance Evaluation Inspection Reports were completed for these facilities in November and December 2013. At these facilities the stormwater management facilities (SWMFs) are inspected routinely and all necessary repairs are undertaken immediately. WMS employs two technicians tasked with the maintenance of the SWMFs. No pesticides are used at these facilities; encroaching vegetation is removed entirely by mechanical means.

County-owned facilities operated by DPW, Bureau of Highways, that require NPDES storm water general discharge permit coverage are listed in Table 2. Each of these facilities maintains compliance documentation required by the new General Permit 12-SW, for submittal to MDE.

Table 2. Bureau of Highways Facilities

Facility	Permit Number	NOI and SWPPP Submission	Permit Coverage Period
Northern District Roads			
200 Dover Rd	12-SW-1176	June 30, 2014	Sept. 12, 2014 – Dec. 31, 2018
318 Mountain Rd	12-SW-1181	June 30, 2014	Aug. 21, 2014 – Dec. 31, 2018
Central District Roads			
1427 Duckens St	12-SW-1177	June 30, 2014	Aug. 21, 2014 – Dec. 31, 2018
1847 Crownsville Rd	12-SW-1179	June 30, 2014	Aug. 21, 2014 – Dec. 31, 2018
415 Broadneck Rd	12-SW-1182	June 30, 2014	Aug. 21, 2014 – Dec. 31, 2018
Southern District Roads			
350 West Central Ave	12-SW-2298	June 30, 2014	Aug. 21, 2014 – Dec. 31, 2018
6657 Old Solomons Island Rd	12-SW-1180	June 30, 2014	Aug. 21, 2014 – Dec. 31, 2018

Bureau of Highways Stormwater Pollution Prevention Plan Development and Implementation

During the period July 1, 2013, through June 30, 2014, the following items related to implementation of 02-SW were completed:

- Implemented each SWPPP, including:
  - Performed routine facility inspections of each facility, at least quarterly.
  - Completed annual outfall visual assessments of each facility, following a major storm.
  - Completed comprehensive annual inspections of each facility in June 2014.
  - Completed updates to each SWPPP in June 2014.
  - Completed an internal document review during comprehensive annual inspections of each facility.
  - Continuation of maintenance improvements to further prevent stormwater impacts, including:
    - Use of coir log wattles and/or straw bales at select locations.
    - Use of asphalt curbing to contain bulk road maintenance materials at select locations.
- Completed underground storage tank testing using Maryland Department of the Environment Certified UST Inspectors for:
  - Annual testing of spill buckets (catchment basins) at all facilities during 2014.
  - Five year tank tightness testing completed at all facilities during August 2013.

- Five year containment sump testing completed at select facilities during August 2013.

- Completed capital improvements to Salt Barn storage infrastructure at the following District Yards:

- Northern District, Dover Road, salt barn repairs, October 2013
- Central District, St. Margaret's Yard, salt barn repairs, November 2013
- Southern District, Davidsonville Yard, salt barn repairs, September 2013

b. The County shall continue to implement a program to reduce pollutants associated with maintenance activities at County-owned facilities including parks, roadways, and parking lots. The maintenance program shall include these or MDE-approved alternative activities:

i. Street sweeping;

Status:

Anne Arundel County's street sweeping program is intended to provide a continuous level of street cleanliness while keeping debris (including litter and floatables) and pollutants out of storm drains, our creeks, rivers and ultimately the Chesapeake Bay.

Anne Arundel County has historically operated a modest program that includes two (2) county-owned street sweepers. In June 2014, the County contracted for street sweeping services for which funding was appropriated via the Watershed Protection and Restoration Fund (WPRF). These services will initially augment the existing County street sweeping program. As the WPRF is phased in and increased funding is available, the program can be expanded to encompass additional curbed County roadways.

FY14 Sweeping Schedule

The County's neighborhood streets are relatively clean because of the work of conscientious residents who assist the County by keeping the areas in front of their homes free of litter and debris. Residential streets were not included in the program for routine street sweeping during this reporting period. Main thoroughfares, business districts and industrial areas were scheduled for street sweeping up to four times per year. Arterial, major collector and roads in business districts were targeted for routine sweeping. This allows the County to capture the most debris for each available hour of street sweeping effort.

The County swept 275 curb miles of streets from July 1, 2013 to June 30, 2014, which equates to 22.9 curb miles/month - a 23% decrease from the last

reporting period. Major equipment repairs and associated downtime on the County's two street sweepers constrained the sweeping effort during the reporting period.

To appropriately allocate the impervious area management credit and pollutant load reduction credit for these street sweeping activities, accomplishment data for the two time periods corresponding to the two applicable NPDES permit terms is provided:

- July 1, 2013 through January 31, 2014: The County swept 169 miles of streets during this period.
- February 1, 2014 through June 30, 2014: The County swept 106 miles of streets during this period.

ii. Inlet inspection and cleaning;

Status:

The County cleaned and removed debris from catch basins, inlets and outlets of pipes to maintain proper drainage for 15,804 structures during the July 1, 2013 to June 30, 2014 reporting period. This is an 11% decrease from the last reporting period in which 17,677 structures were cleaned.

In addition, the County inspects catch basins, manholes, and associated pipes/ditches to identify structures for cleaning with a sewer vacuum. A total of 1,165 structures were cleaned with a Vactor™ truck, a decrease of 36% from the last reporting period in which 1,824 were cleaned with a sewer vacuum.

To appropriately allocate the impervious area management credit and pollutant load reduction credit for these cleaning activities, accomplishment data for the two time periods corresponding to the two applicable NPDES permit terms is provided:

- July 1, 2013 through January 31, 2014: The County cleaned 10,753 structures during this period.
- February 1, 2014 through June 30, 2014: The County cleaned 6,213 structures during this period.

Ditch & Curbline Cleaning

During the reporting period, the County cleaned and removed debris from roadside inlet and outlet ditches and concrete swales; removed leaves from ditch lines and curbs using a leaf vacuum; and cleaned and reshaped roadside ditches by machine for a total of 126,350 feet during the reporting period.

This is a 26% decrease from the last reporting period in which the County cleaned 170,787 feet.

iii. Reducing the use of pesticides, herbicides, fertilizers, and other pollutants associated with vegetation management through increased use of integrated pest management;

Status:

Pesticides & Herbicides

Anne Arundel County makes a financial contribution annually to support Maryland Department of Agriculture (MDA) programs for Gypsy Moth control (http://mda.maryland.gov/plants-pests/Pages/gypsy_moth_program.aspx) and Mosquito control (http://mda.maryland.gov/plants-pests/pages/mosquito_control.aspx). Some of this work occurs along county-maintained roadways. No data regarding the quantity of pesticides applied along roadways is recorded by the Bureau of Highways.

Herbicide use associated with road maintenance performed by the Bureau of Highways is limited to the activities included in the performance standard for H0040, which covers the application of Glyphosate (e.g., Roundup ™) on County rights-of-way to control vegetative growth around guardrails, concrete structure, and prior to crack sealing operations in the traveled portion of the roadway. A total of 138 gallons of Glyphosate were used during the reporting period. This is a 1,625% increase over the previous reporting period in which eight gallons were applied.

Other than noted above, the Bureau of Highways recorded no other pesticide or fertilizer application. Please note, however, that other pesticides, herbicides, and fertilizers may be used along the County roadside rights-of-way as part of CIP projects, developer projects, projects by citizens, or contractors working on behalf of other agencies of County Government. Special care of median landscaping along certain County and State roads in Anne Arundel County is completed under the direction of the Department of Central Services Facilities Management Division. The Bureau of Highways does not record pesticide, herbicide, and fertilizer use that occurs outside of the Bureau of Highways.

Landfills and recycling centers managed by WMS do not use herbicides to control the unwanted woody vegetation and encroaching vegetation. Weeds and other problematic vegetation at these facilities is removed entirely by mechanical means.

The Facilities Maintenance Division (FMD) – Horticulture Department, under the Office of Central Services, has a Pesticide Public Agency Permit and also a

Public Agency Applicator Certificate. The application categories are 3-A (exterior ornamental care), 3-B (interior ornamental care), and 6 (right-of-way weed control). The applicator certificate is held by Rodney Gotts, who is required to attend a one day re-certification training class once a year, per the guidelines of MDA. This class includes Integrated Pest Management (IPM) and pesticide safety. This education and other education is used by Rodney to train his crew throughout the year with IPM. Each time there is chemical use, a pesticide report must be filled out and file, which reviewed during MDA's biennial inspection.

Integrated Pest Management (IPM)

The maintenance plan for all FMD properties and right-of ways include IPM. Key elements include:

- use of herbicides only when pulling or cutting weeds have not proven effective;
- use of insecticides only when natural methods have not proven effective;
- elimination of fertilizer use, proper use of hand weeding and mulching, and sparing use of herbicides in on roadway medians;
- limiting fertilizer use on FMD properties, and only using when grass needs nutrients to encourage proper growth that helps with the prevention of soil erosion and limits runoff;
- selecting disease- and insect-resistant plants for new plantings; and
- selecting the least toxic product available, using appropriate storage facilities and techniques, and compliance with all applicable laws and regulations.

During the reporting period, the Department of Recreation and Parks (R&P) began implementation an (IPM) program for County parks and athletic facilities. The IPM plan is required pursuant to County legislation that became effective July 1, 2013 and that modified Article 14 of the County Code by adding §14-1-105 (Integrated Pest Management Plan). The updated Article 14 of the County Code can be found online at: www.aacounty.org/CountyCode/index.cfm. Pursuant to this legislative requirement, the public is provided prior notification of pesticide application at R&P public facilities.

Documentation for the program is available in **Appendix H**. Program objectives are to:

- minimize the amount and toxicity of pesticides used in the park facilities;

- eliminate unnecessary pesticide applications;
- provide IPM education to the public, park users and park staff;
- improve landscape and grounds cleanliness;
- utilize only Licensed, Certified and Registered Technician pesticide applicators;
- reduce or eliminate exposure of children, vulnerable adults, nursing mothers with infants and pets to pesticide applications; and
- provide universal public and staff notification.

iv. Reducing the use of winter weather deicing materials through research, continual testing and improvement of materials, equipment calibration, employee training, and effective decision-making; and

Status:

Snow and Ice Control

The amounts of de-icing chemicals used by the County Bureau of Highways from July 1, 2013 to June 30, 2014 are found in Table 3. De-icing chemical data for the 2011-2012 and 2012-2013 reporting period are provided as a comparison. The quantity of deicing chemicals used each year is highly variable because it is based on actual winter weather conditions including precipitation type, and factors such as road surface temperature.

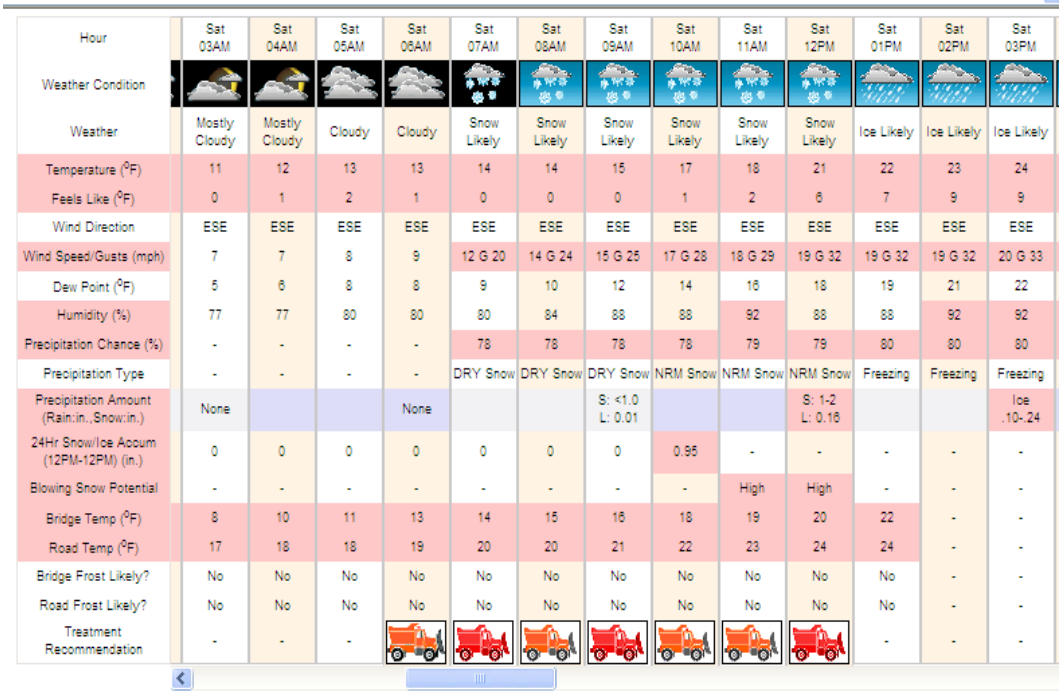
Table 3. Deicing Material Applied

Material	2011-2012	2012- 2013	2013 – 2014
Salt	1,689 tons	6,378 tons	50,996
Sand/ Salt mix	0 tons	0 tons	0
Liquid Calcium Chloride	0 gallons	355 gallons	13,355(a)
NWS1 Snow Totals (BWI)	1.8 inches	8.0 inches	39 inches (b)

(a) Average winter temperature at BWI Thurgood Marshall Airport is 35.1 degrees according to the National Weather Service (NWS). Winter 2013-2014 average temperature was 33.3. Calcium Chloride depresses the freezing-point and is used more extensively during colder periods to prevent ice formation and to deice road surfaces.
(b) Average annual snowfall total at BWI Thurgood Marshall Airport is 20.1 inches according to the National Weather Service (NWS). Winter 2013-2014 snowfall totals were 39 inches, 94% higher than average.

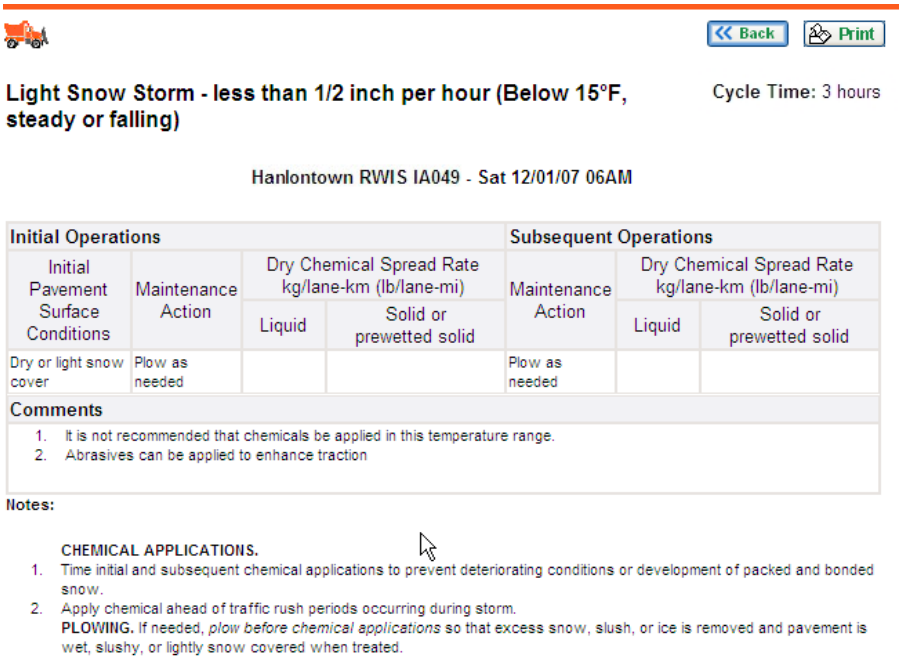
In 2013-2014, the Bureau continued its use of a maintenance decision support system (MDSS) which uses real-time data from our Road Weather Information System (RWIS). The RWIS system is a series of pavement and bridge deck sensors and other instruments installed along certain County-owned bridges and roadways. The integration of RWIS data into a MDSS allows the

management team to select the most appropriate winter treatment for actual weather conditions in each area of the County during a winter storm event. Studies have shown use of an MDSS can help reduce the use of deicing chemicals. Screen shots from the MDSS (Figure 2 and Figure 3) are from the County's subscription weather service, MxVision WeatherSentry Online at http://weather.dtn.com/dtnweather/. Annual training on proper snow plowing techniques is also offered. It includes information on the application of deicing products and proper application rates.



Hour	Sat 03AM	Sat 04AM	Sat 05AM	Sat 06AM	Sat 07AM	Sat 08AM	Sat 09AM	Sat 10AM	Sat 11AM	Sat 12PM	Sat 01PM	Sat 02PM	Sat 03PM
Weather Condition													
Weather	Mostly Cloudy	Mostly Cloudy	Cloudy	Cloudy	Snow Likely	Snow Likely	Snow Likely	Snow Likely	Snow Likely	Snow Likely	Ice Likely	Ice Likely	Ice Likely
Temperature (°F)	11	12	13	13	14	14	15	17	18	21	22	23	24
Feels Like (°F)	0	1	2	1	0	0	0	1	2	6	7	9	9
Wind Direction	ESE	ESE	ESE	ESE	ESE	ESE	ESE	ESE	ESE	ESE	ESE	ESE	ESE
Wind Speed/Gusts (mph)	7	7	8	9	12 G 20	14 G 24	15 G 25	17 G 28	18 G 29	19 G 32	19 G 32	19 G 32	20 G 33
Dew Point (°F)	5	6	8	8	9	10	12	14	16	18	19	21	22
Humidity (%)	77	77	80	80	80	84	88	88	92	88	88	92	92
Precipitation Chance (%)	-	-	-	-	78	78	78	78	79	79	80	80	80
Precipitation Type	-	-	-	-	DRY Snow	DRY Snow	DRY Snow	NRM Snow	NRM Snow	NRM Snow	Freezing	Freezing	Freezing
Precipitation Amount (Rain:in.,Snow:in.)	None			None			S: <1.0 L: 0.01			S: 1-2 L: 0.16			Ice .10-.24
24Hr Snow/Ice Accum (12PM-12PM) (in.)	0	0	0	0	0	0	0	0.95	-	-	-	-	-
Blowing Snow Potential	-	-	-	-	-	-	-	-	High	High	-	-	-
Bridge Temp (°F)	8	10	11	13	14	15	16	18	19	20	22	-	-
Road Temp (°F)	17	18	18	19	20	20	21	22	23	24	24	-	-
Bridge Frost Likely?	No	No	No	No	No	No	No	No	No	No	No	-	-
Road Frost Likely?	No	No	No	No	No	No	No	No	No	No	No	-	-
Treatment Recommendation	-	-	-								-	-	-

Figure 2. MDSS Hourly Weather Forecast With Treatment Recommendations



Back Print

Light Snow Storm - less than 1/2 inch per hour (Below 15°F, steady or falling) Cycle Time: 3 hours

Hanlontown RWIS IA049 - Sat 12/01/07 06AM

Initial Operations				Subsequent Operations		
Initial Pavement Surface Conditions	Maintenance Action	Dry Chemical Spread Rate kg/lane-km (lb/lane-mi)		Maintenance Action	Dry Chemical Spread Rate kg/lane-km (lb/lane-mi)	
		Liquid	Solid or prewetted solid		Liquid	Solid or prewetted solid
Dry or light snow cover	Plow as needed			Plow as needed		

Comments

1. It is not recommended that chemicals be applied in this temperature range.
2. Abrasives can be applied to enhance traction

Notes:

CHEMICAL APPLICATIONS.

1. Time initial and subsequent chemical applications to prevent deteriorating conditions or development of packed and bonded snow.
2. Apply chemical ahead of traffic rush periods occurring during storm.

PLOWING. If needed, *plow before chemical applications* so that excess snow, slush, or ice is removed and pavement is wet, slushy, or lightly snow covered when treated.

Figure 3. MDSS Treatment Recommendation

Activities at WMS facilities also require the use of salt de-icing. The salt usage at each facility is as follows:

- Millersville Landfill and Resource Recovery Facility – 15 tons
- Northern Recycling Center – 7.5 tons
- Central Recycling Center – 6.25 tons
- Southern Recycling Center – 5 tons

v. Ensuring that all County staff receive adequate training in pollution prevention and good housekeeping practices.

Status:

The three County-owned facilities managed by WMS that fall under the State's General Discharge Permit 12-SW (Northern Recycling Center, Millersville Sanitary Landfill and Resource Recovery Center, and Southern Recycling Center) have approved SWPPPs. WMS held trainings at each of the facilities in December 2013 on the following topics: Hazardous Waste Operations (Response); Good Housekeeping and Spill Prevention; Preventative Maintenance for Sediment and Erosion Control; Runoff Control; and other SWPPP-related topics. Documentation regarding these facilities is included in **Appendix E**.

BOH also held staff training sessions that have been administered to Road District personnel during the reporting period to support SWPPP implementation, as summarized in Table 4.

Table 4. SWPPP Training Summary for Bureau of Highways Facilities

Training Number	Training Location	Training Date	Training Session Topic
14985932	1312SD	05/19/2014	TRAINING SESSION #2: WHAT IS A SWPPP?
14985924	1310NM	05/19/2014	TRAINING SESSION #1:WHEN IT RAINS IT DRAINS
14985931	1311CS	05/19/2014	TRAINING TOPIC: EROSION CONTROL
14985929	1311CO	05/19/2014	TRAINING SESSION #1: WHEN IT RAINS IT DRAINS
14985928	1311CC	05/19/2014	TRAINING SESSION #4: OUR STORMWATER POLLUTION PREVENTION PLAN PART II
14972448	1311CS	03/05/2014	TRAINING TOPIC: SPILLS & CLEAN UP
14972447	1311CO	03/05/2014	TRAINING SESSION #5: SECONDARY CONTAINMENT
14972446	1311CC	03/05/2014	TRAINING SESSION #3: OUR STORMWATER POLLUTION PREVENTION PLAN PART I
13960464	1312SD	12/16/2013	TRAINING SESSION #1: WHEN IT RAINS IT DRAINS
13960460	1310NM	12/16/2013	TRAINING SESSION #1: "WHEN IT RAINS IT DRAINS"
13960463	1311CS	12/16/2013	TRAINING SESSION #5: SECONDARY CONTAINMENT
13960462	1311CO	12/16/2013	TRAINING SESSION #6: POLLUTION PREVENTION TEAM
13960461	1311CC	12/16/2013	TRAINING SESSION #6: POLLUTION PREVENTION TEAM
13951319	1310NM	10/07/2013	TRAINING TOPIC: MULCHING BMP-15
13951318	1310ND	10/07/2013	TRAINING TOPIC: MULCHING FOR EROSION CONTROL.
13951324	1311CS	10/07/2013	TRAINING SESSION #1: "WHEN IT RAIN IT DRAINS"
13951322	1311CO	10/07/2013	TRAINING SESSION #2: WHAT IS A SWPPP?
13951321	1311CC	10/07/2013	TRAINING SESSION #5: SECONDARY CONTAINMENT
13948608	1310ND	09/19/2013	TRAINING SESSION #1: WHEN IT RAINS IT DRAINS
13947291	1310NM	09/10/2013	TRAINING TOPIC: BMP-10 SPILL PREVENTION /CONTROL
13941546	1312SD	08/06/2013	TRAINING TOPIC: INSPECTION – FACILITY/OUTFALL/STORAGE TANKS
13941540	1310ND	08/06/2013	TRAINING SESSION #1: WHEN IT RAINS IT DRAINS

6. Public Education

Anne Arundel County shall continue to implement a public education and outreach program to reduce stormwater pollutants. Outreach efforts may be integrated with other aspects of the County's activities. These efforts are to be documented and summarized in each annual report. The County shall continue to implement a public outreach and education campaign with specific performance goals and deadlines to:

a. Maintain a compliance hotline or similar mechanism for public reporting of water quality complaints, including suspected illicit discharges, illegal dumping, and spills.

Status:

I&P maintains a 24-hour Environmental Hotline for citizens to report environmentally-related complaints including spills and illegal dumping into the County storm drain system. The Hotline has been in existence since 1988 and has been advertised in numerous ways, including the County webpage (www.aacounty.org/IP/EnvironmentalPrograms/index.cfm). For the reporting period a total of 641 environmentally-related complaints were received and investigated by the Department. The complaints received typically involve potential Critical Area violations, sediment control issues, or illegal grading activities. All complaints including their compliance status, inspection results, enforcement and completion dates are viewable on the Inspections & Permits Compliance Case Database which is available for viewing on the above referenced web page.

b. Provide information to inform the general public about the benefits of:

i. Increasing water conservation;
ii. Residential and community stormwater management implementation and facility maintenance;
iii. Proper erosion and sediment control practices;
iv. Increasing proper disposal of household hazardous waste;
v. Improving lawn care and landscape management (e.g., the proper use of herbicides, pesticides, and fertilizers, ice control and snow removal, cash for clippers, etc.);
vi. Residential car care and washing; and
vii. Proper pet waste management.

Status:

The County continues to provide residents with information necessary to make informed decisions regarding water quality issues and environmental stewardship. Several County departments have public outreach programs tailored to their specific discipline. Examples of some of the outreach activities are described below.

Via the County website, Anne Arundel County DPW provides water quality-related information associated with County-provided services (www.aacounty.org/DPW/index.cfm). Information, presentations, brochures and fliers available through this website address such issues as:

- Annual Drinking Water Quality Report,

- Rehabilitation and maintenance of County sewer infrastructure,
- Information on recent wastewater spills,
- Fix a Leak Week,
- Preventing Sewer Backups,
- It Takes Teamwork to Protect the Bay,
- West County Groundwater Quality,
- Homeowner's Guide to Septic Tanks, and
- Homeowner's Guide to Grinder Pumps.

The DPW Bureau of Utilities webpage includes a link to a Kids Page. This page uses brightly colored pictures and interactive games to teach the importance of water as a valuable resource and to instill water saving habits at a young age. The page also includes a description of the Water Cycle (www.aacounty.org/DPW/Kids/watercycle.cfm) and information on the County's Jr. Smart Water Saver Program (www.aacounty.org/DPW/Kids/util03.cfm). The Jr. Smart Water Saver Program teaches elementary-aged children about the importance of water and water conservation through games and coloring activities

The DPW Bureau of Highways developed a website and authored material to act as a Resident's Guide to Rain Gardens in Anne Arundel County. The materials, available at www.aacounty.org/DPW/Highways/RainGarden.cfm, explain relevant County requirements, and outline opportunities for homeowners to use rain gardens to provide flood control, groundwater recharge, and water-cooling benefits, while removing many types of pollutants and other contaminants from stormwater runoff.

Additionally, and in response to residents sweeping leaves into storm drain facilities, the Bureau of Highways authored and published a Leaf Brochure, available at www.aacounty.org/dpw/highways/LeafRemoval.cfm#.U2mgp1cVCIo. It explains relevant County services, and suggested opportunities for homeowners to manage leaves most responsibly.

Relating to sediment and erosion control practices, the I&P website contains general information available to the public regarding this topic including buffer management, grading and permits, the Chesapeake Bay Critical Area, invasive species, and sensitive areas. This information can be found at www.aacounty.org/IP/FAQs/Environment.cfm. Additionally, I&P staff outreach to the public on sediment and erosion control practices through the conduct of "Responsible Personnel Certification" classes. Commonly known as "Green Card Training", these classes serve to education not only the construction contractors operating in the County but are also made available to representatives of local watershed groups and citizens interested in learning more on this topic.

Outreach pertinent to household hazardous waste disposal has been reported in prior annual reports. The DPW, Waste Management Services Division (DPW WMS) manages an extensive outreach campaign geared toward residential recycling. Additionally, the County advertised and conducted six Household Hazardous Waste drop-off days, holding two events at each of the County Landfills and Convenience Centers during this reporting period. These events successfully kept 139 tons of hazardous waste out of landfills. Additional information is available on the County's website at: http://www.aacounty.org/dpw/wastemanagement/householdwaste.cfm.

Literature outlining alternatives to hazardous household chemicals, and safe disposal of such chemicals, is provided to the public through many different venues. DPW WMS also provides information such as what can be recycled; ways to get recycling and composting bins; dealing with yard waste and grasscycling; amounts recycled in different areas of the County; local events that promote recycling; and question and answer forums at outreach events, in County offices, through the County website (http://www.aacounty.org/DPW/WasteManagement/index.cfm), on the "Recycle. More. Often." website (www.recyclemoreoften.com) and on the Anne Arundel County Recycling Division Facebook page (www.facebook.com/annearundelrecycling). Since the recycling programs inception in 2008, the Countywide recycling rate has increased from 31% to 44%.

The County demonstrates their own commitment to lawn care and landscape management by instituting IPM programs. Programs such as those put in place by Facilities Maintenance Department and the Department of Recreation and Parks model best practices for citizens.

The County uses social media (e.g., WPRP Facebook and Twitter accounts) to remind residents about bay-friendly de-icing practices. These reminders occur more prominently when snow events are eminent. Additional information on Bay Friendly deicing practices will be incorporated into the WPRP web page (www.aarivers.org) in FY15 as that webpage develops. The County's webpage, www.aacounty.org/dpw/highways/snowremoval.cfm, also explains our roadway winter de-icing strategy and provides resources to help shape customer expectations. An example excerpt is included below:

> *"Winter operations activities related to snow and ice control include plowing snow from the roadway and shoulders, and responsibly applying deicing chemicals to arterial and collector roads and isolated icy spots to facilitate snow plowing.*

Anne Arundel County uses covered storage facilities for its road salt and stores a total of approximately 11,650 tons of salt at the following locations: Dover Road (Glen Burnie), Mountain Road (Pasadena), Crownsville Road (Annapolis), Broadneck Road (St. Margarets), Duckins Street (Odenton), West Central Avenue (Davidsonville), and at a storage yard in Friendship, MD. At the present time, a small portion of Anne Arundel County's fleet is equipped with liquid calcium chloride pre-wetting equipment. Pre-wetting dry salt during its application helps the salt to adhere to the roadway. In contrast, dry salt can "bounce" and blow off the roadway and be less effective.

Deicing materials are an effective tool for maintaining safe winter road conditions. However, Anne Arundel County is aware that excessive use can have negative impacts on the environment. We strive to only apply as much salt as necessary to achieve safe driving conditions. So, what are some of the environmental concerns associated with road salts? Heavy use of road salts has been assessed to cause damage to vegetation, organisms in soil, birds and to other wildlife. Chloride ions from road salts find their way eventually into waterways, whether by direct runoff into surface water or by moving through the soil and groundwater. In surface water, road salts can harm freshwater plants, fish and other organisms that are not adapted to living in saline waters.

In winter months, as soon as snow begins to accumulate, equipment is dispatched to service arterial and collector roadways. Our next priority will be insuring each community road is passable. Passable means that although the road may be snow-covered or snow-packed, at least one travel lane will be accessible with a front-wheel drive car. All-weather tires are a must. If our snowplow driver determines that your street meets our definition of passable, no further service will be provided."

Residential car care and residential car washing can readily contribute pollutants to the stormdrain system as can improper boat cleaning and maintenance actions. Information on proper maintenance and cleaning of these vehicles is provided on both the County WPRP web page (www.aarivers.org) and through the County's Watershed Stewards Academy (WSA). In addition to outreach by individual stewards, information on proper car and boat repair is found on the WSA webpage: www.aawsa.org/solutions/reduce-personal-pollution/maintain-your-car-and-boat.html. This webpage also include links to Maryland's Clean Marina Initiative and Eco-Friendly Car Washing, among others.

The Public Safety article of the Anne Arundel County Code includes regulations governing animal control. §12-4-909 is specific to the removal of animal excreta and requires that "*A person shall remove excreta deposited by*

an animal owned by that person on public walks, recreation areas, or private property other than the owner's." DPW WMS maintains a webpage that advises residents on the proper disposal methods for a variety of problematic household waste products, including pet waste (www.aacounty.org/DPW/WasteManagement/problemProducts.cfm). Additionally, education regarding pet waste management is included on the "Think Bay" section of the WPRP webpage (www.aarivers.org) as well as the WSA webpage www.aawsa.org/solutions/reduce-personal-pollution/scoop-your-pet-waste.html. These webpages include links to information regarding pet waste removal stations as well as local services that will clean up pet waste. The WSA page includes an interactive map of pet waste stations in the County such that residents and visitors can locate such stations for use when exercising their pets.

During this reporting year Anne Arundel County DPW, the County Board of Education's Arlington Echo Outdoor Education Center, The Keith Campbell Foundation, the Chesapeake Bay Trust and National Fish and Wildlife Foundation continued to provide leadership and funding to the Watershed Stewards Academy (WSA), which was established in 2008 as an organized framework to educate community leaders to become "Master Watershed Stewards". During this reporting period, WSA completed certification of the 23 Master Watershed Stewards, including the completion of capstone projects. Capstone projects include a comprehensive community assessment; outreach and education to the community on how to reduce pollution sources and employ rainscaping to reduce runoff; and either one in the ground rainscaping project per person or one behavior change program per group. During the reporting period, the WSA initiated a two track certification system in which deeper training was offered in either rainscaping projects or community based social marketing. Community based social marketing projects involve a social science framework to effect pollutant reducing behavior change. The rainscaping projects range from water harvesting to rain gardens and bioswales.

During this reporting period, WSA also recruited and trained an additional 28 Master Watershed Steward Candidates, who began work on their capstone projects. Once certified, Master Watershed Stewards complete about 40 hours per year in volunteer community watershed restoration, eight continuing education classes and three networking sessions annually. All certification and continuing education courses were instructed by stormwater professionals or Master Watershed Stewards and consisted of 58 volunteer instructors logging over 116 hours of volunteer time spent on instruction.

The effort to replicate WSA has continued with a new WSA holding its first certification course in Cecil County. Efforts continued to support the Howard

County WSA, including the certification training of their leader, Terry Matthews.

The WSA continued to support and engage Certified Master Watershed Stewards through the following activities:

- Conducted three networking meetings designed to allow Stewards to share their successes and learn new techniques for engaging communities.
- Offered eight continuing education classes for Certified Stewards.
- Held the third annual "Spring into Action" conference to a sellout crowd of 120 Stewards and Consortium members. This day-long conference offered additional training and networking opportunities to foster collaboration and action.
- Coordinated the use of training and outreach materials.
- Coordinated plant orders to give Stewards wholesale rates for additional rainscaping projects in their communities.
- Connected interested communities with their closest Master Watershed Steward for consultation and presentations.
- Coordinated the Backyard Buffer program, in collaboration with Maryland Department of Natural Resources (MD DNR), in which 2,400 tree seedlings were planted in areas adjacent to stormwater flow. An educational workshop for participants was held to instruct homeowners on how to plan, install and care for trees.
- Created a comprehensive Behavior Change Handbook to guide the development and piloting of pollution reducing behavior change campaigns.
- *Leaves are a Pain in the Drain* – WSA created and piloted a leaf pick up behavior change campaign focusing on communities in Ward 1 of the City of Annapolis, and in Severna Park, to voluntarily pick up their leaves from impervious areas adjacent to their property. Focus groups and survey work informed the development of door hangers, commitment tools, and magnetic prompts.

As a group, Certified Steward and Steward Candidates gave 3,693 volunteer hours toward engaging their communities in stormwater education and restoration. Stewards engaged 780 community volunteers who gave 3,424 volunteer hours to install and maintain stormwater BMPs. They reached over 5,000 people in one-on-one outreach and education on stormwater topics. Stewards and their communities installed 55 rain barrels and 9 cisterns that captured over 5,000 gallons of water during each major rain event; planted

over 14,000 native trees and plants; created 317,887 square feet of stormwater restoration; and removed almost 30,000 square feet of invasive plants. Stewards recruited over $978,185 in grant matching funds and led their communities to donate almost $70,000 in private funds. Additionally, in-kind services valued at over $76,000 were donated to Steward projects.

The Watershed Stewards Academy piloted the "Clean Water Communities" neighborhood certification program in the Hillsmere community. This pilot program installed 9 cisterns, 7 conservation landscapes, and 2 rain gardens across 10 properties to prevent over 200,000 gallons of polluted runoff from entering Duvall Creek, a tributary of the South River. This program implementation represents over a 20% runoff reduction across 10 parcels in this community.

As noted in prior Annual Reports and in earlier sections of this report, the WSA developed and refined training and resources for stewards to employ community-based social marketing to effect pollutant reducing behavior changes such as pet waste disposal, removal of leaves from impervious surfaces, and reduction in fertilizer use. Using face-to-face surveys, Stewards are taught to measure a baseline of behavior and measure a behavior change. They are also supported with template tools and sample behavior change campaigns for use in their own community.

The WSA facilitated the networking of Anne Arundel County restoration resources via involvement of watershed organizations, the WSA Consortium of Support Professionals, County restoration projects, and private communities to avoid duplication and further common goals. Together with several members of the Consortium of Support Professionals, the WSA has offered several stormwater tours to engage constituents in stormwater issues and provide professional level instruction on rainscaping techniques.

The WSA board of directors continues to provide fundraising and strategic direction for the organization. In April 2014, the WSA Board finalized its 5 year strategic plan, affirming the strong partnership between Anne Arundel County government and the non-profit WSA.

To evaluate program success, Stewards continue to use the data input form at www.aacounty.org/DPW/Watershed/Restoration/RestorationActivity.cfm to track restoration projects installed by Master Watershed Stewards or their communities via a GIS application. These efforts are displayed graphically on the County's WPRP GIS Mapping Application (http://www.aacounty.org/OIT/GIS/MyAnneArundel.cfm). The WPRP Modeling & Analysis team is able to connect a pollutant load reduction for most BMPs and graphically summarize the extent of education efforts in the County.

In an effort to increase stormwater pollution awareness throughout Anne Arundel County, the WPRP has developed a compressive web-based informational program. A major component of this initiative was the development of the WPRP's webpage (www.aarivers.org) to provide residents with an overview of the WPRP program and stormwater fee, environmental restoration plans, watershed assessments and information about stormwater pollution in general. The webpage also provides links to other County departments such as Utilities for water conservation tips and Inspections and Permits for stormwater management and Chesapeake Bay Critical Area information.

Since the development of the WPRP webpage, several enhancements have been integrated. Residents are provided with educational resources to reduce stormwater pollution from their property. Residents learn how their everyday actions can have an impact on our local waterways and provide recommendations on how they can minimize these impacts. The following topics are addressed:

- Rain barrel benefits and installation
- Rain garden benefits and installation
- Permeable pavement and paver benefits and installation
- Bay-friendly car maintenance tips
- Household Hazardous Waste disposal tips
- Fertilizer and pesticide application tips
- Recycling, litter reduction and source reduction tips
- Pet waste management tips
- Onsite septic tank maintenance tips
- Green boating tips

In the coming months, several additional enhancements are planned for the webpage. The goal is to provide residents with the most up to date information regarding the WPRP in the most convenient way.

In addition to the WPRP webpage, several social media outlets including Facebook (https://www.facebook.com/aawprp) and Twitter (https://twitter.com/AAWPRP), were also introduced to help educate residents about water quality issues and to provide an avenue for timely updates of restoration projects, educational materials, links to local watershed groups and newspaper articles. These social media sites are updated on a daily basis and provide residents with an outlet to discuss local stormwater issues and allow the WPRP to continually educate residents about the program.

The Arlington Echo Outdoor Education Center is operated by the Office of Environmental Literacy and Outdoor Education Program of Anne Arundel

County Public Schools. Arlington Echo Outdoor Education Center offers Anne Arundel County students year-round opportunities to experience the natural environment. The Outdoor Education programs at Arlington Echo use environmental and outdoor learning to enhance, extend and enrich classroom curriculum. Arlington Echo mainly hosts fourth grade elementary students on day and overnight trips, but also hosts middle, and high school groups.

While developing a positive environmental ethic and sense of stewardship, students learn the meaning of respecting each other as well as respecting the environment. By the end of their residential experience, students are given the tools necessary to become Chesapeake Stewards, and have gained the knowledge to protect and preserve the Chesapeake Bay and its watershed at home, school, and on their own.

Chesapeake Connections is the Outdoor Education outreach program of Arlington Echo which connects classroom instruction with a series of relevant hands-on experiences that lead to environmental stewardship. The staff at Arlington Echo Outdoor Education Center provides support and expertise to complete yearlong environmental service-learning projects as part of Chesapeake Connections with many Anne Arundel middle and elementary schools. The service-learning projects are infused into each school's curricula and involve using community areas or school grounds for environmental restoration activities. The program works to restore and/or create bogs, gardens, and runoff areas on school grounds or in the community. These projects meet growing environmental needs in our area and help protect the Chesapeake Bay.

The WPRP has partnered with the Chesapeake Connections program to provide hands-on experiences for Anne Arundel County students through the planting of native trees and other vegetation at several restoration projects. Below is a listing of those opportunities that occurred during the reporting period:

- Ruppert's Ravine – September 2013 - 310 6th grade students from Marley Middle School
- Gray's Luck – October 2013 - 200 6th grade students from Corkran Middle School
- Windsor Ridge – November 2013 - 300 6th grade students from George Fox Middle School
- Fair Oaks II – November 2013 - 60 students (6th-8th grade) from Meade Middle School
- Forest Drive Outfall – June 2014 - 90 6th grade students from Annapolis Middle School

The WPRP strives to keep residents apprised of current accomplishments of the program. One of the most effective ways to communicate those milestones is through the local media. Below are select articles about the WPRP that were published during the reporting period:

- *"Stormwater funding could improve ailing Magothy River"* – February 24, 2014- Capital Gazette, http://bit.ly/1ydXYM7
- *"Longtime Crofton resident: Beaver Creek restoration 'in everybody's interest'"* – April 15, 2014 – Capital Gazette, http://bit.ly/1ye3JcQ
- *"Anne Arundel to pull up miles of concrete channels"* – April 16, 2014 – Capital Gazette, http://bit.ly/1ydYUjQ
- *"Two stormwater projects completed in Annapolis"* – June 12, 2104 – Capital Gazette, http://bit.ly/1ydXaqD

The following is a list of informational presentations and events in which the WPRP participated during the reporting period:

- August 16, 2013 – Severna Park Chamber of Commerce
- September 17, 2013 -- Brooklyn Park Town Hall Meeting
- January 12, 2014 – Severn River Commission
- February 20, 2014 – State of the Magothy
- February 21, 2014 – Anne Arundel County Planning Advisory Board
- March 10, 2014 – Anne Arundel County Watershed Stewards Academy
- March 12, 2014 – Linthicum Heights Improvement Association
- March 15, 2014 – Davidsonville Green Expo
- March 24, 2014 – Turnbull Estates HOA
- April 11, 2014 – Anne Arundel County Council Work Session
- April 15, 2014 – New Opportunities in Construction – County Event
- May 20, 2014 – Harwood Civic Association
- May 27, 2014 – Chesapeake Environmental Protection Association
- June 4, 2014 – Greater Pasadena Council
- June 5, 2014 – Severn River Association
- June 5, 2014 – Baltimore Port Alliance

The Anne Arundel County Department of Health publishes fact sheet series entitled "Health Matters" (see examples in **Appendix F**). These fact sheets are distributed at events run by the Department of Health and can also be found on their website (www.aahealth.org). Some of the subjects covered include:

- Water Quality and Swimming or Fishing In Anne Arundel County Rivers and Creeks;
- On-site sewage disposal systems and private water wells;

- Bay Restoration Fund (BRF) Program, for nitrogen-reducing pretreatment units for septic systems to be installed within the Chesapeake Bay Critical Area;
- Collapsed Septic Tanks, Overflowing Septic Systems and Failing Septic Systems Interim Health and Safety Requirements; and
- Application Procedures for Property Improvements Where Well or On-Site Septic Systems are Utilized.

The Anne Arundel County Department of Health continues to publicize a hotline (410-222-7999) on the Department of Health's website (www.aahealth.org), Health Matters fact sheets, and other literature. This hotline alerts the public to current advisories and closures of recreational water as the result of sewage spills and bacterial exceedances from the 106 bathing beaches that the department monitors from Memorial Day through Labor Day. The Department also promotes an e-alert system so an individual can be notified by e-mail when the Department has an advisory or closure of recreational waters. Individuals can sign up for the e-alert system on the Department of Health's website.

The Department of Health, in conjunction with MDE and the Maryland Department of Health and Mental Hygiene, promotes the Maryland Healthy Beaches campaign. The campaign makes people aware of everyone's impact to the waterways in the State of Maryland. One of the campaigns major focus is the importance of picking up pet waste. In 2013, the Department of Health created a 'Beach Swimming Guide' on its website to keep the public abreast of recreational water quality in the County.

The Department of Health also publicizes information about on-site sewage disposal systems and private water wells. The Department also provides a DVD on the maintenance and care of an on-site sewage disposal system to each individual homeowner at the time of installation for each newly installed system. The DVD's are also available to view on the department's web-site.

The Department of Health sponsored a Septic System and Bay Restoration Fund Expo at several public schools throughout the County this past March and promotes locally the Bay Restoration Program. This program is a grant that plans to use grant funds to help qualified applicants connect to existing public sewer and continues to pay for nitrogen reducing pretreatment units that must be installed in conjunction with an onsite sewage disposal system that is in the Chesapeake Bay Critical Area. The grant funds the entire cost off the treatment unit and a five-year service and maintenance program for repairs of failing systems in the Critical Area. The Department of Health administers this grant, awarded by MDE and funds about 250 nitrogen reducing pretreatment units annually. These treatment units reduce the nitrogen load

from an on-site sewage disposal system by at least 50 percent. This is a direct reduction to the nitrogen load that is reaching the Chesapeake Bay.

There are many other environmental health information topics located on the Department's website, under Environmental Health, including:

- The Bay Restoration Fund,
- Environmental Assistance Programs,
- Environmental Health Fees,
- Recreational water quality, and
- Well and Septic Systems.

c. Provide information regarding the following water quality issues to the regulated community when requested:

i. NPDES Permitting requirements;
ii. Pollution prevention plan development;
iii. Proper housekeeping; and
iv. Spill prevention and response.

Status:

The County provides training for staff working at County facilities with stormwater discharge permits as discussed in **Part IV.D.5.b.** BOH has developed a comprehensive training document consisting of a series of six modules intended to educate staff on pollutant sources, the importance of storm water pollution prevention, what components constitute a storm water pollution prevention plan, implementation of a storm water pollution prevention plan, secondary containment concepts, and an effective pollution prevention team. These modules are presented bi-monthly on an annual, rotating basis.

Managers at each of the County-owned facilities requiring coverage under NPDES general discharge permit have updated their SWPPPs following the issuance of the new General Permit by MDE in January 2014. Training is performed yearly, which is critical to ensure staff are fully knowledgeable of the potential pollutant sources at each facility, how to properly store and handle these sources, and the procedures for responding to a spill or emergency. Refresher trainings are provided when necessary.

In demonstration of compliance, the SWPPP Evaluation Reports for the four Waste Management Services facilities are included digitally in **Appendix E**, including training outlines for each. Pollution prevention plans and spill prevention, control, and countermeasure plans are kept at these facilities and updated regularly.

Lastly, following the January 2014 issuance of the new General Permit 12-SW, the County coordinated with several private businesses regarding implementation of Permit 12-SW requirements and provision of information for completion of SWPPPs.

E. Restoration Plans and Total Maximum Daily Loads

Anne Arundel County shall annually provide watershed assessments, restoration plans, opportunities for public participation, and TMDL compliance status to MDE. A systematic assessment shall be conducted and a detailed restoration plan developed for all watersheds within Anne Arundel County. As required below, watershed assessments and restoration plans shall include a thorough water quality analysis, identification of water quality improvement opportunities, and a schedule for BMP and programmatic implementation to meet stormwater WLAs included in EPA approved TMDLs.

1. Watershed Assessments

a. By the end of the permit term, Anne Arundel County shall complete detailed watershed assessments for the entire County. Watershed assessments conducted during previous permit cycles may be used to comply with this requirement provided the assessments include all of the items listed in PART IV.E.1.b below. Assessments shall be performed at an appropriate watershed scale (e.g., Maryland's hierarchical eight or twelve-digit sub-basins) and be based on MDE's TMDL analysis or an equivalent and comparable County water quality analysis;

b. Watershed assessments by the County shall;

- ***i. Determine current water quality conditions;***
- ***ii. Include the results of a visual watershed inspection;***
- ***iii. Identify and rank water quality problems;***
- ***iv. Prioritize all structural and nonstructural water quality improvement projects; and***
- ***v. Specify pollutant load reduction benchmarks and deadlines that demonstrate progress toward meeting all applicable stormwater WLAs.***

Status:

Anne Arundel County developed a TMDL Support group within the Watershed Protection and Restoration Program (WPRP) to comply with the conditions outlined in the NPDES MS4 permit. One component of the program is to perform watershed assessments, as stipulated by the permit requirements (**Part E.1.b**), for each of the County's 12 watersheds. The watershed studies involve a partnership

between the County, various consultants, and citizen stakeholders. The field data collection is performed primarily by consultants specifically for each watershed study effort. All modeling, analysis, and reporting are performed in-house by County staff. Once the data are collected and analyzed for a watershed, the TMDL support staff collaborates with the consultants and other citizen stakeholders in a series of professional management team meetings to thoroughly review the information and reach consensus pertaining to assumptions and data interpretations. Once consensus is reached, the County publishes the study, including recommended restoration/preservation actions and desired implementation strategies. Additionally, environmental concerns and recommendations are portrayed in GIS files published on the County website on the interactive WERS mapping application found at the following website address:
http://gis-world2.aacounty.org/silverlightviewer/?Viewer=WERS.

Recommendations developed during watershed studies are used to advise and prioritize land use decisions and Capital Improvement Program expenditures relating to environmental restoration and preservation. To expedite implementation, preliminary restoration designs are developed as part of the watershed assessment and planning effort for some of the highest priority recommendations.

During past permit cycle, the County completed watershed assessments on seven of 12 of its eight-digit sub-basins (Bodkin Creek, Magothy River, Patapsco Non-Tidal, Patapsco Tidal, Severn River, South River, and Upper Patuxent) Two watershed assessments are currently in progress (Little Patuxent, and West and Rhode Rivers) and two watershed assessments are planned for the future (Herring Bay and Middle Patuxent) and are expected to be completed by 2017

Completed watershed assessments can be found on the County's website
http://www.aacounty.org/DPW/Watershed/WatershedStudies.cfm

Table 5 shows the current schedule established to complete these studies.

Table 5. Watershed Assessment Schedule

Watershed	MDE 8-Digit Watershed Code	Timeline for Targeted Bioassessment Completion (Calendar Year)	Timeline for Habitat Assessment Completion (Calendar Year)	Timeline for Analysis Completion (Calendar Year)
Severn	02131002	Complete	Complete	Complete
South	02131003	Complete	Complete	Complete
Upper Patuxent	02131104	Complete	Complete	Complete
Magothy	02131001	Complete	Complete	Complete
Patapsco Non-Tidal	02130906	Complete	Complete	Complete
Patapsco Tidal	02130903	Complete	Complete	Complete
Bodkin	02130902	Complete	Complete	Complete
Little Patuxent	02131105	Complete	Complete	2015
Rhode	02131004	Complete	Complete	2015
West	02131004	Complete	Complete	2015
Herring Bay	02131005	Complete	2016	2016
Middle Patuxent	02131102	2016	2017	2017

During 2014, the County completed the field assessment task and analysis of overtopping culvert crossings for the West and Rhode Study. Work remains to be completed for the geomorphology and prioritization analyses. All study related materials will be published on the County website: http://www.aacounty.org/DPW/Watershed/WestRhodeStudy.cfm

During 2014, the County continued its work on the Watershed Master Plan study efforts for the Little Patuxent Watershed. Analyses were completed for the Stream Reach Priority for Restoration as well as for the overall watershed Subwatershed Priority for Restoration and Preservation. Work still remains on the development of concept restoration plans and final report. All study related materials will be published on the County website:
http://www.aacounty.org/DPW/Watershed/LittlePatuxentStudy.cfm

Watershed restoration efforts are monitored through the County's Watershed Protection and Program (WPRP): Stream Monitoring project. This project funds the ongoing assessment of restoration project efficacy. At a minimum, restoration projects are monitored for stability and native vegetation survivability for up to five years following project completion. During this monitoring period, any identified issues that may lead to project failure are either addressed through immediate remediation via the Stream Monitoring project, or are put forward for re-design and construction through a stand-alone capital project.

2. Restoration Plans

a. Within one year of permit issuance, Anne Arundel County shall submit an impervious surface area assessment consistent with the methods described in the MDE document "Accounting for Stormwater Wasteload Allocations and Impervious Acres Treated, Guidance for National Pollutant Discharge Elimination System Stormwater Permits" (MDE, June 2011 or subsequent versions). Upon approval by MDE, this impervious surface area assessment shall serve as the baseline for the restoration efforts required in this permit.

By the end of this permit term, Anne Arundel County shall commence and complete the implementation of restoration efforts for twenty percent of the County's impervious surface area consistent with the methodology described in the MDE document cited in PART IV.E.2.a. that has not already been restored to the MEP. Equivalent acres restored of impervious surfaces, through new retrofits or the retrofit of pre-2002 structural BMPs, shall be based upon the treatment of the WQ_v criteria and associated list of practices defined in the 2000 Maryland Stormwater Design Manual. For alternate BMPs, the basis for calculation of equivalent impervious acres restored is based upon the pollutant loads from forested cover.

Status:

The following write-up details Anne Arundel County's (County) process for determining controlled and uncontrolled impervious surfaces, as outlined in the August 2014 MDE document titled "Accounting for Stormwater Wasteload Allocations and Impervious Acres Treated Guidance for National Pollutant Discharge Elimination System Stormwater Permits." As previously described in **Part IV C.4** of this report, the portion of impervious surfaces under the County's jurisdiction is 30,972 acres. This includes both public and private lands within the County's jurisdiction and excludes all Federal, State, and City of Annapolis lands.

The first step in this process was to identify all managed impervious surfaces using records from the County's Urban BMP database that have been inspected within the past three years and have a documented water quality volume; past implemented stream restoration projects and living shoreline restoration projects; rooftop disconnects; open section roads; septic conversions to waste water treatment plants; upgraded septic systems to enhanced nitrogen removal systems; and street sweeping practices. Once all managed impervious surfaces have been accounted for, the total was subtracted from the initial 30,972 acres resulting in **1,700** acres of managed impervious surfaces and **29,273** acres of unmanaged impervious surfaces. This is the Anne Arundel County impervious area baseline resulting from the impervious surface assessment. Multiplying the **29,273** acres of unmanaged impervious by 20% resulted in **5,854** acres of impervious surfaces to be controlled/managed during the five year permit cycle.

The first year of the current permit cycle began February 12, 2014. Between February 2014 and the end of this reporting period (June 30, 2014), the County implemented restoration projects and alternative BMPs corresponding to **55.6** equivalent impervious acres of the targeted **5,854** impervious acres for restoration.

The following provides and details the methods utilized by the County to determine impervious surface baseline, and the credit to be applied to the baseline restoration target.

Existing BMP Credit

Using the criteria outlined in the guidelines, Section II Establishing Baselines: Impervious Surface Area Assessment, BMPs records were queried and selected from the County's Urban BMP database that were found to meet the requirements by having a documented water quality volume from either the grading permit application or sealed stormwater report and having an inspection record within the last three years. This resulted in a list of 238 BMPs that could count towards the baseline. The BMPs consisted of mostly infiltration trenches, dry wells, and wet pond practices. Associated GIS layers are included in **Appendix A** of this report and are attributed with the BMP unique identifier Storm ID linking back to the Urban BMP database. Credit was calculated by applying the designed treatment volume in relation to the one inch runoff volume, and was found to provide 263 equivalent impervious acres of treatment that was included in the baseline assessment.

Toward the end of this reporting year, additional Urban BMP maintenance inspectors were hired. As the County further enhances its maintenance inspection program, ramps up field inspection efforts using inspection checklist, and increases inspection and maintenance of additional BMPs, the impervious credit associated with these practices will be applied toward impervious surface restoration. It is expected that the County will make progress towards calculating water quality volumes for the BMPs during the upcoming reporting year and continue into the future years. The County will take impervious surface treatment and load reduction credit for these practices once the measured water quality volume has been determined. This effort is tied to the ongoing Urban BMP Database improvements and the required database enhancements associated with the August 2014 guidance, which the County began implementing shortly after receipt of that guidance (MDE 2014). The database structure will be modified as necessary to remain compliant with MDE's requirements.

Water Quality Improvement Project Credit

Prior to the issuance of the August 2014 guidelines, the County did not consistently track water quality volume treatment for all environmental restoration projects. Under the current guidelines, the County claimed equivalent

impervious surface treatment credits for stream restoration and living shoreline restoration projects implemented prior to February 2014 based on the linear foot of treatment per project. The County identified 58 previously implemented restoration projects providing an equivalent impervious surface treatment credit of 461 acres that was included in the baseline assessment. The County has been working to calculate water quality volume for the remaining previously implemented water quality improvement projects. As water quality volume treatment is determined for these projects, the equivalent impervious surface treatment credit will be applied toward the 20% impervious surface restoration target.

Water quality improvement projects constructed after February 2014 utilized the August 2014 guidelines for determining equivalent impervious surface treatment credit based on the water quality volume provided in relation to the one inch rainfall runoff water quality volume. During this time period, the County constructed nine pond retrofits and two stream restoration projects for a total equivalent impervious surface restoration credit of 28.7 acres towards the 20% reduction target goal. GIS layers depicting both of these water quality improvement project impervious surfaces are attached in **Appendix A** of this report.

Rooftop Disconnect Credit

Rooftop disconnects have been identified by intersecting the County's building rooftop GIS layer against areas zoned as Rural Agriculture (RA) which specifies one dwelling per 20 acres and Residential Low Density (RLD) one dwelling per five acres. Building rooftops within these zoning classifications were then further refined by selecting rooftops on residential parcels greater than three acres and are a distance greater than 100 ft. from streams. As a result of this analysis, 14,070 rooftops were identified for a disconnect credit of 499 impervious acres. These disconnected impervious acres were included in the baseline assessment. A GIS layer depicting these rooftop disconnects is attached in **Appendix A** of this report.

Open Section Roadway Credit

Open section roads denote roads that do not have curb and gutters. These areas have been identified by intersecting the County's functional road classification GIS layer against areas zoned as Rural Agriculture (RA) and Residential Low Density (RLD). These two zoning classifications make up a majority of rural areas within the County. Open section roads within these zoning classifications were further refined by removing from the selection, roadways drained by the County's closed storm drain layer and roadway segments with a distance less than 100 feet from streams. As a result of this analysis, 393 individual roadway segments were identified for a disconnect credit of 211 impervious acres. These disconnected impervious acres were included in the baseline assessment. A GIS

layer depicting these open section roadway impervious surfaces is attached in **Appendix A** of this report.

Septic System Connection to Wastewater Treatment Plant Credit

Septic system connections to the County's sewer treatment system, implemented prior to February 2014, received an equivalent impervious surface credit of 0.39 acre for each connection and this credit was applied to the baseline assessment. The County made 180 connections, or 70 acres in equivalent impervious credit, prior to February 2014. After February 2014, the County made an additional 40 connections or 15.6 acres that are applied as equivalent impervious surface reduction credits towards the 20% reduction target. A GIS layer depicting these septic system connection impervious surfaces are attached in **Appendix A** of this report.

Septic Systems Upgraded to Enhanced Nitrogen Removal System Credit

Septic system upgrades to enhanced nitrogen removal units made by the County prior to February 2014 received an equivalent impervious surface credit of 0.26 acre for each upgrade and this credit was applied to the baseline assessment. Prior to February 2014, the County made 710 upgrades or 184.6 acres in equivalent impervious credit that were applied to the baseline assessment.. After February 2014, the County made an additional 15 upgrades or 3.9 acres of equivalent impervious surface reduction credits towards the baseline restoration target. A GIS layer depicting these septic system upgrade impervious surfaces are attached in **Appendix A** of this report.

Street Sweeping Credit

In addition to the above mentioned credit inventories, the County also maintains an inventory of street sweeping miles. During 2014 the County contracted for street sweeping services. These services augment the existing County street sweeping program and will expand as the Stormwater Remediation Fee is phased in and additional revenue becomes available to encompass additional curbed County roadways. Currently, the County targets those curbed roads with high traffic volumes or outfalls that discharge to and/or touch a tidal or non-tidal water body within the Patapsco River Watershed, the priority area given the Baltimore Harbor Trash TMDL. Additionally, during 2014 the Bureau of Highways hired two Vactor operators and is currently in the process of purchasing two Vactor trucks for the storm drain inlet cleaning program.

Prior to February 2014, the County swept 169 curb miles of roadway or the equivalent of 167.7 acres of impervious surfaces based on the August 2014 guidance. This equates to 11.74 acres of equivalent impervious acres for the baseline assessment. After February 2014, the County swept an additional 106

curb miles or 105.2 acres of impervious surfaces or 7.36 acres of equivalent impervious surface credit towards the baseline impervious surface restoration target. As these data are not maintained in a GIS format, they will not be geographically represented in **Appendix A**. The values stated above have been added to the values represented in **Appendix A** and are reflected in the calculations referenced earlier in this section.

b. Within one year of permit issuance, Anne Arundel County shall submit to MDE for approval a restoration plan for each stormwater WLA approved by EPA prior to the effective date of the permit. The County shall submit restoration plans for subsequent TMDL WLAs within one year of EPA approval. Upon approval by MDE, these restoration plans will be enforceable under this permit. As part of the restoration plans, Anne Arundel County shall:

- ***i. Include the final date for meeting applicable WLAs and a detailed schedule for implementing all structural and nonstructural water quality projects, enhanced stormwater management programs, and alternative stormwater control initiatives necessary for meeting applicable WLAs;***
- ***ii. Provide detailed cost estimates for individual projects, programs, controls, and plan implementation;***
- ***iii. Evaluate and track the implementation of restoration plans through monitoring or modeling to document progress toward meeting established benchmarks, deadlines, and stormwater WLAs; and***
- *iv.* ***Develop an ongoing, iterative process that continuously implements structural and nonstructural restoration projects, program enhancements, new and additional programs, and alternative BMPs where EPA approved TMDL stormwater WLAs are not being met according to the benchmarks and deadlines established as part of the County's watershed assessments.***

Status:

Prior to the February 12, 2014 effective date of Anne Arundel County's current NPDES MS4 permit, EPA had approved a number of WLAs for the County (Table 6).

Table 6. Waste Load Allocations (WLAs) Approved by EPA for Anne Arundel County

Basin Name	8-Digit Basin Number	Impairment	Year	Comment
Chesapeake Bay Mainstem 3 Mesohaline	02139997, 02130511, 02130505, 02130903	Nutrients & Sediment	2010	Bay TMDL
Chesapeake Bay Mainstem 4 Mesohaline	02139998, 02130511, 02131005	Nutrients & Sediment	2010	Bay TMDL
Chesapeake Bay Mainstem 4 Mesohaline (Tracy & Rockhold Creeks)	02131005	Bacteria	2006	
Little Patuxent River	02131105	Sediments	2011	
Magothy River Mesohaline	02131001	Nutrients & Sediments	2010	Bay TMDL
Magothy River Mesohaline (Mainstem, Forked Creek, & Tar Cove)	02131001	Bacteria	2006	
Patapsco River Lower N. Branch	02130906	Bacteria	2009	
Patapsco River Lower N. Branch	02130906	Nutrients & Sediments	2009, 2011	Bay TMDL
Patapsco River Mesohaline	02130902, 02130903	Nutrients & Sediments	2010	Bay TMDL
Patapsco River Mesohaline (Baltimore Harbor)	02130903	Nutrients	2007	Bay TMDL
Patapsco River Mesohaline (Furnace & Marley Creeks)	02130903	Bacteria	2011	
Patuxent River Oligohaline	02131101	Nutrients & Sediments	2010	Bay TMDL
Patuxent River Tidal Fresh	02131102	Nutrients & Sediments	2010	Bay TMDL
Patuxent River Upper	02131104	Bacteria	2011	
Patuxent River Upper	02131104	Sediments	2011	
Rhode River Mesohaline	02131004	Nutrients & Sediments	2010	Bay TMDL
Rhode River Mesohaline (Bear Neck & Cadle Creeks)	02131004	Bacteria	2006	
Severn River Mesohaline	02131002	Nutrients & Sediments	2010	Bay TMDL
Severn River Mesohaline (Mainstem, Mill, Meredith, and Whitehall Creeks)	02131002	Bacteria	2008	
South River Mesohaline	02131003	Nutrients & Sediments	2010	Bay TMDL
South River Mesohaline (Mainstem, Duvall Creek, Ramsey Lake, & Selby Bay)	02131003	Bacteria	2005	
West River Mesohaline	02131004	Nutrients & Sediment	2010	Bay TMDL
West River Mesohaline (Mainstem & Parish Creek)	02131004	Bacteria	2006	

*Note: Local TMDL is superceded by the Bay TMDL if the latter is more stringent.

In late FY14 and early FY15, Anne Arundel County executed contracts to develop restoration plans for the nine TMDLs that have been approved for bacteria impairments and for three (3) TMDLs that have been approved for sediment impairments. These TMDL restoration plans are currently in draft format. As required by the permit these restoration plans will identify a suite of structural and non-structural projects and programs necessary for meeting the WLAs identified in the individual TMDLs and will include detailed cost

estimates and a schedule for implementation. These restoration plans are being developed pursuant to the following MDE guidance documents:

- *"Accounting for Stormwater Wasteload Allocations and Impervious Acres Treated – Guidance for National Pollutant Discharge Elimination System Stormwater Permits". August 2014*
- *"General Guidance for Developing a Stormwater Wasteload Allocation (SW-WLA) Implementation Plan". May 2014*
- *"Guidance for Developing a Stormwater Wasteload Allocation Implementation Plan for Bacteria Total Maximum Daily Loads". May 2014*
- *"Guidance for Developing Stormwater Wasteload Allocation Implementation Plans for Nutrient and Sediment Total Maximum Daily Loads." November 2014*

Although they were not developed during this FY14 reporting period, draft restoration plans to meet the bacteria and sediment stormwater WLAs are submitted to MDE, as required by the permit, as **Appendix G** of this NPDES MS4 Permit Annual Report. The County anticipates concurrently advertising the availability of these reports for review and comment as per the requirements of **Part IV.E. 3** of this permit (below).

The twelve (12) remaining TMDLs, those with stormwater WLAs for nutrients and sediment, approved prior to the issuance date of the permit are being addressed via the Chesapeake Bay TMDL through the County's Phase II Watershed Implementation Plan (WIP) and associated Programmatic and Implementation 2-Year Milestones. The County submitted its first set of 2 – Year Milestones (2012-2013) on July 2, 2012 as part of its Phase II WIP submittal. MDE conducted an evaluation of the County's progress toward meeting those 2-Year Milestones in July, 2014. The County received "High" ratings in most Milestone categories. MDE found that the County had made significant commitments to the stormwater sector as well as the septic and wastewater sectors. MDE also found that although substantial progress was made, follow through on commitments related to securing legal authorities and public engagement needed to be reflected in future milestones. In February 2014 Anne Arundel County submitted its 2014-2015 2-Year Milestones. An interim progress report on those milestones will be submitted to MDE by January 30, 2015.

The County's Phase II WIP, 2-Year Milestones and progress reports can be found at:
www.mde.state.md.us/programs/Water/TMDL/TMDLImplementation/Pages/WIPPhaseIICountyDocuments.aspx

3. Public Participation

Anne Arundel County shall provide continual outreach to the public regarding the development of its watershed assessments and restoration plans. Additionally, the County shall allow for public participation in the TMDL process, solicit input, and incorporate any relevant ideas and program improvements that can aid in achieving TMDLs and water quality standards. Anne Arundel County shall provide:

a. Notice in a local newspaper and the County's web site outlining how the public may obtain information on the development of watershed assessments and stormwater watershed restoration plans and opportunities for comment;

b. Procedures for providing copies of watershed assessments and stormwater watershed restoration plans to interested parties upon request;

c. A minimum 30 day comment period before finalizing watershed assessments and stormwater watershed restoration plans; and

d. A summary in each annual report of how the County addressed or will address any material comment received from the public.

Status:

The County provides information on watershed assessment and restoration via the County website (www.aarivers.org) as well as through our interactive online mapping application. As watershed assessments are completed, the associated study reports are published on the WPRP webpage as noted in **Part E.1**. Additionally, restoration projects are highlighted on the WPRP webpage. Future watershed assessments to be initiated in FY15 will also include local news media notification regarding availability of information from these assessments.

As originally reported in the 2010 Annual Report, the County developed an interactive online mapping application to track restoration projects undertaken by non-County organizations such as the Watershed Stewards Academy, grassroots environmental preservation groups, and local Riverkeepers. The mapping application also allows these organizations, and anyone with internet access and interest, to open the mapping application and view the many data layers that have resulted from the County's watershed assessments. Since 2010, the County has provided additional functionality to this mapping application by making changes to the overall look and feel of the application. Most recently, the viewer was changed to a more robust Geocortex viewer. This required a change in the URL of

the mapping application, the new address is http://gis-world2.aacounty.org/silverlightviewer/?Viewer=WERS.

During FY2015 and as TMDL Implementation Plans are drafted and new watershed assessments initiated, the County will provide notice of these activities in local newspapers and on social media outlets. The County recognizes the importance of public input into these studies and plans and will provide a minimum of 30 days for public comment on draft TMDL implementation plans as well as watershed assessment reports. Draft documents will be made available for review and/or download through the County webpage, and a minimum number of hard copy reports will also be made available on request. Prior to final acceptance, a summary of the comments received and County response will be incorporated into each document.

4. TMDL Compliance

Anne Arundel County shall evaluate and document its progress toward meeting all applicable stormwater WLAs included in EPA approved TMDLs. An annual TMDL assessment report with tables shall be submitted to MDE. This assessment shall include complete descriptions of the analytical methodology used to evaluate the effectiveness of the County's restoration plans and how these plans are working toward achieving compliance with EPA approved TMDLs. Anne Arundel County shall further provide:

a. Estimated net change in pollutant load reductions from all completed structural and nonstructural water quality improvement projects, enhanced stormwater management programs, and alternative stormwater control initiatives;

b. A comparison of the net change in pollutant load reductions detailed above with the established benchmarks, deadlines, and applicable stormwater WLAs;

c. Itemized costs for completed projects, programs, and initiatives to meet established pollutant reduction benchmarks and deadlines;

d. Cost estimates for completing all projects, programs, and alternatives necessary for meeting applicable stormwater WLAs; and

e. A description of a plan for implementing additional watershed restoration actions that can be enforced when benchmarks, deadlines, and applicable stormwater WLAs are not being met or when projected funding is inadequate.

Status:

As noted earlier, Anne Arundel County continues to work collaboratively with MDE and various stakeholders within the County to implement individual watershed restoration plans and the Chesapeake Bay TMDL Watershed Implementation Plan (WIP) to reduce the nutrient and sediment load within Anne Arundel County's portion of three major tributary basins (Lower Western Shore, Patuxent, and Patapsco). Individual TMDL restoration plans were recently drafted and submitted, with this report, for MDE review and comment (see **Part IV.E.2.b**). Implementation of activities associated with the Chesapeake Bay TMDL stormwater WLA for Anne Arundel County have been ongoing since FY2013. Detailed information pertaining to the County's progress toward achieving programmatic and implementation milestones associated with the County's Phase II WIP were reported to MDE on 31 January 2015 as previously documented in this section.

With respect to the net change in pollutant loads necessary to meet TMDL requirements, **Appendix A, Table G** of this report lists the pollutant load reduction summary for completed water quality improvement projects, alternative stormwater controls, and enhanced management programs implemented by the County through the end of this reporting period. This summary includes both those water quality improvement projects implemented between 2008 and February 2014, and those projects, alternative controls, and management programs implemented after issuance of the 4th generation Permit (February 2014 through June 2014). The net pollutant load reductions associated with the County's cumulative stormwater management and restoration efforts, and the County's Chesapeake Bay TMDL stormwater WLA are shown below in Table 7. Pollutant Load Reductions and Waste Load Allocations (WLA). The remaining reduction required to meet the SW WLAs are to be achieved by 2025.

Table 7. Pollutant Load Reductions and Waste Load Allocations (WLA)

	SW WLA Delivered	Required Reduction to Meet WLA	Load Reduction Achieved	Remaining Reduction Needed
Total Nitrogen (lbs/yr)	449,641	207,742	5,192	202,550
Total Phosphorus (lbs/yr)	30,147	26,385	3,016	23,369
Total Suspended Sediment (Tons/yr)*	2,323	4,786	504	4,282
*Numbers derived from MAST scenario run spreadsheet dated July 2012.				

Water quality improvement projects and programs implemented from 2008 through the end of the reporting period are documented **Appendix J.** This spreadsheet includes the total cost associated with each project and program included this accounting.

Project costs incurred during the reporting period, and associated with stormwater programs, restoration projects, and street sweeping, are provided in **Part IV. G** of this Report. More specifically, for the time period of February 2014 through June 30, 2014, the County implemented nine BMP (i.e. Pond) retrofits, two stream restoration projects, and swept one hundred six curb miles of roadway for a cost of $2,547,465. The total pollutant load reductions associated with these specific actions are included in the above summary table and are detailed below:

- 611.5 lbs/year of Total Nitrogen,
- 121.6 lbs/year of Total Phosphorus, and
- 32.2 tons of Total Suspended Solids.

.The County continues to work toward meeting the TMDL targeted goals, and it is anticipated that 275 Capital Program water quality improvement projects will be in the design stage for the next permit reporting period as previously mentioned in **Part IV C.6** of this report. Information on projected costs, through FY2020, to complete the restoration projects identified and budgeted for TMDL and MS4 Permit compliance can be found in the County's current (FY15) capital budget. These budgets are available on the County webpage (www.aacounty.org/Budget/index.cfm). The Capital Budget Program Class for Watershed Protection and Restoration Projects identifies and provides cost estimates for those projects specifically identified to meet stormwater WLAs and MS4 restoration requirements. A summary of projected funding from FY15 through FY20 is:

FY15: $78,927,300
FY16: $76,582,100
FY17: $75,815,100
FY18: $75,750,300
FY19: $76,673,000
FY20: $80,189,200

It is important to note that the Capital Program budget for FY16 and beyond is approved but funding has not been appropriated. Much like the operating budget, the Capital Program funds are appropriated on a fiscal year basis.

Part IV. E.4.e. of Anne Arundel County's NPDES MS4 permit requires the development of a plan for implementing additional watershed restoration actions that can be enforced when benchmarks, deadlines, and applicable stormwater WLAs are not being met or when projected funding is inadequate.

During the 2012 development of *Maryland's Phase II Watershed Implementation Plan (WIP) For The Chesapeake Bay*, Anne Arundel County with the concurrence of the State of Maryland and EPA recognized the need for adaptive management in the WIP development and implementation process. As discussed in *Maryland's*

Phase II Watershed Implementation Plan For The Chesapeake Bay, March 20, 2012, as implementation moves forward achievement of stormwater waste load allocation goals needs to be evaluated and watershed restoration plans modified in response to the rate of progress, additional modeling results, and resource availability.

Anne Arundel County took a conservative approach when developing the urban stormwater component of its Phase II WIP. The County's strategy was structured to achieve the Edge of Stream (EOS) final target load derived from the County's Watershed Management Tool (WMT) baseline estimate which was higher than the MAST baseline estimates. In addition, the strategy included only restoration and preservation recommendation for the seven watersheds that were assessed at the time the County's Phase II WIP was developed in July 2012. Restoration opportunities for load reduction from the Little Patuxent, West and Rhode Rivers, Herring Bay and Middle Patuxent River watersheds were not identified nor taken into account.

Further, Anne Arundel County adopted legislation in June 2013 to create the WPRP, including a Stormwater Remediation Fee (Fee). The Stormwater Remediation Fee is structured to provide sufficient funding for projects to meet the pollutant load reduction required by the Chesapeake Bay TMDL, EPA-approved individual TMDLs with a stormwater WLA, and to meet the impervious surface management requirements as well as other stormwater obligations set forth in the County's NPDES MS4 Permit. Given the basis upon which the Fee was established, at this time, funding to achieve applicable stormwater WLAs is considered to be sufficient.

Adaptive management is a critical component of achieving the WLAs required by the County's NPDES MS4 Permit. The Chesapeake Bay TMDL and individual approved TMDLs have clearly established load reduction targets. 2-Year Implementation Milestones have been established by the County to provide interim planning targets and to serve as a vehicle for assessing progress toward the load reduction targets. Progress will be measured through three approaches: tracking implementation of management measures, estimating load reductions through modeling, and tracking overall program success through long term monitoring. Planning targets will then be re-evaluated against progress and revised to ensure that Anne Arundel County is on track to meet its goals. Progress assessments are scheduled for 2017 and 2021, with 2025 set as the final date for achievement of loads reductions.

Following the adoption of its Stormwater Remediation Fee in 2013 Anne Arundel County developed a 6-year Capital Improvement Program (CIP) in FY14 that created a Watershed Protection and Restoration Program (WPRP) Class of projects to implement those restoration projects identified in the County's Phase II WIP for achieving stormwater WLAs. Funding for this class of projects

averages 74 million dollars annually. Projects in the WPRP Class were identified and prioritized through a planning level assessment and consist of restoration of ephemeral and perennial streams with a MBSS Maryland Physical Habitat Index (MPHI) score of severely degraded or degraded; implementation of stormwater/water quality treatment at currently untreated stormwater pipe outfalls (greater than 24 inches), and retrofit of stormwater management ponds built prior to 2002, with drainage areas in excess of 10 acres, to optimize pollutant reduction and ecosystem functions for the facilities. As WPRP projects are funded, more detailed feasibility and constructability assessments are conducted. These assessments may result in identifying projects previously thought to be implementable but due to a variety of reasons are not; or identifying additional and new opportunities for load reduction. As these feasibility assessments are completed the County will incorporate these findings into its modeling, reassess anticipated load reductions and adapt its implementation program to delete or add projects.

At this time, multiple lines of evidence including results of several model runs, monitoring data, and the most recent science on BMP effectiveness and water quality response will be evaluated as part of TMDL compliance assessment. The milestones and progress assessments will contribute to continual reassessment of management plans, and adapting responses accordingly as technologies and efficiencies change, programs mature, credit trading is enacted, and regulations are put in place.

F. Assessment of Controls

Assessment of controls is critical for determining the effectiveness of the NPDES stormwater management program and progress toward improving water quality. The County shall use chemical, biological, and physical monitoring to assess watershed restoration efforts, document BMP effectiveness, or calibrate water quality models for showing progress toward meeting any applicable WLAs developed under EPA approved TMDLs identified above. Additionally, the County shall conduct physical stream monitoring to assess the implementation of the latest version of the 2000 Maryland Stormwater Design Manual. Specific monitoring requirements are described below.

1. Watershed Restoration Assessment

The County shall continue monitoring the Parole Plaza outfall and Church Creek in- stream station in the South River watershed, or select and submit for MDE's approval a new watershed restoration project for monitoring. Monitoring activities shall occur where the cumulative effects of watershed restoration activities can be assessed. One outfall and an associated in-stream station, or other locations based on a study design approved by MDE, shall be

monitored. The minimum criteria for chemical, biological, and physical monitoring are as follows:

a. <u>Chemical Monitoring</u>

i. Twelve storm events shall be monitored per year at each monitoring location with at least two occurring per quarter. Quarters shall be based on the calendar year. If extended dry weather periods occur, baseflow samples shall be taken at least once per month at the monitoring stations if flow is observed;

ii. Discrete samples of stormwater flow shall be collected at the monitoring stations using automated or manual sampling methods. Measurements of pH and water temperature shall be taken;

iii. At least three samples determined to be representative of each storm event shall be submitted to a laboratory for analysis according to methods listed in 40 CFR Part 136 and EMC shall be calculated for:

Biochemical Oxygen Demand (BOD_5)	***Total Lead***
Total Kjeldahl Nitrogen (TKN)	***Total Copper***
Nitrate plus Nitrite	***Total Zinc***
Total Suspended Solids	***Total Phosphorus***
Total Petroleum Hydrocarbons (TPH)	***Hardness***
E. coli or enterococcus	

iv. Continuous flow measurements shall be recorded at the in-stream monitoring station or other practical locations based on an approved study design. Data collected shall be used to estimate annual and seasonal pollutant loads and reductions, and for the calibration of watershed assessment models. Pollutant load estimates shall be reported according to any EPA approved TMDL with a stormwater WLA.

Status:

Anne Arundel County continues to conduct a long-term monitoring program to satisfy the above permit conditions. This monitoring program includes chemical, biological, and physical monitoring in the Church Creek subwatershed located in the South River Watershed. Monitoring for this permit reporting period extended from July 2013 through June 2014. The full Church Creek monitoring report can be found in **Appendix B** and the data required to support this section are also provided in **Appendix A** in the prescribed format.

The chemical monitoring activities take place at two monitoring stations in the Church Creek subwatershed:

- Parole Plaza Station: Outfall representing a highly impervious (87 percent) commercial land use which was redeveloped in 2007 as the Annapolis Towne Centre; the construction incorporated stormwater management into the redevelopment (i.e. a restoration station); and
- Church Creek Station: An instream station approximately 2,000 feet downstream of the Parole Plaza monitoring station.

During the 2014 reporting period, seven storm events were sampled and five baseflow samples were collected and analyzed. Storm event samples were collected from both stations for the rising, peak, and falling limbs of the hydrograph. Samples were analyzed for the parameters, including Hardness which became a requirement in the fourth generation NPDES MS4 Permit which took effect in February 2014.

Continuous water level measurements were taken at the Church Creek instream station and within both the 60" corrugated metal pipe and the 54" reinforced concrete pipe at the Parole Monitoring Station. Event Mean Concentrations (EMCs) for each parameter were calculated for each storm and applied to total stormflow discharges to calculate stormflow pollutant loads for each site. An EMC is a statistical parameter used to represent the flow-weighted average concentration of a given parameter during a storm event (USEPA 2002). Total seasonal loads were calculated by multiplying the average seasonal EMC by the total volume for the season. Annual loads were calculated by summing all seasonal loads.

As in prior years, comparisons to water quality criteria continue to indicate elevated pollutant concentrations in the Church Creek watershed, primarily during wet weather conditions. In particular, copper, zinc, total phosphorous, BOD5, nitrate-nitrite, and E. coli frequently exceeded criteria at both sampling stations. Additionally, the Federal water quality criteria were exceeded for total phosphorous, nitrate-nitrite and E. coli during baseflow sampling at both the Church Creek and Parole Plaza Stations, with lead, copper, zinc and BOD5 also being exceeded at the Parole Plaza station.

Water quality criteria for the pollutants listed above were more frequently exceeded at the Parole Plaza monitoring station than at the Church Creek station for all contaminants except for BOD5. Total phosphorous, nitrate-nitrite and E. coli concentrations remained high at both stations throughout the 2014 monitoring period, exceeding water quality criteria for at least 90% of the time at both Church Creek and Parole Plaza. Note that prior to site stabilization, total suspended solids concentrations had been particularly high due to construction activity at Annapolis Towne Centre. Following stabilization of the site in Fall 2008, the event mean concentrations for total suspended solids have dropped significantly. During the last three reporting years, no wet weather samples exceeded the water quality criterion for total suspended solids at either station.

During the 2014 reporting year, loading rates increased for all sampled parameters at the Parole Plaza Station when compared to the 2013 reporting year except for E. coli. At the Church Creek Station, 2014 reporting year loading rates increased for all sampled parameters when compared to the 2013 reporting year except for BOD5, zinc and lead. The sharp increase in E. coli loads at the Church Creek station may be due to an increase in pet waste washing into the storm drain system as a result of the likely increase in occupancy of the Annapolis Towne Centre residential buildings. This same increase was observed at the Parole Plaza station during the 2013 reporting year, but a slight decrease in E. coli loads occurred at this station in 2014.

Hardness was much higher in the winter at both stations due to the large amount of road salt used to deice local roads during a winter that produced an abnormally large amount of snow and ice. TKN and nitrate-nitrite loads were also highest in the winter months at each station. Water chemistry monitoring during the 2014 winter months consisted solely of baseflow sampling, and the higher natural background nitrogen concentrations observed during baseflow (which are often diluted during storm events) is the likely cause of the elevated winter TKN and nitrate-nitrite loads. All other Church Creek pollutant loads, except E. coli, were highest in the spring. The increase in metal and total phosphorus loads were likely associated with the increase in TSS, which is likely a product of accelerated stream bank erosion occurring after several freeze-thaw cycles facilitated by the consistent swings in temperature observed during the 2014 winter. All metal, total phosphorus, and TSS loads were highest in the fall at the Parole Plaza station, which is primarily due to the total volume of water passing through this station in the fall being much higher than volumes observed in the other seasons. It should be noted, however, that the limited number of samples collected for each season ultimately makes it difficult to draw strong conclusions about seasonal pollutant loading rates. These interpretations should be viewed cautiously.

Further discussion of the monitoring activities at these stations and the resulting data can be found in the included monitoring report in **Appendix B**.

b. <u>Biological Monitoring</u>

i. Benthic macroinvertebrate samples shall be gathered each Spring between the outfall and in-stream stations or other practical locations based on an MDE approved study design; and

ii. The County shall use the EPA Rapid Bioassessment Protocols (RBP), Maryland Biological Stream Survey (MBSS), or other similar method approved by MDE.

Status:

A total of four 75-meter biological monitoring reaches are positioned along Church Creek between the Annapolis Towne Centre outfall and the Church Creek in-stream water quality monitoring station. Benthic macroinvertebrate samples were collected from these stations in March 2014, following the MBSS spring index period protocols. One station is located on the Parole Plaza Tributary just below Forest Drive, two stations are located along the Church Creek mainstem, on either side of Solomons Island Road (Maryland State Highway 2), and a fourth site, located just upstream of the confluence with the Parole Plaza Tributary, was added in 2007 to monitor the effects of runoff from the adjacent Annapolis Harbour Center and Festival at Riva shopping centers.

The biological condition at each station was evaluated using the BIBI developed for use in Maryland's Coastal Plain streams. Results of the 2014 sampling period indicate that biological conditions within the Church Creek study area continue to be impaired by urbanization within the surrounding watershed. Since 2006, all stations have consistently been rated as either 'Poor' or 'Very Poor.' The number of EPT taxa, the number of *Ephemeroptera* and the percent *Ephemeroptera* were low for all stations.

The physical habitat quality was evaluated using both the MBSS Physical Habitat Index (PHI) and EPA's Rapid Bioassessment Protocol (RBP). The stream physical habitat remains degraded throughout the entire study reach and appears to have changed very little from prior years. Overall, PHI and RBP scores indicate that habitat conditions limit the potential for healthy biological communities. The close proximity to roads and development, along with a lack of instream woody debris and stable epifaunal substrate, prohibits the stream from supporting a diverse and healthy macroinvertebrate community. Elevated levels of dissolved solids indicate the presence of water quality stressors. These appear to be a few of the factors limiting the biological conditions within Church Creek. The results of the biological monitoring program are included in **Appendix B**.

c. Physical Monitoring

i. A geomorphologic stream assessment shall be conducted between the outfall and in-stream monitoring locations or in a reasonable area based on the approved study design. This assessment shall include an annual comparison of permanently monumented stream channel cross-sections and the stream profile;

ii. A stream habitat assessment shall be conducted using techniques defined by the EPA's RBP, MBSS, or other similar method approved by MDE; and

***iii.* A hydrologic and/or hydraulic model shall be used (e.g., TR-20, HEC-2, HEC-RAS, HSPF, SWMM, etc.) in the fourth year of the permit to analyze the effects of rainfall; discharge rates; stage; and, if necessary, continuous flow on channel geometry.**

Status:

Due to the highly altered conditions of the drainage area and stream channel in the study area, reliable bankfull indicators were often difficult to locate in the field, thus leading to a fair amount of professional judgment used to interpret the data and categorize the stream segments. This means that categorization of some of the stream segments may change dramatically from year to year. Table 8 is a summary of each reach and its classification.

Table 8. Physical Characterization Summary

Reach	2013 Classification	2014 Classification	Notes
XS-1	F4	F5/4	Channel degradation, loss of floodplain connectivity, and widening indicate this channel is not stable.
XS-2	G5c	G4c	Actively degrading and widening with lack of sinuosity; shifting to a less-stable form.
XS-3	G4c	G4c	This section was recently stabilized with modification to the channel dimensions.
XS-4	C5	C5	Low entrenchment, low width/depth ratio, low slope, and well-connected floodplain.
XS-5	F4/3	F3	Slight entrenchment, moderate width/depth ratio, and low sinuosity.

While geomorphic data collected in the Church Creek study area were generally consistent with previous measurements, significant departure from expected values, as derived from Maryland Coastal Plain regional relationships of bankfull channel geometry, were observed for cross sectional area, bankfull width, and bankfull depth dimensions. All dimensions were generally larger in the Church Creek study area, and were more similar to relationships of bankfull channel geometry derived from urban watersheds. This reflects the higher level of imperviousness in the study area, as compared to those levels in the drainage areas used to develop the regional relationship data.

Additional information and data pertinent to the water quality, biological, physical and habitat assessments of Church Creek are included in the *Chemical, Biological, and Physical Characterization of the Church Creek and Parole Plaza NPDES Monitoring Stations: 2013-2014*, located in **Appendix B**.

d. Annual Data Submittal

The County shall describe in detail its monitoring activities for the previous year and include the following:

i. EMCs submitted on MDE's long-term monitoring database as specified in Part V below;

ii. Chemical, biological, and physical monitoring results and a combined analysis for the approved monitoring locations; and

iii. Any requests and accompanying justifications for proposed modifications to the monitoring program.

Status:

The required chemical monitoring results are found in **Appendix A**. This database has been revised to comply with the formatting requirements as per the fourth generation Permit issued in February 2014. Also included in **Appendix B** is the report entitled *Chemical, Biological, and Physical Characterization of the Church Creek and Parole Plaza NPDES Monitoring Stations: 2013-2014,* which provides greater detail on the work performed in this watershed.

During the 2015 reporting year, the County will continue the monitoring program at the Church Creek and Picture Spring Branch Stations. The County is currently investigating other potential candidate sites for the long term monitoring program and, should an appropriate candidate site be identified, will propose the relocation of the monitoring stations to MDE.

2. Stormwater Management Assessment

The County shall continue monitoring the Picture Spring Branch in the Severn River watershed, or select and submit for MDE's approval a new watershed restoration project for determining the effectiveness of stormwater management practices for stream channel protection. Physical stream monitoring protocols shall include:

a. An annual stream profile and survey of permanently monumented cross-sections in Picture Spring Branch to evaluate channel stability;

b. A comparison of the annual stream profile and survey of the permanently monumented cross-sections with baseline conditions for assessing areas of aggradation and degradation; and

c. A hydrologic and/or hydraulic model shall be used (e.g., TR-20, HEC-2, HEC- RAS, HSPF, SWMM, etc.) in the fourth year of the permit to analyze the effects of rainfall; discharge rates; stage; and, if necessary, continuous flow on channel geometry.

Status:

Physical condition and habitat monitoring for Picture Spring Branch, in the vicinity of the West County Library site, began in 2003 and is conducted annually. Five permanent cross-sections were established throughout the study area to evaluate channel stability over time (see **Appendix C** for a location map). Three cross-sections are located on the North Tributary, including one downstream of Maryland State Highway 170, and one on the South Tributary. It should be noted that the South Tributary does not receive significant stormwater runoff from the West County Library site. The majority of the runoff from this site drains to the North Tributary.

In 2014, these cross sections were re-measured and longitudinal profile surveys were conducted along both the North Tributary (totaling 1,935 linear feet) and South Tributary (totaling 366 linear feet). Channel dimensions along the North Tributary have not changed substantially from baseline conditions, although some minor aggradation was noted. Channel dimensions appear moderately constant for three out of the five cross sections in 2014, compared to baseline conditions. Only very minor changes were observed from baseline conditions in cross section XS-2, showing signs of minor aggradation in this overwidened reach. On the other hand, cross sections XS-1 and XS-4 have experienced a 37.5% and 31.6% increase over baseline conditions, respectively. Not surprisingly, these are the only two sections not located in an engineered or partially-armored channel. However, when comparing the most recent four years of data, only minor changes are shown where XS-1 has degraded by 9.3% while XS-4 has aggraded by 7.5%. Although cross section XS-4 has filled in slightly between 2013 and 2014, notable stream bed erosion is apparent. Between 2012 and 2013, the cross section area of XS-4 increased significantly by 62.8%. Cross sections XS-3 and XS-5 decreased in cross-section areas between the baseline assessment and the 2014 survey by 8.4% and 8.2%, respectively. These two stations also show a similar change between 2011 and 2014 surveys by a decrease of 5.5% and 6.3%, respectively. During the 2014 survey, slight deposition was seen along the right bank of cross section XS-3.

Overall, it appears that the BMPs installed as part of the development of the West County Library site have been effective in reducing the geophysical impacts of stormwater runoff. As noted previously, the South Tributary does not receive significant amounts of drainage from the West County Library site.

In March 2014, a biological assessment was conducted at three previously established 75-meter reaches within the study area. From 2006 to 2008, biological condition in these reaches appeared to remain fairly steady with ratings of ‘Fair’ to ‘Poor’; however, during 2009 scores declined at all three sites with two of the sites rating ‘Poor’ and one rating ‘Very Poor’. Between 2009 and 2014, BIBI scores have been somewhat variable, fluctuating between the ‘Poor’ and ‘Fair’

categories. In 2012 all sites received a rating of 'Fair', and in 2013 two of three sites received a rating of 'Fair' while one returned to the 'Poor' category. In 2014 the ratings for all sites returned to the 'Poor' category. The full biological and geomorphological conditions report is included in **Appendix C**.

G. Program Funding

1. Annually, a fiscal analysis of the capital, operation, and maintenance expenditures necessary to comply with all conditions of this permit shall be submitted as required in Part V below.

Status:

The 2014 Annual Report covers the reporting period of July 2013 to June 2014, and corresponds to the County's 2014 Fiscal Year (FY2014). The summary of funding for this reporting period is shown in this section (Table 9). The funding period reflects the initial year of the revenue change from general obligation bonds and County pay-go funding to the dedicated special revenue from the WPRP. The Watershed Protection and Restoration Fund (WPRF) was implemented July 1, 2013 in response to State legislated requirements found in HB987. This Fund now provides the primary fiscal support for all eligible components of the NPDES MS4 Permit program. Those permit-required elements not eligible for funding through WPRP will continue to be supported through the County's annual budget process (general revenue funds).

During the reporting period, funding for NPDES MS4 Permit compliance was addressed through the County CIP and fiscal year operating budgets. CIP funding for the current County fiscal year and the next five fiscal years is allocated to the "Stormwater Runoff Controls," "Water Quality Improvements" and "Watershed Protection and Restoration" CIP project classes. Specific line items funded through the CIP include stormwater permit compliance program; storm drain rehabilitation; closed storm drain repairs and replacement; stormwater infrastructure inspection and maintenance; stormwater facility retrofits; outfall repairs; and stream and ecological restoration projects.

The capital budgets for "Stormwater Runoff Controls" and "Water Quality Improvements" project classes are being phased into the Watershed Protection and Restoration CIP project class. When all ongoing capital projects from these two project classes are completed, the classes will be closed. New projects that would previously be funded in these two classes are now being incorporated into and funded through the "Watershed Protection and Restoration" CIP project class. The 6-year CIP budget (FY14 through FY19) for the "Watershed Protection and Restoration" project class is $460,000,000.

The Anne Arundel County operating budget for FY14 also provides permit compliance support through funding of personnel services (i.e., staff) associated with permit compliance. Such support is derived primarily from the County's OPZ, I&P, SCD, DPW, Office of Law, and the County Health Department. Each of these agencies has responsibility or provides support for certain permit requirements and that all must work collaboratively to achieve County compliance with permit terms. Funding for permit compliance has been included in the operating budgets for the WPRF.

With the implementation of the WPRF, a dedicated revenue source was created. Revenues for FY14 totaled $13,168,000. For the initial year of the funding program, 169,722 properties in Anne Arundel County were assessed a fee equal to 60% of the full fee. During FY2015, properties will be assessed 80% of the fee, with full implementation in FY2016. Estimated projections of revenue for FY2015 and FY2016 are $17,790,900 and $21,954,000 respectively. These revenues fund the operating budget directly, and the CIP budget indirectly through debt repayment on WPRF bonds.

The complete FY2014 approved County budget is available for review and download at www.aacounty.org/Budget/index.cfm.

2. Adequate program funding to comply with all conditions of this permit shall be maintained. Lack of funding does not constitute a justification for noncompliance with the terms of this permit.

Status:

Table 9 denotes the distribution of funding from the County's FY2014 Capital and Operating Budgets. This table is provided below and also as an electronic file in the required spreadsheet format.

With the FY14 revenue associated with the WPRF, the County was able to begin increasing the number of staff dedicated to stormwater management program implementation and compliance with MS4 permit and TMDL requirements. Delays due to proposed legislation changes slowed these program enhancements somewhat. However, additional increases in staff will continue in FY15. These staffing levels will improve the commitment of the County in achieving MS4 permit compliance and maintaining adequate funding to meet permit obligations.

Table 9. Fiscal Analysis

Permit Condition	Fiscal Year 2014
Legal Authority	$79,300
Source ID	$573,685
SW Management	$382,344
Erosion and Sediment Control	$49,012
Illicit Discharge Detection and Elimination	$110,752
Trash and Litter Control	$222,073
Property Management	$8,331,864
Inlet Cleaning	$489,621
Street Sweeping	$36,808
Other Road Maintenance	$0
Public Education	$109,261
Watershed Assessment	$94,567
Watershed Restoration	$72,053,217
Chemical Monitoring Assessment	$133,779
Biological Monitoring Assessment	$216,201
Physical Stream Assessment	$89,121
Stormwater Design Manual Monitoring	$294,950
TMDL Assessment	$196,247
Annual Report Preparation	$46,983
Total Annual Cost for NPDES MS4 Program	**$83,509,785**

H. Discharge Characterization (Part D of Third Generation Permit)

Anne Arundel County and ten other municipalities in Maryland have been conducting discharge characterization monitoring since the early 1990s. From this expansive monitoring, a statewide database has been developed that includes hundreds of storms across numerous land uses. Summaries of this dataset and other research performed nationally effectively characterize stormwater runoff in Maryland for NPDES municipal stormwater purposes. These data shall be used by Anne Arundel County for guidance to improve stormwater management programs and develop watershed restoration projects. Monitoring required under this permit is now designed to assess the effectiveness of stormwater management programs and watershed restoration projects developed by the County. Details about this monitoring can be found in Part III.H. (Fourth Generation Permit - Part IV.F.)

Status:

Discharge Characterization reporting is a requirement of the Anne Arundel County's prior NPDES MS4 Permit (Third Generation Permit). This requirement was not carried forward with the Fourth Generation NPDES MS4 Permit issued in February 2014. Thus, this specific section of the annual report will not be included in future years' reports.

As a component of the County's required watershed studies, Event Mean Concentration (EMC) data for the Anne Arundel County urban land covers were compiled for various studied pollutants (CWP 2005, CWP & VA DCR 2007, Pitt et al 2004). The EMC data are weighted mean values derived from statistical assessment of pollutant concentrations measured for multiple storm events. These data are currently utilized for assessing pollutant loadings using the EPA Simple Method.

During the 2005 to 2014 reporting years, the EMC discharge characterization values were applied to a wide array of land conditions to assist County staff, stakeholders, and decision makers in addressing water quality concerns. The EMC data were used in the EPA Simple Method to model pollutant loads, correlate the results with the drainage area contributory imperviousness, and develop pollutant loading goals associated with watershed and subwatershed assessments, as well as individual water quality restoration projects.

During the 2011 Phase II WIP development, the County reconciled its EMCs for various land covers with those used in the Chesapeake Bay Program's (CBP) Watershed Model (Version 5.3) such that the County's pollutant load modeling efforts would produce results analogous to those of the CBP Watershed Model. Subsequently, these EMCs were used to characterize pollutant loading and develop watershed restoration projects. Use of these reconciled EMCs will continue with future watershed assessments.

Recognizing that EMC values associated with the Bay Model may be updated in the coming years, the County continues to monitor and incorporate updates into its watershed modeling scenarios that support Part IV.E. of the Fourth Generation NPDES MS4 Permit. Additionally, as pre-2011 watershed assessments are updated and pollutant load models are re-run, the CBP Model values will be utilized in an effort to better align the County's pollutant loading estimates with the Bay Program and the Phase II WIP. Lastly, the County recognizes the importance of keeping records denoting the EMC values used in each of the pollutant loading characterizations undertaken as part of the watershed assessments.

I. References

Booth, D.B. 1990. Stream channel incision following drainage basin urbanization. Water Resources Bulletin 26(3): 407-417.

Center for Watershed Protection (CWP). 2005. *A User's Guide to Watershed Planning in Maryland*. Ellicott City, MD. Available at: http://dnr.maryland.gov/watersheds/pubs/planninguserguide/UserGuide.pdf

Center for Watershed Protection & Virginia Department of Conservation and Recreation (CWP & VA DCR). 2007. *Virginia Stormwater Management: Nutrient Design System. APPENDIX A: Analysis of Virginia Event Mean Concentrations (EMCs) and Land Use Loading Rates*. Ellicott City, MD. Available at: http://www.dcr.virginia.gov/documents/stmwtrcwprpt.pdf

DPW (Anne Arundel County Department of Public Works). 2014. *Chesapeake Bay TMDL: 202-2013 Programmatic Milestones – Final Report.* Annapolis, MD. January 2014. http://www.mde.state.md.us/programs/Water/TMDL/TMDLImplementation/Documents/Milestones/2012-2013/Local/2012-2013_Anne_Arundel_Programmatic_Milestones_FINAL_Report_%20January_2014.pdf

Karr, J. R. and E.W. Chu. 1999. Restoring Life in Running Waters: Better Biological Monitoring. Island Press, Washington, DC. p. 19.

KCI. 2006. Upper Patuxent River Biological Monitoring and Assessment –2006. Produced by KCI Technologies, Inc., Hunt Valley, MD, 21401 for the Anne Arundel County Office of Environmental and Cultural Resources (now AAC DPW Watersheds, Ecosystems, and Restoration Services), Annapolis, MD. 23 pp., plus Appendices.

Leopold, L. 1994. A View of the River. Published by Harvard University Press, Cambridge, MA.

Maryland Department of the Environment (MDE). 1997. Dry Weather Flow and Illicit Discharges in Maryland Storm Drain Systems.

Maryland Department of the Environment (MDE). 2000. 2000 Maryland Stormwater Design Manual, Volumes I & II. Revised May 2009. Prepared by the Center for Watershed Protection, Ellicott City, MD, for the Maryland Department of the Environment, Baltimore, MD.

Maryland Department of the Environment (MDE). 2014. Accounting For Stormwater Wasteload Allocations and Impervious Acres Treated: Guidance for National Pollutant Discharge Elimination System Stormwater Permits. Baltimore, MD.

Millard, C.J., P.F. Kayzak, and A.P. Prochaska. 2001. Anne Arundel County results of the 1994-1997 Maryland Biological Stream Survey: County Level Assessments. Maryland

Paul, M.J. and J.L. Meyer. 2001. Streams in the urban landscape. Annual Review of Ecology, Evolution, and Systematics. 32: 333-365.

Pitt, R., A. Maestre, R Morquecho, T. Brown, T. Schueler, K. Cappiella, P. Sturm, and C. Swann. 2004. *Findings of the National Stormwater Quality Database (NSQD)*. Department of Civil and Environmental Engineering, University of Alabama, Tuscaloosa, AL and Center for Watershed Protection, Ellicott City, MD. Available at: http://rpitt.eng.ua.edu/Research/ms4/Paper/Mainms4paper.html

Roberts, M., C. Smith, and C. Victoria. 2006. Aquatic Biological Assessment of the Watersheds of Anne Arundel County, Maryland: 2005. Anne Arundel County, Office of Environmental and Cultural Resources, Annapolis, Maryland.

Roth, N., J. Volstad, L. Erb, E. Weber, P. Kayzak, S. Stranko, and D. Boward. 2005. Maryland Biological Stream Survey 2000-2004—Vol. 6: Laboratory, Field, and Analytical Methods. Prepared for the Maryland Department of Natural Resources, Monitoring and Non-tidal Assessment Division, Tawes State Office Building, Annapolis, MD, 21401 by Versar Inc., and MD DNR. Pub # DNR 12-0305-0108-EA-05-03.

Schueler, T.R. 1987. Controlling urban runoff: a practical manual for planning and designing urban BMPs. Metropolitan Washington Council of Governments. Publication number 87703.

Stribling, J.B., B. Jessup, and C.J. Victoria. 2008a. Aquatic Biological Assessment of the Watersheds of Anne Arundel County, Maryland: 2006. Anne Arundel County Department of Public Works, Watershed and Ecosystem Services, Annapolis, Maryland. 34 pp., plus Appendices.

Stribling, J.B., B. Jessup, and C.J. Victoria. 2008b. Aquatic Biological Assessment of the Watersheds of Anne Arundel County, Maryland: 2007. Anne Arundel County Department of Public Works, Watershed and Ecosystem Services, Annapolis, Maryland. 35 pp., plus Appendices.

USEPA. United States Environmental Protection Agency. 2002. *Urban Stormwater BMP Performance Monitoring: A Guidance Manual for Meeting the National Stormwater BMP Database Requirements*. EPA-821-B-02-001.

Victoria, C.J., J. Markusic, J. Stribling, and B. Jessup. 2010. Aquatic Biological Assessment of the Watersheds of Anne Arundel County, Maryland: 2008. Anne Arundel County Department of Public Works, Watershed, Ecosystem, and Restoration Services, Annapolis, Maryland.

Victoria, C.J, and J. Markusic. 2007. Aquatic Biological Assessment of the Watersheds of Anne Arundel County, Maryland: 2004. Anne Arundel County, Department of Public Works, Watershed and Ecosystems Services Group, Annapolis, Maryland. 31 pp, plus Appendices.

CHEMICAL, BIOLOGICAL, AND PHYSICAL CHARACTERIZATION OF THE CHURCH CREEK AND PAROLE PLAZA NPDES MONITORING STATIONS: 2013 - 2014

Prepared for

Anne Arundel County
Department of Public Works
Watershed Protection and Restoration Program
2662 Riva Road
Annapolis, MD 21401

Prepared by

Versar, Inc.
9200 Rumsey Road
Columbia, MD 21045

VERSAR

September 2014

TABLE OF CONTENTS

Page

1 INTRODUCTION 1-1

2 METHODS 2-1
2.1 CHEMICAL MONITORING 2-1
2.1.1 Monitoring Sites 2-1
2.1.2 Water Sample Collection and Data Analysis 2-2
2.1.3 Monitoring Station Maintenance 2-7
2.2 BIOLOGICAL MONITORING 2-9
2.2.1 Sampling Locations 2-9
2.2.2 Stream Habitat Evaluation 2-10
2.2.3 Water Quality Measurement 2-12
2.2.4 Biological Sample Collection 2-12
2.2.5 Biological Sample Processing and Identification 2-13
2.2.6 Biological Data Analysis 2-13
2.3 PHYSICAL MONITORING 2-15
2.3.1 Monitoring Sites 2-15
2.3.2 Physical Data Collection and Analysis 2-15
2.4 LAND USE AND STORMWATER MANAGEMENT ASSESSMENT 2-17
2.4.1 Church Creek Watershed Land Use 2-17
2.4.2 Church Creek Watershed Stormwater BMPs 2-19

3 RESULTS 3-1
3.1 POLLUTANT CONCENTRATIONS 3-1
3.2 EVENT MEAN CONCENTRATIONS AND POLLUTANT LOADINGS 3-3
3.3 BIOLOGICAL ASSESSMENT 3-4
3.4 GEOMORPHIC ASSESSMENT 3-6

4 DISCUSSION 4-1
4.1 WATER CHEMISTRY 4-1
4.2 PHYSICAL HABITAT AND BIOLOGICAL CONDITIONS 4-13
4.3 GEOMORPHIC CONDITIONS 4-16

5 REFERENCES 5-1

APPENDICES

A STORM EVENT HYDROGRAPHS, NARRATIVES AND COMPOSITE SAMPLING METHOD TECHNICAL MEMORANDUM A-1
B MASTER TAXA LIST B-1
C BIOLOGICAL ASSESSMENT RESULTS C-1
D QA/QC INFORMATION D-1

TABLE OF CONTENTS (CONTINUED)

Page

E ROSGEN CLASSIFICATION SCHEME E-1
F GEOMORPHOLOGICAL DATA F-1
G CHEMICAL MONITORING RESULTS G-1
H BMP ACRONYMS H-1

I:\WPShared\DEPT.74\Anne Arundel\Church Creek\15457\15457-R.doc

LIST OF TABLES

Table No. **Page**

2-1. Drainage areas and site locations of monitoring stations in Church Creek watershed 2-1
2-2. Land use summary for the monitoring stations in the Church Creek subwatershed 2-2
2-3. Analytes, detection limits, and analytical methods for the Church Creek and Parole Plaza Monitoring stations 2-2
2-4. Rainfall data for sampled storm and baseflow events 2-5
2-5. Maryland Biological Stream Survey PHI scoring 2-10
2-6. EPA Rapid Bioassessment Protocol (RBP) scoring 2-12
2-7. Maryland COMAR Water Quality Standards for Use I Streams 2-12
2-8. Biological condition scoring for the coastal plains metrics 2-14
2-9. Maryland Biological Stream Survey BIBI scoring 2-15
2-10. Rosgen stream classification types 2-16
2-11. Church Creek BMP overview 2-20
3-1. The percentage of non-detects by parameter 3-1
3-2. Maximum dry weather values observed during sampling period 3-2
3-3. Maximum wet weather values observed during sampling period 3-2
3-4. Storm dates for wet weather maximum values 3-3
3-5. Average EMCs observed during July 2013 to June 2014 3-4
3-6. Estimated pollutant loadings for observed events, in pounds, for the July 2013 to June 2014 sampling period 3-4
3-7. PHI and RBP physical habitat assessment results - 2014 3-5
3-8. Benthic macroinvertebrate assessment results - 2014 3-5
3-9. *In situ* water quality results - 2014 3-6
4-1. State and Federal water quality criteria available for parameters sampled at Church Creek 4-1
4-2. Maximum concentrations observed for baseflow samples compared to appropriate criteria 4-2
4-3. Maximum concentrations observed for wet weather samples compared to appropriate criteria 4-2
4-4. Percentage of all wet weather samples that exceed appropriate criteria 4-4
4-5. Annual average event mean concentrations and criteria (parameters that exceeded appropriate criteria are indicated) 4-4

LIST OF TABLES (CONTINUED)

Table No. **Page**

4-6. Total annual loading rates, in pounds, observed at the Parole Plaza Sampling Station from 2002 to 2014 4-5
4-7. Loading rates, in pounds, observed at the Church Creek Sampling Station from 2002 to 2014 4-5
4-8. Seasonal loading rates, in pounds, observed at the Church Creek and Parole Plaza sampling stations in 2014 4-6
4-9. PHI scores from 2006 to 2014 4-13
4-10. BIBI scores from 2006 to 2014 4-15
4-11. Past Rosgen classifications 4-16
4-12. Summary of cross sectional area changes over time. 4-20

LIST OF FIGURES

Figure No. **Page**

2-1. Church Creek study area and stream monitoring locations 2-11
2-2. Church Creek BMPs 2-18
4-1. Parole station long-term monitoring: annual EMCs (TKN, NO_2+NO_3, TP, TPH; mg/L) 4-7
4-2. Parole station long-term monitoring: annual EMCs (Cu, Pb, Zn; mg/L) 4-8
4-3. Parole station long-term monitoring: annual EMCs (TSS; mg/L) 4-8
4-4. Parole station long-term monitoring: annual EMCs (BOD_5; mg/L) 4-9
4-5. Parole station long-term monitoring: annual EMCs (*E. coli*; MPN/100 mL) 4-9
4-6. Church Creek station long-term monitoring: annual EMCs (TKN, NO_2+NO_3, TP, TPH; mg/L) 4-10
4-7. Church Creek station: long-term monitoring: annual EMCs (Cu, Pb, Zn; mg/L) 4-11
4-8. Church Creek station long-term monitoring: annual EMCs (TSS; mg/L) 4-11
4-9. Church Creek station long-term monitoring: annual EMCs (BOD_5; mg/L) 4-12
4-10. Church Creek station long-term monitoring: annual EMCs (*E. coli*; MPN/ 100 mL) 4-12
4-11. Comparison of PHI scores from 2006 to 2014 4-14
4-12. Comparison of BIBI scores from 2006 to 2014 4-15
4-13. Comparison of bankfull channel cross sectional area to drainage area 4-17
4-14. Comparison of mean bankfull depth to drainage area 4-18
4-15. Comparison of bankfull width to drainage area 4-19

1 INTRODUCTION

In 1998, Anne Arundel County began implementing a long-term monitoring program that satisfies requirements for its Countywide National Pollutant Discharge Elimination System (NPDES) Municipal Separate Storm Sewer System Discharge Permit. Monitoring has continued to be required as part of the terms of each renewed permit. Currently, monitoring is required to satisfy conditions outlined in Section F: Assessment of Controls of the County's new permit issued in February 2014. The monitoring program includes chemical, biological, and physical monitoring in the Church Creek subwatershed located within the larger South River watershed. This document describes the monitoring effort undertaken from July 2013 through June 2014.

Biological and physical monitoring take place at monumented locations along the study reach, as described in more detail below. The chemical monitoring activities take place at two stations in the Church Creek subwatershed:

- Downstream of two high-imperviousness, commercial land use outfalls, called the Parole Plaza monitoring station
- An instream station downstream of the Route 2 culvert, called the Church Creek monitoring station

The basic permit requirements for storm event monitoring include sampling a target of 12 storms per year (three in each quarter) that are characterized by three representative (rising, peak, and falling limbs of the hydrograph) discrete samples per storm event, the collection of baseflow samples during extended dry periods, laboratory analysis of water quality parameters specified in the permit, biological and physical characterizations of the study reach, and continuous flow monitoring.

The County is interested in determining the extent to which the redevelopment of the Parole Plaza site (now known as the Annapolis Towne Centre at Parole) has affected the quality of the stormwater effluent from the site. Construction began in 2004, and the bulk of the site work was completed in late 2008.

2 METHODS

2.1 CHEMICAL MONITORING

During the 2014 sampling period, July 2013 through June 2014, seven storm events were sampled and five baseflow samples were collected and analyzed. This section describes the equipment and techniques used in this sampling program. It includes discussions of sample collection, sample analysis, flow data collection, and basin rainfall characterization. A summary of maintenance activities is also included. Data and quarterly data reports (Versar, Inc., 2014a, 2014b, and 2014c) were used to prepare this annual summary report.

2.1.1 Monitoring Sites

The long-term chemical monitoring program is performed at one outfall station, Parole Plaza, and one instream station, Church Creek. The two stations are described below:

Parole Monitoring Station. This station is a restoration station located at the head of the Parole Tributary to Church Creek. There are two outfalls draining to the sampling station. The first is a 60" corrugated metal pipe (CMP) that has been the historical sampling location for the monitoring of this station. The second is a 54" reinforced concrete pipe (RCP) that was connected to the drainage network during the summer of 2007.

Church Creek Monitoring Station. This station is an instream station on the mainstem of Church Creek. It is located approximately 500 feet downstream of the confluence of the tributary that carries the runoff from the Parole Plaza monitoring station. The samples are collected in the 96" CMP culvert that carries Church Creek underneath Maryland State Highway 2 (Solomons Island Road). Currently, the bottom of this culvert is lined with concrete that extends 1.8 feet in height up the sides of the corrugated metal culvert.

Location information and land use data were taken from the *Annapolis Towne Centre @ Parole Stormwater Management Report* (Greenhorne & O'Mara 2005), and summarized for each site in Tables 2-1 and 2-2.

Table 2-1. Drainage areas and site locations of monitoring stations in Church Creek watershed

Monitoring Station	Station Type	Location	Area (acres)
Parole Plaza	Restoration/Outfall	Southwest corner of Forest Drive and MD State Highway 2	60.41
Church Creek	Instream	Downstream (east) of MD State Highway 2	279.09

Table 2-2. Land use summary for the monitoring stations in the Church Creek subwatershed				
Land Use	**Land Use Area (acres)**		**Percent of Total Acreage**	
	Parole Plaza	**Church Creek**	**Parole Plaza**	**Church Creek**
Impervious	52.81	191.37	87.4	68.6
Open Space	7.60	87.72	12.6	31.4
TOTAL	**60.41**	**279.09**	**100**	**100**

2.1.2 Water Sample Collection and Data Analysis

The sample period for this reporting cycle extended from July 2013 through June 2014. Samples are analyzed for the presence of the pollutants listed in Table 2-3.

Table 2-3. Analytes, detection limits, and analytical methods for the Church Creek and Parole Plaza Monitoring stations		
Parameter	**Detection Limit (mg/L)**	**Analytical Method**
Biochemical Oxygen Demand (5 Day)	4.0	SM 5210 B-01
Total Kheldahl Nitrogen	0.5	SM 4500-NH3 C97
Nitrate + Nitrite	0.05	SM 4500-NO3 H00
Total Phosphorus	0.01	SM 4500-P E99
Total Suspended Sediments	1.0	SM 2540 D-97
Total Copper	0.002	EPA 200.8
Total Lead	0.002	EPA 200.8
Total Zinc	0.02	EPA 200.8
Total Petroleum Hydrocarbons	5.0	EPA 1664
E. coli (MPN/100 ml)	10.0	SM 9223B
Hardness	1.0	SM 2340 C

During the sampling period, seven storm samples and five baseflow samples were collected. Baseflow samples were taken in lieu of storm samples for the following reasons:

- August 28, 2013 - Versar field staff set up to monitor the storm event, but only 0.02" of rain fell. Since it was the end of the second month of the summer quarter with no successful events captured, and there had been less than 0.05" of rain that day, baseflow samples were collected instead. At time of arrival (late morning), Church Creek was exhibiting baseflow conditions and Parole Plaza had a small discharge

from both pipes. It had rained 0.02 inches earlier in the day, thus providing enough water to represent the CMP in the baseflow sample. Since both pipes had approximately 0.02 feet of level, a 50 percent composite was collected at both sites. A baseflow sample was collected from Church Creek as well.

- September 27, 2013 - Total rainfall for the month of September was 1.99", which is below average. Rainfall in September primarily occurred on September 12 which was a monitored storm event and on September 22 when no staff were available to monitor the storm. With only a few days left in September, field staff obtained a baseflow sample to represent the September event. Versar personnel arrived at the sites at approximately 10:30 a.m. At the time of arrival, Church Creek was exhibiting baseflow conditions and Parole Plaza had a small discharge coming from the 54" RCP outfall; the 60" CMP was dry. A baseflow sample was collected from Church Creek and the 54" RCP outfall at Parole Plaza.

- March 6, 2014 - Rainfall amounts which included rain, snow, wintry mix, and snow melt for the months of January, February, and March totaled 9.72." During January, there was snowfall on January 3 followed by rain on January 5 which aided in melting the snow. The 72-hour dry time allowed Versar to attempt monitoring a storm on January 11 but was not successful. After January 11 a runoff event (either rain, snow or snow melt) took place every other day, which did not permit staff to attempt another monitoring event until February 3 (which also was unsuccessful). Several snow events, snow melts, and false starts for storm and baseflow sample collection took place in February; however, as of March 6 there had been no sample collection for the winter quarter. Therefore, Versar staff decided to collect baseflow samples from each site on March 6. Versar personnel arrived at the sites at approximately 11:00 a.m. At the time of arrival, Church Creek was exhibiting baseflow conditions with a level of 0.640 feet. However Parole Plaza was not exhibiting "normal" baseflow conditions; both pipes had a small amount of discharge. A baseflow sample was collected from Church Creek and a composite sample was collected from the 54" RCP outfall and the 60" CMP outfall at Parole Plaza. The 54" RCP outfall level was 0.04 feet and the 60" CMP outfall level was 0.01 feet; therefore, 80% of the sample volume came from the 54" RCP outfall and 20% of the volume came from the 60" CMP outfall.

- March 18, 2014 - With only a half of a month left in the quarter, another false start occurring on March 12, and more snow on March 16, field staff obtained a second set of baseflow samples to represent the winter quarter. Even though the snow event took place two days before, the temperatures were cold enough that there wasn't appreciable snow melt at the time of sample collection. Versar personnel arrived at the sites at approximately 2:00 p.m. to collect the samples. At the time of arrival, Church Creek was exhibiting baseflow conditions with a level of 0.640 feet. However, Parole Plaza was not exhibiting "normal" baseflow conditions; both pipes had a small amount of discharge. A baseflow sample was collected from Church Creek and a composite sample was collected from the 54" RCP outfall and the 60" CMP outfall at Parole

Plaza. The 54" RCP outfall level was 0.06 feet and the 60" CMP outfall level was 0.10 feet; therefore, roughly 40% of the sample volume came from 54" RCP outfall and 60% of the volume came from the 60" CMP outfall.

- March 28, 2014 - Rain was predicted for Friday March 28 and the entire weekend. A Versar field crew prepared to sample the smaller event on Friday since the event over the weekend was forecast to be well-above the duration time upper limit of 16.5 hours. Versar arrived at the site at approximately 10 a.m. to prepare for sampling. At approximately 1 p.m. Versar's weather staff notified the field team that the last of the rain was coming through the Annapolis area. Unfortunately, the amount was less than the minimum criterion of 0.1 inches of rain; therefore, no storm sampling took place. Since it was at the end of the month and the rainfall did not exceed the 0.05" requirement for dry time, Versar collected baseflow samples. At 1:35 p.m., Church Creek was exhibiting baseflow conditions with a level of 0.605 feet. However Parole Plaza was not exhibiting "normal" baseflow conditions; both pipes had a small amount of discharge. A baseflow sample was collected from Church Creek and a composite sample was collected from the 54" RCP outfall and the 60" CMP outfall at Parole Plaza. The 54" RCP outfall level was 0.07 feet and the 60" CMP outfall level was 0.08 feet; therefore, roughly 50% of the volume comprising the sample was obtained from each pipe.

Below is a discussion of the storm events that were sampled during the monitoring period. Additional discussion of each event can be found in Appendix A.

- September 12, 2013 - The total rainfall for this event was 0.84" and lasted approximately 2 hours, based on data from the Church Creek rain gauge.

- October 7, 2013 - The total rainfall for this event was 0.64" and lasted approximately 7 hours, based on data from the Church Creek rain gauge.

- December 6, 2013 - This storm represents the November storm event since Versar staff were not able to sample the November 26th storm due to the holiday weekend. The total rainfall for this event was 0.61" and lasted approximately 10 hours, based on data from the Church Creek rain gauge.

- December 23, 2013 - The total rainfall for this event was 0.43" and lasted approximately 12 hours, based on data from the Church Creek rain gauge.

- April 7, 2014 - The total rainfall for this event was 0.29" and lasted approximately 12 hours, based on data from the Church Creek rain gauge.

- May 27, 2014 - The total rainfall for this event was 0.58" and lasted approximately 3 hours, based on data from Weather Underground weather station KMDANNAP17, which is located in Broad Creek, MD. This gauge was used because the ISCO that is

connected to the rain gauge at the Church Creek station had no power during the event, therefore temperature, conductivity, pH, and rainfall was not continuously recorded. At the Church Creek station, pH and conductivity were measured using an *In situ* from the Parole Plaza station after the samples were collected; however, temperature was not measured due to the likely change in the water sample temperature after being stored outside of the stream for an extended period of time.

- June 19, 2014 - The total rainfall for this event was 0.23" and lasted approximately 3 hours, based on data from the Church Creek rain gauge.

A total of 37.93 inches of precipitation was recorded at the Church Creek Station during the 2014 reporting period. This does not include any rainfall that occurred while the station was powered down during late May and early June. Rainfall was measured using a tipping bucket rain gage located at the Church Creek Station. Table 2-4 lists the total rainfall for each sampled event. Hydrographs are provided in Appendix A. These data, along with stream level readings collected at 5 minute intervals from a permanently mounted pressure transducer, were logged into an ISCO 6712FR automated sampler.

Table 2-4. Rainfall data for sampled storm and baseflow events

Date	Rainfall (inches)
28 August 2013	0.00 (Baseflow)
12 September 2013	0.84
27 September 2013	0.00 (Baseflow)
7 October 2013	0.64
6 December 2013	0.61
23 December 2013	0.43
6 March 2014	0.00 (Baseflow)
18 March 2014	0.00 (Baseflow)
28 March 2014	0.00 (Baseflow)
7 April 2014	0.29
27 May 2014	0.58
19 June 2014	0.23

The ISCO sampler located at the Church Creek station is configured to hold 24 one-liter polyethylene bottles, and can be used to collect samples directly from the 96" CMP. However, this station is generally manned for the entire duration of each event. Therefore, samples are typically taken as grabs from the culvert outfall. Total petroleum hydrocarbon and *E. coli* samples are always collected as manual grab samples. The grab sample location is approximately six feet downstream of the intake for the automated sampler and samples should be equivalent in concentrations. When personnel leave the site during an event, the sampler is programmed to collect discrete, four-bottle (four-liter) samples at fixed time intervals. These intervals are based

upon observations of the unique storm response characteristics of each watershed and the anticipated event duration to ensure that samples are distributed to characterize the typical storm as accurately as possible.

When the 54" RCP came online at Parole Plaza in the summer of 2007, portions of the drainage that had historically been passing through the 60" CMP began flowing through the new pipe. In order to maintain consistency in the characterization of the watershed, it was determined that samples were required from both pipes. Pressure transducers were permanently mounted in the 60" CMP and 54" RCP. These measured flow depth at 5-minute intervals, and stored data for up to three months. Data were downloaded bi-weekly. Stage/discharge relationships were prepared for each pipe, to determine the discharge from the pipes based on field-measured depths. The relationships were based on a combination of field measurements and modeled values. The model was necessary in order to characterize major storm events where measured values were not currently available. The rating tables are included in Appendix A.

A spreadsheet was developed to allow the field sampling crews to input field-measured level data. The spreadsheet interpolated the corresponding flow from the rating curves developed as described above. The flows from the 60" CMP and the 54" RCP were totaled and the resulting combined hydrograph for each event was plotted real-time. This method allowed the field crews to determine when the rising, peak, and falling limbs for the combined hydrograph occurred. The spreadsheet also calculated the percentage of the combined flow that each pipe was contributing. Using volumetric containers, the sampling team prepared composite samples using these percentages, and distributed them to the sample containers. A Technical Memorandum describing the sampling procedures in detail was submitted to the Maryland Department of the Environment in May 2008, and is included in Appendix A.

Water quality instruments for measuring pH, temperature, and conductivity were used at both stations. At Parole, an In-Situ Troll 9500 unit mounted within each pipe was used to obtain measurements during storm events; providing measurements every 5 minutes. Measurements for these parameters were not available when personnel were not present due to the low flow conditions at this station. Permanently installed probes would likely dry out and need to be replaced often, thus these units are engaged only during storm events. At the Church Creek Station, a YSI 600 XL multiparameter sonde was permanently mounted within the culvert and was connected directly to the ISCO automated sampler; providing measurements every 5 minutes. This unit operates continuously.

Samples were distributed into bottles provided by Martel Laboratories JDS, Inc., and Chesapeake Environmental Lab, Inc. All *E. coli* samples were delivered to the Chesapeake Environmental Lab for processing within six hours of being collected, and all other samples were delivered to Martel Laboratories JDS within 48 hours.

Event Mean Concentrations (EMCs) for each parameter were calculated for each storm and applied to total stormflow discharges to calculate stormflow pollutant loads for each site. An EMC is a statistical parameter used to represent the flow-weighted average concentration of a given parameter during a storm event (USEPA 2002). The EMC for a storm event where discrete

samples have been collected (i.e., samples collected during the rise, peak, and falling limb of a storm event), was calculated using the following formula:

$$EMC = \frac{\sum_{i=1}^{n} V_i C_i}{\sum_{i=1}^{n} V_i}$$

where,

V: volume of flow during period *i*, which is determined from the interval associated with the samples collected during each limb
C: analytical result associated with period *i*
n: total number of limbs taken during event

The stormflow pollutant load for each parameter was calculated as:

$$Load = EMC_j V_j$$

where,

V: total volume of flow during period *j* (entire storm event).

Average annual EMCs were calculated by taking the arithmetic average of separate EMCs calculated when non-detects were set to zero and when non-detects were set to the detection limit. Since the true concentration of non-detect samples falls somewhere between the detection limit and the null value, this calculation represents a more accurate estimate than using EMCs with non-detects set to either zero or the detection limit. Seasonal loads (also referred to as quarterly loads) for monitored events were calculated by summing all monitored event loads for a specific season. Total seasonal loads were calculated by multiplying the average seasonal EMC by the total volume for the season. Annual loads were calculated by summing all seasonal loads.

2.1.3 Monitoring Station Maintenance

Maintenance was conducted at each sampling station on a biweekly basis. Maintenance included calibration of all probes, inspection of the sampling equipment, intake lines, and programming, and an overall cleaning and organization of the stations. A few issues concerning the replacement of monitoring equipment and the loss of data occurred during the monitoring period; below is a summary of these issues:

- On August 6, staff noticed the Global Water logger in the RCP at Parole Plaza was reading negative numbers frequently and therefore scheduled a calibration visit. On September 12, staff calibrated the logger before the storm event. During the storm event, field staff noted that the actual level as measured with a ruler was greater than the logger value. The day after the storm event, Versar staff noted that the logger was still reading negative numbers and calibrated the logger once again. At this time a tear in the logger's sensor wire was also noted and reported to Anne Arundel County.

After evaluating the problem, Versar and County staff agreed that a purchase of a new Global Water logger for this pipe was warranted.

ISCO sampler and Global Water WL-16 logger data were downloaded during each maintenance visit and were provided with the summer 2013 quarterly report (Versar 2014a) as Excel files "Church Creek Continuous Flow Data_07-09_13" and "Parole Plaza Continuous Flow Data_07-09_13." In the file labeled "Parole Plaza Continuous Flow Data_07-09_13" there is spreadsheet with raw data that shows the frequent occurrence of negative level values recorded by the malfunctioning logger in the RCP pipe. The columns in green are instances of satisfactory data collection. Yellow columns correspond to questionable data and red columns represent inaccurate data. Data in the yellow and red columns were replaced with corrected data that were calculated by applying a correction curve. The correction curve was prepared by plotting CMP level versus RCP level from storm events where both data sets were known to be correct. The corrected RCP data were obtained by using the correction curve equation, which was determined using a SAS curve-fitting program. Resulting RCP levels that were 0 or less were replaced with an assumed baseflow value of 0.02 ft. Included in these same files are the storm hydrographs for each site.

- County staff agreed that a purchase of a new Global Water logger for the RCP pipe was necessary; however, it was not installed until November 22 due to time needed to ship and calibrate the new equipment. Flow conditions prior to November 22 were estimated by applying a correction curve. However, during the storm of October 7, field staff noted the actual level with a ruler during sample collections to make a hydrograph. During several routine maintenance visits after the installation of the new logger, Versar staff noticed that the logger was reading 0.0 feet when physical measurements with the ruler showed 0.02 feet. After discussions with the County, Versar assigned a baseflow level reading of 0.02 feet for those instances where electronic level measurements of 0.0 feet were recorded. Subsequently, loggers were recalibrated to add a fixed offset of 0.02 feet for baseflow level readings.

- The Global Water logger in the CMP at Parole Plaza lost battery power on December 16 at 3:27; field staff replaced the batteries on December 22 at 22:31 before the storm. During an attempted January storm, data from the CMP and RCP files were accidently deleted by Versar staff, therefore no data are available for the remainder of the year (December 23 – 31).

- On January 8, the Global Water logger in the RCP at Parole Plaza was recalibrated to a fixed offset of 0.02 feet to represent normal baseflow level readings. During an attempted January storm, data from the CMP and RCP files were accidently deleted by Versar staff, therefore no data are available from December 23 – January 8. The Global Water logger in the CMP at Parole Plaza lost battery power on February 2 at 13:40. After trouble-shooting the problem the batteries were replaced on February 20 at 16:10. On February 28 at 1:00 until 12:20 and again that evening at 18:15 until the next day at 12:20, the Global Water logger in the CMP pipe recorded very high level

readings because of low temperatures ranging from 34-36 degrees Fahrenheit (highlighted in red in the data file provided with the winter 2014 quarterly report (Versar 2014c)). Several times throughout the quarter at Church Creek, especially late night into the early hours of the morning, temperatures were low which caused the depth to fall below average level for the stream (*highlighted* in blue in the data file). During routine maintenance on January 29 at Church Creek, field staff noticed an inch of ice had accumulated on the top layer of the stream, which caused the level transducer to measure a level of -0.3 feet. Field staff broke up the ice and recalibrated the transducer to the correct level of 0.56 feet. The level transducer was inspected carefully during each visit thereafter for damage and to assure accuracy.

- On April 24 the global logger in the CMP at Parole Plaza was calibrated from 9:40 until 10:00 due to loss of calibration.

- Starting on May 26 the ISCO sampler at the Church Creek station began to have power issues, which caused it to lose data intermittently until May 27, when it completely lost power during a storm event. Manual readings were taken during the event in order to obtain a storm hydrograph. On June 5 the power was supplied by a battery; however, the technician accidently forgot to run the program, therefore no data was collected until Versar technicians visited the station for routine maintenance on June 11.

2.2 BIOLOGICAL MONITORING

All biological assessment data were collected in accordance with the Anne Arundel County Biological Monitoring and Assessment Program: Quality Assurance Project Plan (Anne Arundel County 2010), which incorporates many elements of Maryland Department of Natural Resources' Maryland Biological Stream Survey (MBSS). Geomorphic assessment data were collected in accordance with the standard operating procedures (SOPs) approved for the County's NPDES Program. All methods are consistent with previous years' methods (with applicable updates) to ensure data comparability between years. Collection methods are summarized below. Field data were collected in 2014 by Versar, Inc., a consultant to Anne Arundel County.

2.2.1 Sampling Locations

The study area is located in the northern portion of the Church Creek subwatershed, within the larger South River watershed in Anne Arundel County, Maryland (Figure 2-1). A total of four 75-meter biological monitoring sites are positioned along the study reach and are monitored annually. Three sites were established and first monitored in 2006; one site is located on the Parole Plaza Tributary just below Forest Drive, and two sites are located along the Church Creek mainstem, on either side of Solomons Island Road (Maryland State Highway 2). A fourth

site, located just upstream of the confluence with the Parole Plaza Tributary, was added in 2007 to monitor the effects of runoff from the Festival at Riva shopping center.

2.2.2 Stream Habitat Evaluation

To support the biological monitoring, a visual assessment of physical habitat was completed at each monitoring site to evaluate the reach's ability to support aquatic life. Both the MBSS's Physical Habitat Index (PHI; Paul et al. 2003) and the EPA's Rapid Bioassessment Protocol (RBP) habitat assessment for high gradient streams (Barbour et al. 1999) were used to visually assess the physical habitat at each site in conjunction with the spring benthic monitoring. Both habitat assessments consist of a review of biologically significant habitat parameters that evaluate a stream's ability to support an acceptable level of biological health.

To calculate PHI at each site, six parameters were given a numerical score and a categorical rating: instream habitat, epibenthic substrate, remoteness, instream woody debris and rootwads, shading, and bank stability. The raw scores are then transformed into a scaled score (0-100 scale) as described in Paul et al. (2003), and the six scaled scores are averaged into an aggregate final PHI score. Narrative condition descriptions and scoring ranges for the PHI are displayed in Table 2-5.

Table 2-5. Maryland Biological Stream Survey PHI scoring

Score	Narrative
81-100	Minimally Degraded
66-80.9	Partially Degraded
51-65.9	Degraded
0-50.9	Severely Degraded

The Rapid Bioassessment Protocol (RBP) habitat assessment consists of a review of ten biologically significant habitat parameters that assess a stream's ability to support an acceptable level of biological health: Epifaunal substrate/available cover, Embeddedness, Velocity/depth regime, Sediment deposition, Channel flow status, Channel alteration, Frequency of riffles/ bends, Bank stability, Vegetative protection, and Riparian vegetative zone width. In the field, each parameter was given a numerical score from 0-20 (20=best, 0=worst), or 0-10 (10=best, 0=worst) for individual bank parameters, and a categorical rating of optimal, suboptimal, marginal or poor (Barbour et al. 1999). Overall habitat quality typically increases as the total score for each site increases. The individual RBP habitat parameters for each reach were summed to obtain an overall RBP assessment score. Because adequate reference conditions currently do not exist for Anne Arundel County, the percent comparability was calculated based on western coastal plain reference site conditions obtained from work done in Prince George's County streams (Stribling et al. 1999). The percent of reference score, or percent comparability score, was then used to place each site into corresponding narrative rating categories. The ranges are shown in Table 2-6.

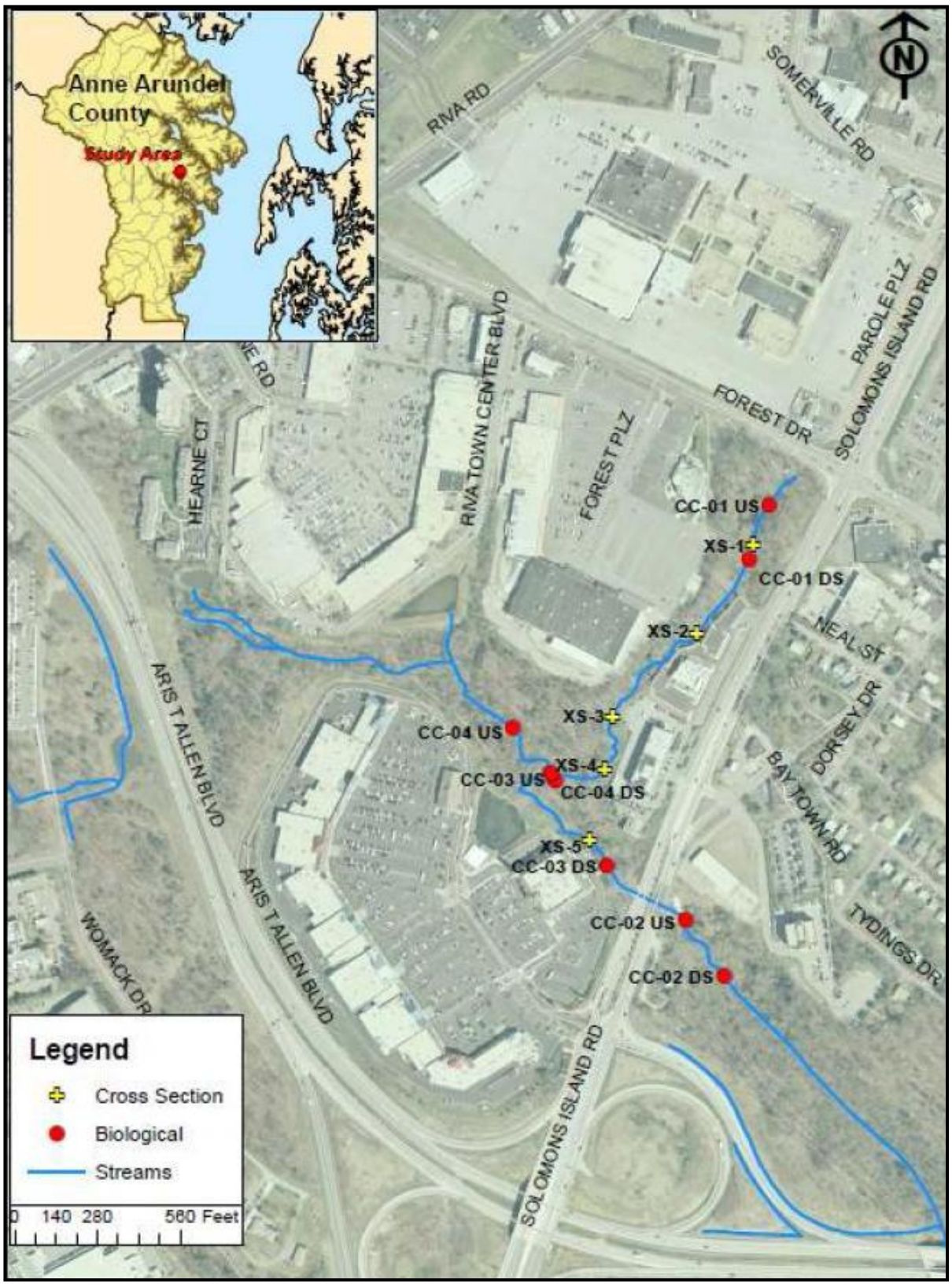


Figure 2-1. Church Creek study area and stream monitoring locations

Table 2-6. EPA Rapid Bioassessment Protocol (RBP) scoring	
Percent of Reference Score	**Narrative**
90 - 100	Comparable to Reference
75.1 - 89.9	Supporting
60.1 - 75	Partially Supporting
0 - 60	Non-Supporting

2.2.3 Water Quality Measurement

In situ water quality was measured at each site with a YSI 6820 multiparameter water quality sonde. Turbidity was measured once at the upstream end of the site, all other parameters were measured from three locations within each sampling reach (upstream end, mid-point, and downstream end) and results were averaged to minimize variability and better represent water quality conditions throughout the entire sampling reach. Data were compared to the standards listed in the Code of Maryland Regulations (COMAR) 26.08.02.03-3 – Water Quality (MDE, 2010) and shown in Table 2-7.

Table 2-7. Maryland COMAR Water Quality Standards for Use I Streams	
Parameter	**Standard**
pH	6.5 to 8.5
Dissolved Oxygen (mg/L)	Minimum of 5 mg/L
Conductivity (µS/cm)	No existing standard
Turbidity (NTU)	Maximum of 150 NTU and maximum monthly average of 50 NTU
Temperature (°C)	Maximum of 32 °C (90 °F) or ambient temperature, whichever is greater
Source: Code of Maryland Regulations (COMAR) 26.08.02.03-3-Water Quality	

2.2.4 Biological Sample Collection

Benthic macroinvertebrate samples were collected in March 2014 following the MBSS Spring index period protocols (DNR, 2010) and as specified in *Anne Arundel County Biological Monitoring and Assessment Program: Quality Assurance Project Plan* (QAPP; Anne Arundel County 2010). This methodology emphasizes the community composition and relative abundance of benthic macroinvertebrates inhabiting the most taxonomically diverse, or productive, instream habitats. In this sampling approach, a total of twenty jabs are distributed among the most productive habitats present within the 75-meter reach and sampled in proportion to their occurrence within the segment. The most productive stream habitats are riffles followed by root-wads, rootmats and woody debris and associated snag habitat; leaf packs; submerged macrophytes and associated substrate; and undercut banks. Other less preferred habitats include gravel, broken peat, clay lumps and detrital or sand areas in runs; however, of the aforementioned habitat types, those that are located within moving water are preferred over those in still water.

2.2.5 Biological Sample Processing and Identification

Benthic macroinvertebrate samples were processed and subsampled according to Maryland Biological Stream Survey methods described in the MBSS laboratory methods manual (Boward and Freidman, 2000) and as briefly summarized in the Anne Arundel County Biological Monitoring and Assessment Program: Quality Assurance Project Plan (Anne Arundel County 2010). Subsampling is conducted to standardize the sample size and reduce variation caused by field collection methods. In brief, the sample was washed of preservative in a 0.595 mm screen and spread evenly across a tray comprised of 100 numbered 5cm x 5cm grids. A random number between one and 100 was selected and the selected gird was picked entirely of macroinvertebrates under a bright light source. This process was repeated until a count of 120 was reached. The 120 organism target was used following MBSS methods to allow for specimens that are missing parts or are early instars, which cannot be properly identified.

The samples were taxonomically identified by Versar taxonomists certified by the Society for Freshwater Science (SFS) (formerly known as the North American Benthological Society, NABS). The taxonomic hierarchical level for most organisms was genus level when possible with the exception of Oligochaeta, which were identified to the family level. Early instars or damaged specimens were identified to the lowest possible level. Oligochaeta and Chironomidae specimens were permanently slide mounted for identification. Counts and identifications were recorded on a laboratory bench sheet and entered into a master database for analysis. A list of all taxa identified is provided in Appendix B: Master Taxa List.

2.2.6 Biological Data Analysis

Benthic macroinvertebrate data were analyzed using methods developed by MBSS as outlined in the *New Biological Indicators to Better Assess the Condition of Maryland Streams* (Southerland et al. 2005). The Benthic Index of Biotic Integrity (BIBI) approach involves statistical analysis using metrics that have a predictable response to water quality and/or habitat impairment. The metrics selected fall into five major groups including taxa richness, composition measures, tolerance to perturbation, trophic classification, and habit measures. Tolerance values were obtained from Bressler et al. (2005).

Raw values from each metric are given a score of 1, 3 or 5 based on ranges of values developed for each metric. The results are combined into a scaled BIBI score ranging from 1.0 to 5.0 and a corresponding narrative rating is assigned. Table 2-8 shows the thresholds for the determination of the metric scoring. Three sets of metric calculations have been developed for Maryland streams based on broad physiographic regions: Coastal Plain, Piedmont and Combined Highlands. The Coastal Plain and Piedmont regions are divided by the Fall Line. The current study area is located within the Coastal Plain region. The metrics calculated for Coastal Plain streams are as follows:

> ***Total Number of Taxa*** – Equals the richness of the community in terms of the total number of genera at the genus level or higher. A large variety of genera typically indicate better overall water quality, habitat diversity and/or suitability, and community health.

Number of EPT Taxa – Equals the richness of genera within the Ephemeroptera (mayflies), Plecoptera (stoneflies), and Trichoptera (caddisflies). EPT taxa are generally considered pollution sensitive, thus higher levels of EPT taxa would be indicative of higher water quality.

Number of Ephemeroptera Taxa – Equals the total number Ephemeroptera Taxa in the sample. Ephemeroptera are generally considered pollution sensitive, thus communities dominated by Ephemeroptera usually indicate lower disturbances in water quality.

Percent Intolerant Urban – Percentage of sample considered intolerant to urbanization. Equals the percentage of individuals in the sample with a tolerance value of 0-3 out of 10. As impairment increases the percent of intolerant taxa decreases.

Percent Ephemeroptera – Equals the percent of Ephemeroptera individuals in the sample. Ephemeroptera are generally considered pollution sensitive, thus communities dominated by Ephemeroptera usually indicate lower disturbances in water quality.

Number Scraper Taxa – Equals the number of scraper taxa in the sample, those taxa that scrape food from the substrate. As the levels of stressors or pollution rise there is an expected decrease in the numbers of Scraper taxa.

Percent Climbers – Equals the percentage of the total number of individuals who are adapted to living on stem type surfaces. Higher percentages of climbers typically represent a decrease in stressors and overall better water quality.

All of the metric scores are summed and then averaged to obtain the final BIBI score. Table 2-8 shows the scores and narrative rankings of the MBSS BIBI. The biological assessment results are included in Appendix C. The QA/QC information is included in Appendix D.

Table 2-8. Biological condition scoring for the coastal plains metrics

Metric	Score		
	5	**3**	**1**
Total Number of Taxa	≥ 22	14-21	< 14
Number of EPT Taxa	≥ 5	2-4	< 2
Number of Ephemeroptera Taxa	≥ 2	1.9-1.0	< 1.0
Percent Intolerant Urban	≥ 28	10-27	< 10
Percent Ephemeroptera	≥ 11	0.8-10.9	< 0.8
Number of Scraper Taxa	≥ 2	1.9-1.0	< 1.0
Percent Climbers	≥ 8.0	0.9-7.9	< 0.9

Table 2-9. Maryland Biological Stream Survey BIBI scoring

BIBI Score	Narrative Ranking	Characteristics
4.0-5.0	Good	Comparable to reference conditions, stream considered to be minimally impacted, biological metrics fall within upper 50th percentile of reference site conditions.
3.0-3.9	Fair	Comparable to reference conditions, but some aspects of biological integrity may not resemble the qualities of minimally impacted streams.
2.0-2.9	Poor	Significant deviation from reference conditions, indicating some degradation. On average, biological metrics fall below the 10th percentile of reference site values.
1.0-1.9	Very Poor	Strong deviation from reference conditions, with most aspects of biological integrity not resembling the qualities of minimally impacted streams, indicating severe degradation. On average, most or all metrics fall below the 10th percentile of reference site values.

2.3 PHYSICAL MONITORING

2.3.1 Monitoring Sites

Five cross sections (XS), four of which were established in 2003 and one which was established in 2007, have been measured annually through 2014. Four of these cross sections are located along the Parole Plaza Tributary, and one cross section is located on the Church Creek mainstem, just upstream of Solomon's Island Road (Maryland State Highway 2; Figure 2-1). Cross section monuments, placed on each bank, consist of capped steel reinforcement bars set within six inches of the ground surface. Field data collected by Versar, Inc. during 2014 were used to prepare this annual summary report.

2.3.2 Physical Data Collection and Analysis

Geomorphic assessments include a longitudinal profile survey, cross section surveys, and representative pebble counts. A spreadsheet tool called *The Reference Reach Spreadsheet* version 4.3L (Mecklenburg 2006) was used to facilitate data entry and analyses. This spreadsheet was used to compile, manipulate, and plot field data and to analyze dimension, profile, and channel material characteristics of the Church Creek study area.

Data from geomorphic assessments were used to determine the stream type of each reach as categorized by the Rosgen Stream Classification methodology (Rosgen 1996). In this classification methodology, streams are categorized based on their measured field values of entrenchment ratio, width/depth ratio, sinuosity, water surface slope, and channel materials according to the table in Appendix E**.** As illustrated in Appendix E, the Rosgen Stream Classification categorizes streams into broad stream types, which are identified by the letters Aa, A, B, C, D,

DA, E, F, and G. Table 2-10 includes general descriptions of each Rosgen stream type. A summary of the stream types identified within this study is included in Appendix F.

Table 2-10. Rosgen stream classification types

Channel Type	General Description
Aa+	Very steep, deeply entrenched, debris transport, torrent streams.
A	Steep, entrenched, confined, cascading, step/pool streams. High energy/debris transport associated with depositional soils. Very stable if bedrock or boulder dominated channel.
B	Moderately entrenched, moderate gradient, riffle dominated channel with infrequently spaced pools. Moderate width/depth ratio. Narrow, gently sloping valleys. Very stable plan and profile. Stable banks.
C	Low gradient, meandering, slightly entrenched, point-bar, riffle/pool, alluvial channels with broad, well-defined floodplains.
D	Braided channel with longitudinal and transverse bars. Very wide channel with eroding banks. Active lateral adjustment, high bedload and bank erosion.
DA	Anastomosing (multiple channels) narrow and deep with extensive, well-vegetated floodplains and associated wetlands. Very gentle relief with highly variable sinuosities and width/depth ratios. Very stable streambanks.
E	Low gradient, Highly sinuous, riffle/pool stream with low width/depth ratio and little deposition. Very efficient and stable. High meander/width ratio.
F	Entrenched, meandering riffle/pool channel on low gradients with high width/depth ratio and high bank erosion rates.
G	Entrenched "gully" step/pool and low width/depth ratio on moderate gradients. Narrow valleys. Unstable, with grade control problems and high bank erosion rates.

Source: Rosgen, D. 1996. Applied River Morphology. Wildland Hydrology. Pagosa Springs, Colorado

The cross section surveys were performed at the five permanent cross section locations, and photos were taken of upstream, downstream, left bank, and right bank views at each cross section location. Cross section surveys consisted of measuring the topographic variability of the associated stream bed, floodplains, and terraces, including:

- Monument elevations
- Changes in topography
- Top of each channel bank
- Elevations of bankfull indicators
- Edge of water during the time of survey
- Thalweg or deepest elevation along active channel
- Depositional and erosional features within the channel

During the cross sectional survey, the following measurements and calculations of the bankfull channel, which are critical for determining the Rosgen stream type of each reach, also were collected:

- Bankfull Width (Wbkf): the width of the channel at the elevation of bankfull discharge or at the stage that defines the bankfull channel.
- Mean Depth (dbkf): the mean depth of the bankfull channel.
- Bankfull Cross Sectional Area (Abkf): the area of the bankfull channel, estimated as the product of bankfull width and mean depth.
- Width Depth Ratio (Wbkf/dbkf): the ratio of the bankfull width versus mean depth.
- Maximum Depth (dmbkf): the maximum depth of the bankfull channel, or the difference between the thalweg elevation and the bankfull discharge elevation.
- Width of Floodprone Area (Wfpa): the width of the channel at a stage of twice the maximum depth. If the width of the floodprone area was far outside of the channel, its value was visually estimated or paced off.
- Entrenchment Ratio (ER): the ratio of the width of the floodprone area versus bankfull width.
- Sinuosity (K): ratio of the stream length versus the valley length or the valley slope divided by the channel slope. Sinuosity was visually estimated or the valley length was paced off so that an estimate could be calculated.

To quantify the distribution of channel substrate particles sizes within the study area, a modified Wolman pebble count (Rosgen 1996) was performed at each cross section location. Reach-wide proportional counts were used. Each pebble count consists of stratifying the reach based on the frequency of channel features in that reach (e.g., riffle, run, pool, glide) and measuring 100 particles across ten transects (i.e., 10 particles in each of 10 transects). The transects are allocated across all feature types in the proportion at which they occur within the reach. The intermediate axis of each measured pebble is recorded. The goal of the pebble count is to measure 100 particles across the bankfull width of the channel and calculate the median substrate particle size (i.e., D50) of the reach. This value is used for categorizing the sites into the Rosgen Stream Classification (Rosgen 1996). If a channel was clearly a sand or silt bed channel with no distinct variation in material size, the pebble count was not performed, and the D50 was visually estimated. However, if the channel did have variation in bed material size from feature to feature, a full pebble count was performed.

2.4 LAND USE AND STORMWATER MANAGEMENT ASSESSMENT

2.4.1 Church Creek Watershed Land Use

Versar (2013) had provided information on land use, based on inspections conducted during 2013. As seen on the 2013 Church Creek land use and BMP map (Figure 2-2), the watershed is predominantly commercial with open space area adjacent to the stream channels.

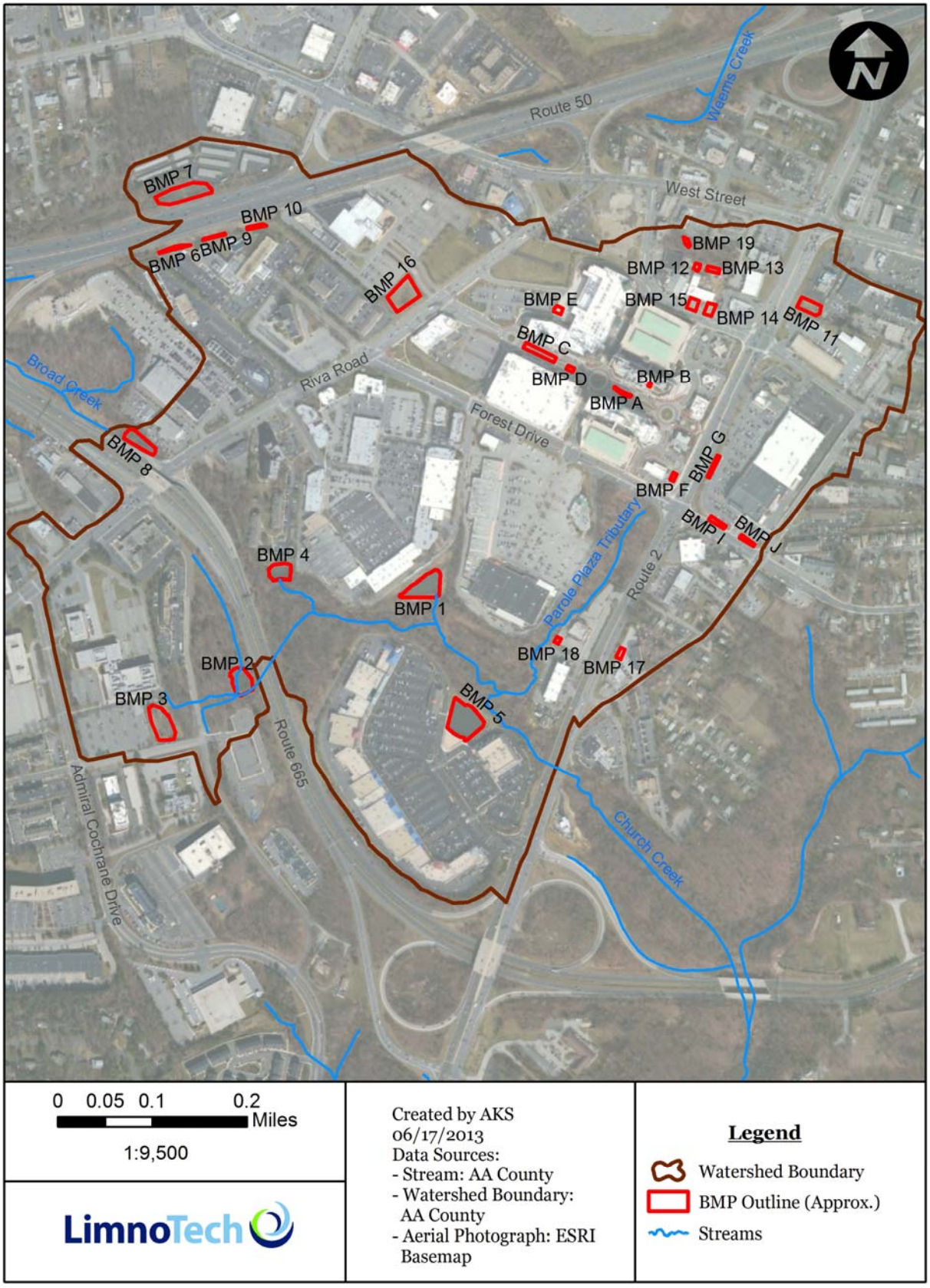


Figure 2-2. Church Creek BMPs (Figure from Versar 2013)

There is little available area for further development in the watershed except for areas that are being redeveloped. Anecdotal information indicates there has been no change in land use in this watershed since the 2013 land use evaluation. Changes in land use characteristics were not field evaluated during the 2014 reporting period.

2.4.2 Church Creek Watershed Stormwater BMPs

As of the 2013 evaluation, the Church Creek watershed contains 28 BMPs, as shown in Figure 2-2. BMP details are provided in Table 2-11. Anne Arundel County Department of Inspection & Permits conducted inspections of the County BMP facilities, located in this watershed, in July of 2014. The results of these inspections will be documented in the 2015 Annual Report.

Table 2-11. Church Creek BMP overview (Table from Versar 2013)

Church Creek BMP[a]	AA County Urban BMP Database ID	BMP Type[b]	Drainage Area (acres)[c]	Location	Address	Presumed Owner
1	AA001128	EDSW	26.95	Festival at Riva Shopping Center	Riva Road and Forest Drive	County
2	not found in 2012 database	DP	-	Forested Area	Between Aris T. Allen Boulevard and Womack Drive	SHA
3	AA000079	DP	14.6	ARINC Parking Lot	Spruill Road and Admiral Cochrane Drive	County
4	AA000074	DP	12.95	Forest Garden Apartments	130 Hearne Court	County
5	AA001042	EDSW	15.7	Annapolis Harbour Center	Solomons Island Road	County
6	Possibly AA010839	IB	0.4	Double Tree by Hilton Hotel Parking Lot	Route 50	SHA
7	AA001069	DP	9.7	Annapolis Self Storage	Route 50 near E Classic Ct	SHA
8	not found in 2012 database	IB	-	Sheehy Nissan of Annapolis	Aris T. Allen Blvd and Riva Road	SHA
9	Possibly AA010839	IB	0.4	Double Tree by Hilton Hotel Parking Lot	Route 50	SHA
10	Possibly AA010839	IB	0.4	Double Tree by Hilton Hotel Parking Lot	Route 50	SHA
11	AA001446	EDSD	1.9	Second National Federal Savings Bank	2045 West St.	City of Annapolis
12	AA012015	ESD SGW	0.25	AAA Mid Atlantic Car Care	2054 Somerville Road	County
13	AA012014	ESD PERMP	0.25	AAA Mid Atlantic Car Care	2054 Somerville Road	County
14	AA012013	ESD MB	0.25	AAA Mid Atlantic Car Care	2054 Somerville Road	County
15	AA012012	ESD MB	0.25	AAA Mid Atlantic Car Care	2054 Somerville Road	County
16	AA000071	EDSD	3.47	Nationwide Insurance	2453-2499 Riva Road	County
17	AA006493	ITPE	0.35	Annapolis Station	2431 Solomons Island Road	County
18	AA001180	ITPE	-	Two Restaurant Sites	2436 Solomons Island Road	County
19	not found in 2012 database	DP	-	Capitol One Bank	2200 Somerville Road	County
A	Possibly AA008471	BR	0.3	Annapolis Towne Center at Parole	Towne Center Boulevard	County

[a] Numbering system carried over from the 2012 BMP inspection report.
[b] BMP type copied from the AA County Urban BMP database. See List of Acronyms in Appendix H.
[c] Drainage areas copied from the 2012 BMP inspection report or from the 2012 AA County Urban BMP database. Some drainage areas are missing in the Urban BMP database.

Table 2-11. (Continued)

Church Creek BMP[a]	AA County Urban BMP Database ID	BMP Type[b]	Drainage Area (acres)[c]	Location	Address	Presumed Owner
B	Possibly AA008472	BS	0.53	Annapolis Towne Center at Parole	Towne Center Boulevard	County
C	Possibly AA008475	BR	0.4	Annapolis Towne Center at Parole	Towne Center Boulevard	County
D	Possibly AA008473	BS	1.88	Annapolis Towne Center at Parole	Towne Center Boulevard	County
E	Possibly AA008474	BS	6.41	Annapolis Towne Center at Parole	Towne Center Boulevard	County
F	Possibly AA008461 through AA008470 or AA009145	StormFilter	4.78	Annapolis Towne Center at Parole	2398 Solomons Island Road	County
G	not found in 2012 database	BR		Shoppers Food Warehouse	2371 Solomons Island Road	County
H	*There is no BMP H; please refer to the 2012 BMP inspection report for further explanation*					
I	not found in 2012 database	BR		Shoppers Food Warehouse	2104-3098 Forest Drive	County
J	not found in 2012 database	BR		Shoppers Food Warehouse	2100-2102 Forest Drive	County

3 RESULTS

3.1 POLLUTANT CONCENTRATIONS

During this sampling period, 52 water chemistry samples were analyzed. In a few instances, analyte concentrations fell below the specified detection limits. Table 3-1 shows the percentage of samples that were below the detection limit. TPH was only detected once during the 2014 reporting year. This occurred at the Parole Plaza monitoring station during the baseflow event sampled on March 18, 2014.

Table 3-1. The percentage of non-detects by parameter

Parameter	Detection Limit (mg/L)	Dry Weather	Wet Weather
BOD_5	4.0	60	26
TKN	0.5	30	29
Nitrate + Nitrite	0.05	0	2
Total Phosphorus	0.01	0	2
TSS	1.0	40	7
Total Copper	0.002	20	7
Total Lead	0.002	90	48
Total Zinc	0.02	10	2
TPH	5.0	90	100
E. coli (MPN/100 ml)	10.0	0	0
Hardness	1.0	0	2

Tables 3-2 and 3-3 show the maximum values observed for dry and wet weather samples for both stations. Table 3-4 shows the maximum value for each parameter during wet weather monitoring, the station of occurrence, and the storm date of the observation. Parole Plaza had the highest wet-weather value for seven of the twelve parameters detected during wet weather sampling in 2014. Chemical monitoring summaries can be found in Appendix G.

Table 3-2. Maximum dry weather values observed during sampling period		
Parameter	**Church Creek**	**Parole Plaza**
Water Temperature (°C)	22.2	21.98
pH	7.1	7.3
BOD_5 (mg/L)	4	10
TKN (mg/L)	5.60	3.80
Nitrate + Nitrite (mg/L)	1.90	6.70
Total Phosphorus (mg/L)	0.12	0.18
TSS (mg/L)	27	73
Total Copper (mg/L)	0.008	0.025
Total Lead (mg/L)	BDL	0.003
Total Zinc (mg/L)	0.091	0.180
TPH (mg/L)	BDL	6.0
E. coli (MPN/100 ml)	644	3,873
Hardness (mg/L)	220	260
BDL: Below Detection Limit		

Table 3-3. Maximum wet weather values observed during sampling period		
Parameter	**Church Creek**	**Parole Plaza**
Water Temperature (°C)	25.80	25.63
pH	7.45	7.87
BOD_5 (mg/L)	36	57
TKN (mg/L)	3.50	4.40
Nitrate + Nitrite (mg/L)	1.80	6.00
Total Phosphorus (mg/L)	1.00	0.42
TSS (mg/L)	190	250
Total Copper (mg/L)	0.092	0.068
Total Lead (mg/L)	0.017	0.010
Total Zinc (mg/L)	0.170	0.340
TPH (mg/L)	0.0	0.0
E. coli (MPN/100 ml)	29,090	68,670
Hardness (mg/L)	120	100
BDL: Below Detection Limit		

Table 3-4. Storm dates for wet weather maximum values

Parameter	Date of Storm	Site	Maximum Value
Water Temperature (°C)	6/19/14	Church Creek	25.80
pH	4/7/14	Parole Plaza	7.87
BOD_5 (mg/L)	5/27/14	Parole Plaza	57
TKN (mg/L)	5/27/14	Parole Plaza	4.40
Nitrate + Nitrite (mg/L)	10/7/14	Parole Plaza	6.00
Total Phosphorus (mg/L)	9/12/13	Church Creek	1.00
TSS (mg/L)	12/23/13	Parole Plaza	250
Total Copper (mg/L)	5/27/14	Church Creek	0.092
Total Lead (mg/L)	5/27/14	Church Creek	0.017
Total Zinc (mg/L)	5/27/14	Parole Plaza	0.340
TPH (mg/L)	N/A	Both	BDL
E. coli (MPN/100 ml)	6/19/14	Parole Plaza	68,670
Hardness (mg/L)	9/12/13, 4/7/14	Church Creek	120

BDL: Below Detection Limit

3.2 EVENT MEAN CONCENTRATIONS AND POLLUTANT LOADINGS

Flow-weighted stormflow event mean concentrations (EMCs) values are presented in Table 3-5. EMCs were equal between the two sites for TPH. EMCs for every parameter except total lead and hardness were higher at Parole Plaza than EMCs at Church Creek.

Summed loads for the sampled events monitored during the July 2013 to June 2014 sampling period are shown in Table 3-6. Church Creek per-acre loading rates for monitored events were higher than or equal to Parole Plaza for all parameters except nitrate-nitrite and total zinc.

Table 3-5. Average EMCs observed during July 2013 to June 2014		
Parameter	**Church Creek**	**Parole Plaza**
Water Temperature (°C)	17.36	19.18
pH	7.10	7.23
BOD_5 (mg/L)	3.53	4.33
TKN (mg/L)	0.590	0.772
Nitrate + Nitrite (mg/L)	0.332	0.575
Total Phosphorus (mg/L)	0.138	0.146
TSS (mg/L)	39.71	48.77
Total Copper (mg/L)	0.011	0.021
Total Lead (mg/L)	0.004	0.003
Total Zinc (mg/L)	0.066	0.120
TPH (mg/L)	2.5	2.5
E. coli (MPN/100 ml)	8,638.07	12,716.40
Hardness (mg/L)	38.32	38.18

Table 3-6. Estimated pollutant loadings for observed events, in pounds, for the July 2013 to June 2014 sampling period				
Parameter	**Church Creek**		**Parole Plaza**	
	Total	**Per Acre**	**Total**	**Per Acre**
BOD_5	924.15	3.31	159.50	2.64
TKN	154.45	0.55	28.44	0.47
Nitrate + Nitrite	86.79	0.31	21.20	0.35
Total Phosphorus	36.14	0.13	5.40	0.09
TSS	10,396.02	37.25	1,797.11	29.75
Total Copper	2.87	0.01	0.78	0.01
Total Lead	0.970	<0.01	0.102	<0.01
Total Zinc	17.338	0.06	4.412	0.07
TPH	654.417	2.34	92.126	1.53
Hardness	10,031.61	35.94	1,407.066	23.29

3.3 BIOLOGICAL ASSESSMENT

Biological and physical habitat assessments were completed on March 14, 2014. Presented below are the summary results for each assessment site. For full bioassessment data and results, refer to Appendix C. A complete taxonomic list can be found in Appendix B. QA/QC information is in Appendix D.

Physical habitat quality was evaluated using the MBSS PHI, and rated "Degraded" for three sites and "Partially Degraded" for one site (Table 3-7). Index scores varied somewhat and ranged from a low of 56.2 at CC-02 to a high of 70.8 at CC-03. All sites received very low scores for remoteness due to the proximity of the stream channel to roads and development. Generally, instream woody debris scored high for all the sites. Individual parameter results are listed in Appendix C. Overall, PHI scores throughout the study area indicate habitat conditions that are limiting the potential for healthy biological communities.

The RBP was also used to evaluate the physical habitat quality and rated "Partially Supporting" for three sites and "Supporting" for one site (Table 3-7). Index ranged from a low of 65 at CC-02 to a high of 81 at CC-03. Generally, epifaunal substrate/cover, embeddedness, velocity/depth regime, and vegetative protection scored low for all the sites. Overall, RBP scores throughout the study area indicate habitat conditions that are limiting the potential for healthy biological communities, similar to what was found using the PHI.

Table 3-7. PHI and RBP physical habitat assessment results - 2014

Site	PHI Score	PHI Narrative Rating	RBP Score	RBP Narrative Rating
CC-01	65.8	Degraded	70	Partially Supporting
CC-02	56.2	Degraded	65	Partially Supporting
CC-03	70.8	Partially Degraded	81	Supporting
CC-04	60.1	Degraded	70	Partially Supporting

For biological conditions, all four stations received a rating of "Very Poor", indicating a highly impaired benthic macroinvertebrate community. The number of individual benthic organisms collected in station CC-01 was 18, which is extremely low. Number of EPT taxa, Percent Intolerant Urban, Number of Ephemeroptera and Percent Ephemeroptera metrics scored low for all sites. Only the Percent Climbers metric received high scores for all sites. The lower than average temperature during March 2014 combined with the high conductivity values from salt treatment on road found at the sites likely contributed to the metrics being scored lower this year than in the past. BIBI scores and ratings are summarized in Table 3-8.

Table 3-8. Benthic macroinvertebrate assessment results - 2014

Site	BIBI Score	Narrative Rating
CC-01	1.57	Very Poor
CC-02	1.86	Very Poor
CC-03	1.29	Very Poor
CC-04	1.57	Very Poor

To supplement the biological assessment data, *in situ* water quality parameters were measured at each biological monitoring site prior to sample collection. Table 3-9 shows the water quality data for each site. All parameters measured were within Maryland's water quality standards for Use I streams. Conductivity values were very elevated compared to most coastal plain streams, and far exceeded the 75th percentile of values (i.e., 307 µS/cm) measured during Round One (2004-2008) of the Countywide Biological Monitoring and Assessment Program (Hill and Pieper, 2011). Conductivity values were relatively high compared to most coastal plain streams, as well as higher than the range of those found in other urban, or highly impervious, drainage areas in Maryland (DNR, 2001, 2003, 2005; KCI, 2009a; Hill and Crunkleton, 2009). Stream conductivity is affected by inorganic dissolved solids such as chloride, nitrate, sulfate, and phosphate anions or sodium, magnesium, calcium, iron, and aluminum cations, many of which are generally found at elevated concentrations in urban streams (Paul and Meyer, 2001). Increased stream ion concentrations (measured as conductivity) in urban systems typically results from runoff over impervious surfaces, passage through pipes, and exposure to other infrastructure (Cushman, 2006). In 2014, the greater than average snow amount caused the roads to be treated with salt more frequently than during an average year. This most likely caused the conductivity values to be higher.

Table 3-9. *In situ* water quality results - 2014

Site	pH	Temperature	Dissolved Oxygen	Turbidity	Conductivity
	SU	°C	mg/L	NTU	µS/cm
CC-01	6.73	9.84	9.4	21.7	3493
CC-02	7.09	3.08	11.03	15.2	3384
CC-03	6.87	5.17	8.97	14.8	3356
CC-04	6.69	7.41	11.01	19.5	3526

3.4 GEOMORPHIC ASSESSMENT

Due to the highly altered conditions of the drainage area (i.e., high imperviousness, altered flow regime, numerous stormwater outfalls) and stream channel (i.e., channelization, stabilization) in the study area, reliable bankfull indicators were often difficult to locate in the field. In the absence of reliable bankfull indicators, bankfull elevations were adjusted to match the predicted values for bankfull area provided by the bankfull channel geometry relationship for urban streams developed specifically for Anne Arundel County (AADPW 2002). Furthermore, categorization of segments into the Rosgen Classification scheme for natural rivers required a fair amount of professional judgment to interpret the data. When assigning the stream classification types, values for some parameters would often fit into the prescribed ranges according to the Rosgen Classification while others would not. Many of the features at the existing cross section locations have shifted from riffle features to pool features, which can skew the channel dimensions since classifications are based on riffle dimensions. Consequently, it was often

necessary to apply best professional judgment and incorporate supplemental information (e.g., presence of depositional features) in order to assign the most appropriate stream classifications.

The most upstream reach on the Parole Plaza Tributary, XS-1, has been undergoing a transition from a Rosgen C4/5 channel to a F4/5 channel, as evidenced by changes in the width/ depth and entrenchment ratios. Previous monitoring in 2010 suggested that this reach was shifting from an E to a C channel as evidenced by channel degradation along the right bank and a notable increase in sediment deposition and point bar formation along the right bank just downstream. Additional degradation between 2010 and 2012 suggest that the channel has lost connectivity to the floodplain and has likely shifted to an F stream type. In 2014, geomorphic assessment parameters continue to support the classification of this reach as an F channel. The channel evolution is supported by a 33% increase in channel cross-sectional area since 2003 and considerable widening and mid-channel bar formation immediately downstream, which is indicative of a channel that it not stable and is undergoing a widening and degradation phase. Left bank widening was also apparent between 2013 and 2014 monitoring years. However, it is also important to acknowledge that this cross section is no longer located in a riffle feature and is now in a pool feature, which affects the channel dimensions and complicates classification using the Rosgen system.

The next site downstream on the Parole Plaza Tributary, XS-2, was classified as a Rosgen G4c channel based on its low width/depth ratio, relatively low slope, and sandy substrate. Between 2013 and 2014 monitoring the substrate became slightly more course. Since 2012 its entrenchment ratio was slightly higher than those typical of G streams, but to retain consistency with the 2011 classification, the G rating was retained. The entrenchment ratio did however decrease from 1.7 to 1.6 between 2012 and 2014 which is comparable with G type streams given the continuum of physical variables of (+/- 0.2). This reach was previously classified as an E type channel; however, it was noted that the reach was actively degrading and widening. While E streams are typically more sinuous, this segment has been noticeably straightened and stabilized by a retaining wall and rubble/fill along the left bank (facing downstream). The lack of sinuosity in the channel has likely resulted in instability, and consequently resulted in a shift to a less-stable form.

Site XS-3, located along the restored segment of Parole Plaza Tributary, was not classified until 2013, after allowing 3 years of stabilization after restoration. In 2013 and 2014 it has been classified as a Rosgen G4c channel based on its low entrenchment ration, low width/depth ratio, and low slope. Before restoration, this cross section was classified as a Rosgen G5c channel; however, since the Rosgen scheme was developed to classify natural channels, or those that are shaped naturally by fluvial processes, it was deemed inappropriate to classify immediately after construction. This section is still heavily armored and reliable bankfull indicators are not easily identified.

The most downstream site on the Parole Plaza Tributary, XS-4, has transitioned from a Rosgen E5 channel to a C5 channel due to an increase in width/depth ratio. It should also be noted that a large woody debris jam located just downstream of the cross section location has resulted in a considerable accumulation of fine sediment and debris across the channel and,

consequently, is leading to aggradation and a reduction in the cross sectional area. Since 2003 cross-sectional area has decreased by 52.4%.

Located on the mainstem of Church Creek, upstream of the MD Rt. 2 culvert, XS-5 has transformed from a Rosgen C3/5 channel into an F3 channel due to a significantly decreased entrenchment ratio from 4.0 to 1.6 between 2012 and 2014. Although still categorized as moderate, width/depth ratio has also decreased slightly. This segment shows evidence of previous alteration in the form of cobble-sized riprap armoring along the bed and lower banks to protect a sewer line crossing and obvious channel straightening, which explains the lack of sinuosity typical of F type streams. The substantial amount of cobble-sized rip-rap in the stream channel has resulted in a bi-modal distribution of substrate particles within this reach, with a predominance of gravel in the pools and artificial cobbles in the riffles.

4 DISCUSSION

Results from the July 2013-June 2014 study period are discussed in the following section. Water quality, biological, and geomorphological data are interpreted, presented and compared to previous data. A discussion of the characteristics of the watershed is also included.

4.1 WATER CHEMISTRY

Water quality criteria are presented in Table 4-1. The measured data are compared, where possible, to these criteria to assess the extent of the pollution concerns in this tributary.

Table 4-1. State and Federal water quality criteria available for parameters sampled at Church Creek

Parameter (mg/L, except as noted)	Chronic	Acute	Reference
Lead (µg/L)	2.5	65	COMAR 26.08.02.03-2
Copper (µg/L)	9	13	COMAR 26.08.02.03-2
Zinc (µg/L)	120	120	COMAR 26.08.02.03-2
Total P	0.0225		USEPA 2000
BOD_5	7		USEPA 1986
Nitrate + Nitrite	0.095		USEPA 2000
TSS	500		USEPA 1974
TKN	None		
TPH	None		
*E. coli** (MPN/100ml)	235		COMAR 26.08.02.03-3.
Hardness	None		

* Used most restrictive standard for *E. coli* as a conservative approach: frequent full body contact recreation criterion.

Criteria are used to protect against both short-term and long-term effects. Numeric criteria are important where the cause of toxicity is known or for protection against pollutants with potential human health impacts or bioaccumulation potential. Narrative criteria can be the basis for limiting toxicity in discharges where a specific pollutant can be identified as contributing to the toxicity. Biological criteria can be used to complement traditional, chemical-specific criteria as indicators of aquatic health and impacts to the aquatic ecosystem.

Tables 4-2 and 4-3 compare baseflow and storm event results to the Federal and State acute and chronic criteria. Comparison and interpretation of Church Creek pollutant concentrations to Federal and State water quality criteria, and relating these conditions to ultimate ecological outcomes in the system, however, are difficult. Criteria do not exist for all

Table 4-2. Maximum concentrations observed for baseflow samples compared to appropriate criteria

Parameter (mg/L, except as noted)	Chronic	Acute	Church Creek	Parole Plaza
Lead (µg/L)	2.5	65	BDL	3*
Copper (µg/L)	9	13	8	25*
Zinc (µg/L)	120	120	91	180*
Total P	0.0225		0.12*	0.18*
BOD_5	7		4	10*
Nitrate + Nitrite	0.095		1.90*	6.70*
TSS	500		27	73
TKN	None		5.60	3.80
TPH	None		BDL	6.0
*E. coli*** (MPN/100ml)	235		644*	3,873*
Hardness	None		220	260

* Criterion exceeded
** Used most restrictive standard for *E. coli* as a conservative approach: frequent full body contact recreation criterion.
BDL: Below Detection Limit

Table 4-3. Maximum concentrations observed for wet weather samples compared to appropriate criteria

Parameter (mg/L, except as noted)	Acute	Church Creek	Parole Plaza
Lead (µg/L)	65	17	10
Copper (µg/L)	13	92*	68*
Zinc (µg/L)	120	170*	340*
Total P	0.0225	1.00*	0.42*
BOD_5	7	36*	57*
Nitrate + Nitrite	0.095	1.80*	6.00*
TSS	500	190	250
TKN	None	3.50	4.40
TPH	None	BDL	BDL
*E. coli*** (MPN/100ml)	235	29,090*	68,670*
Hardness	None	120	100

* Criterion exceeded
** Used most restrictive standard for *E. coli* as a conservative approach: frequent full body contact recreation criterion.
BDL: Below Detection Limit

parameters measured at the monitoring stations. In addition, a clear cause and effect relationship between water quality and ecological condition is difficult to determine. However, these comparisons can be used as general indicators of water quality impairment. Both State and Federal criteria are based on ambient stream conditions. Chronic criteria consider the maximum levels at which aquatic life can survive if continuously subjected to a pollutant concentration. Acute criteria reflect the maximum level at which an aquatic organism can survive if periodically subjected to a pollutant concentration. Since storm events represent a periodic condition, wet-weather samples are compared only to acute criteria.

As in prior years, comparisons to water quality criteria continue to indicate elevated pollutant concentrations in the Church Creek watershed, primarily during wet weather conditions. In particular, copper, zinc, total phosphorous, BOD_5, nitrate-nitrite, and *E. coli* frequently exceeded criteria at both sampling stations. Table 4-3 (above) shows the maximum concentrations for each sampling site, and compares these to the criteria. Additionally, as shown in Table 4-2, the Federal water quality criteria were exceeded for total phosphorous, nitrate-nitrite and *E. coli* during baseflow sampling at both the Church Creek and Parole Plaza Stations, with lead, copper, zinc and BOD_5 also being exceeded at the Parole Plaza station.

Table 4-4 shows the percentage of wet weather samples for which criteria were exceeded. Water quality criteria for the pollutants listed above were more frequently exceeded at the Parole Plaza monitoring station than at the Church Creek station for all contaminants except for BOD_5. Total phosphorous, nitrate-nitrite and *E. coli* concentrations remained high at both stations throughout the 2014 monitoring period, exceeding water quality criteria for at least 90% of the time at both Church Creek and Parole Plaza. Note that prior to site stabilization, total suspended solids concentrations had been particularly high due to construction activity at Annapolis Towne Centre. Following stabilization of the site in Fall 2008, the event mean concentrations for total suspended solids have dropped significantly. During the last three reporting years, no wet weather samples exceeded the water quality criterion for total suspended solids at either station.

Table 4-5 shows the annual average event mean concentrations that exceeded water quality criteria. As can be seen from the table, some criteria were consistently exceeded at both stations.

The high levels of pollutants observed in the watershed are typical for commercial and retail land uses that are coupled with high levels of automobile traffic and impervious surface area (USEPA, 1983). As shown in Table 2-2, 87% of the watershed to the Parole monitoring station and 69% of the watershed to the Church Creek Station is impervious.

In 2007, loading rates (Table 4-6 and 4-7) increased sharply at both stations. For 2008, loading rates were still high, when compared to historical values, but dropped dramatically from the 2007 levels. During the 2009 reporting year, loading rates dropped further, and aligned more closely with historical values. The high levels in 2007 likely resulted from the construction activity that was underway immediately upstream of the Parole Plaza Station. Since the majority of the site was stabilized by the end of 2008, this likely caused the pollutant loads to decrease.

Table 4-4. Percentage of all wet weather samples that exceed appropriate criteria

Parameter (mg/L, except as noted)	Criteria	Church Creek	Parole Plaza
Lead (µg/L)	65	0	0
Copper (µg/L)	13	33	86
Zinc (µg/L)	120	10	48
Total P	0.0225	95	100
BOD_5	7	24	19
Nitrate + Nitrite	0.095	90	100
TSS	500	0	0
TKN	None	NA	NA
TPH	None	NA	NA
*E. coli** (MPN/100ml)	235	95	100
Hardness	None	NA	NA

* Used most restrictive standard for *E. coli* as a conservative approach: frequent full body contact recreation criterion.

Table 4-5. Annual average event mean concentrations and criteria (parameters that exceeded appropriate criteria are indicated)

Parameter (mg/L, except as noted)	Chronic	Acute	Church Creek	Parole Plaza
Lead (µg/L)	2.5	65	4[(a)]	3[(a)]
Copper (µg/L)	9	13	11[(a)]	21[(b)]
Zinc (µg/L)	120	120	66	120
Total P	0.0225		0.138[(a)]	0.146[(a)]
BOD_5	7		3.53	4.33
Nitrate + Nitrite	0.095		0.332[(a)]	0.575[(a)]
TSS	500		39.71	48.77
TKN	None		0.590	0.772
TPH	None		2.5	2.5
*E. coli** (MPN/100ml)	235		8,638.07[(a)]	12,716.40[(a)]
Hardness	None		38.32	38.18

[(a)] Chronic or general criterion exceeded
[(b)] Acute criterion exceeded
* Used most restrictive standard for *E. coli* as a conservative approach: frequent full body contact recreation criterion.

Table 4-6. Total annual loading rates, in pounds, observed at the Parole Plaza Sampling Station from 2002 to 2014

Year	BOD	TSS	TP	TKN	NO_3+NO_2	Zinc	Lead	Copper	Hardness	Fecal Coliform[a]
2002	2,912	26,585	1,178	388	323	58	14	1	NA	1,152,001
2003	21,665	86,385	372	1,477	714	176	69	15	NA	5,350,164
2004	8.025	57,447	293	655	391	57	7	8	NA	402,127
2005	4,573	33,015	184	483	350	50	12	8	NA	665,232
2006	13,562	94,306	650	1,867	410	177	13	25	NA	3,360,952
										E. coli[a]
2007	40,009	848,116	1,649	2,328	1,401	349	26	162	NA	11,017
2008[b]	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2009	2,175	11,787	59	490	117	56	0.8	6.5	NA	2,115
2010	2,209	17,609	89	309	120	40	1.2	4.1	NA	1,740
2011	2,114	13,894	42	371	131	58	1.1	6.3	6,987	2,682
2012	3,660	15,335	62	284	214	57	1.0	6.6	14,578	10,209
2013	1,481	6,079	34	155	108	34	0.5	4.9	8,586	16,041
2014	2,040	18,953	54	536	497	50	1.0	8.1	36,945	12,716
Mean	**8,034**	**102,459**	**389**	**779**	**398**	**97**	**12**	**21**	**16,774**	**8,074[c]**

[a] Units of Fecal Coliform and *E. coli* are MPN/100 mL.
[b] In 2008, monitoring was conducted for both outfalls at Parole Plaza, but continuous level monitoring was not available for the 54" RCP; therefore, loads could not be calculated.
[c] Mean *E. coli* value, does not include pre-2007 Fecal Coliform data.

Table 4-7. Loading rates, in pounds, observed at the Church Creek Sampling Station from 2002 to 2014

Year	BOD	TSS	TP	TKN	NO_3+NO_2	Zinc	Lead	Copper	Hardness	Fecal Coliform*
2002	6,408	58,501	2,593	854	711	127	32	3	NA	2,534,970
2003	47,673	190,090	818	3,250	1,571	387	151	32	NA	11,773,001
2004	17,660	126,411	645	1,441	860	126	19	18	NA	884,887
2005	10,062	72,648	405	1,062	771	109	27	16	NA	1,463,839
2006	29,844	207,520	1,431	4,109	902	390	29	54	NA	7,395,753
										E. coli*
2007	265,499	3,312,794	8,381	20,330	436,206	3,663	277	652	NA	1,755
2008	60,843	458,185	3,037	12,468	4,444	693	37	36	NA	3,857
2009	35,521	206,184	1,296	9,377	2,505	531	30	57	NA	3,912
2010	49,256	341,877	2,066	9,561	2,912	739	39	77	NA	3,358
2011	42,883	214,820	1,340	7,410	3,606	704	30	41	259,076	3,995
2012	40,145	150,490	1,103	3,714	3,018	551	20	31	250,747	5,549
2013	43,980	180,946	899	3,326	2,782	558	27	57	314,179	2,399
2014	31,969	299,830	1,065	12,177	6,019	551	27	78	646,801	8,638
Mean	**52,442**	**447,715**	**1,929**	**6,852**	**35,870**	**702**	**57**	**89**	**367,701**	**4,183****

* Units of Fecal Coliform and *E. coli* are MPN/100 mL.
** Mean *E. coli* value, does not include pre-2007 Fecal Coliform data.

During the 2014 reporting year, loading rates increased for all sampled parameters at the Parole Plaza Station when compared to the 2013 reporting year except for *E. coli*. At the Church Creek Station, 2014 reporting year loading rates increased for all sampled parameters when compared to the 2013 reporting year except for BOD_5, zinc and lead. The sharp increase in *E. coli* loads at the Church Creek station may be due to an increase in pet waste washing into the storm drain system as a result of the likely increase in occupancy of the Annapolis Towne Centre residential buildings. This same increase was observed at the Parole Plaza station during the 2013 reporting year, but a slight decrease in *E. coli* loads occurred at this station in 2014.

From 2009 to 2014, the loading rates at Parole Plaza have tended to be below the levels existing prior to the redevelopment of the Towne Centre. However, at the Church Creek Station, most of the sampled parameters have exceeded average pre-construction (2002-2006) monitoring levels, and continued doing so in 2014.

Seasonal pollutant loads in 2014 are provided in Table 4-8. Hardness was much higher in the winter at both stations due to the large amount of road salt used to deice local roads during a winter that produced an abnormally large amount of snow and ice. TKN and nitrate-nitrite loads were also highest in the winter months at each station. Water chemistry monitoring during the 2014 winter months consisted solely of baseflow sampling, and the higher natural background nitrogen concentrations observed during baseflow (which are often diluted during storm events) is the likely cause of the elevated winter TKN and nitrate-nitrite loads. All other Church Creek pollutant loads, except *E. coli*, were highest in the spring. The increase in metal and total phosphorus loads were likely associated with the increase in TSS, which is likely a product of accelerated stream bank erosion occurring after several freeze-thaw cycles facilitated by the consistent swings in temperature observed during the 2014 winter. All metal, total phosphorus, and TSS loads were highest in the fall at the Parole Plaza station, which is primarily due to the total volume of water passing through this station in the fall being much higher than volumes observed in the other seasons. It should be noted, however, that the limited number of samples collected for each season ultimately makes it difficult to draw strong conclusions about seasonal pollutant loading rates. These interpretations should be viewed cautiously.

Table 4-8. Seasonal loading rates, in pounds, observed at the Church Creek and Parole Plaza sampling stations in 2014

Season	BOD	TSS	TP	TKN	NO_3+NO_2	Zinc	Lead	Copper	Hardness	*E. coli**
Church Creek										
Summer	4,862	64,729	205	377	165	103	6.1	17.6	52,171	12,577
Fall	5,425	73,315	276	1,371	777	133	6.5	21.8	77,841	5,712
Winter	5,090	42,986	177	7,830	3,497	136	2.1	9.8	394,902	403
Spring	16,593	118,800	407	2,598	1,579	179	11.8	29.0	121,887	9,859
Parole Plaza										
Summer	277	2,783	11	55	41	7	0.2	1.4	1,815	14,474
Fall	502	8,375	18	91	63	18	0.4	2.9	6,499	11,363
Winter	815	5,954	17	332	344	17	0.2	2.4	25,822	576
Spring	447	1,841	8	59	48	8	0.1	1.4	2,810	11,927

* Units of *E. coli* are MPN/100 mL.

Annual average event mean concentrations were plotted for each monitoring year. Plots were constructed to illustrate the impact that construction activity and redevelopment of the Annapolis Towne Centre site has had on water quality within the study reach. Figures 4-1 through 4-5 show how the event mean concentrations have changed from 2004 to 2014 at the Parole Monitoring Station. As can be seen from the graphs, nearly every concentration rose substantially between 2006 and 2007 when the majority of the site work was being conducted at the Towne Centre. These concentrations fell significantly in 2008, as the site was stabilized, and continued the downward trend in 2009. The reduction in pollutant concentrations stabilized in 2010 and 2011 possibly indicating that the stream has reached a post-construction baseline. Pollutant concentrations in 2014 increased when compared to those from 2013, with the exception of a drop in *E. coli*, and no change in TPH. The 2013 rise in TPH was due to an increase in the detection limit, and may not be associated with an actual increase in concentration as greater than 95% of TPH concentrations fell below the detection limit. It is important to note that the 2013 data included in these plots do not include summer season data, which is often the season that produces the highest event mean concentrations for many of the parameters.

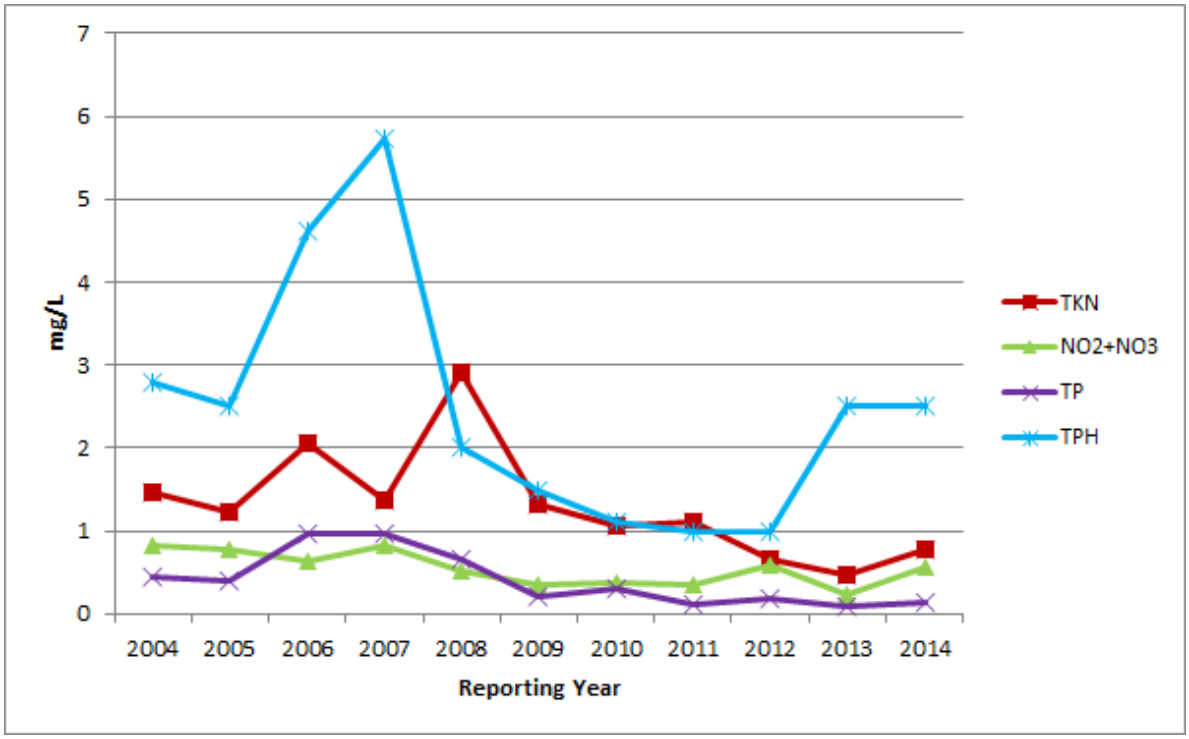


Figure 4-1. Parole station long-term monitoring: annual EMCs (TKN, NO_2+NO_3, TP, TPH; mg/L)

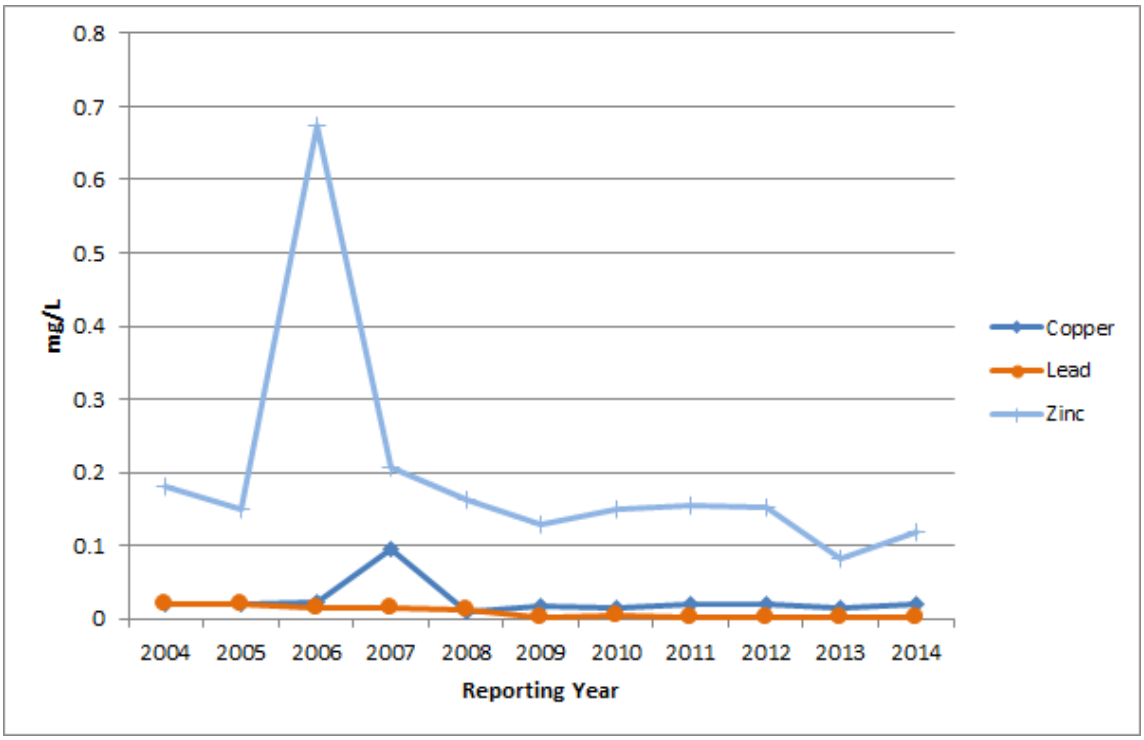


Figure 4-2. Parole station long-term monitoring: annual EMCs (Cu, Pb, Zn; mg/L)

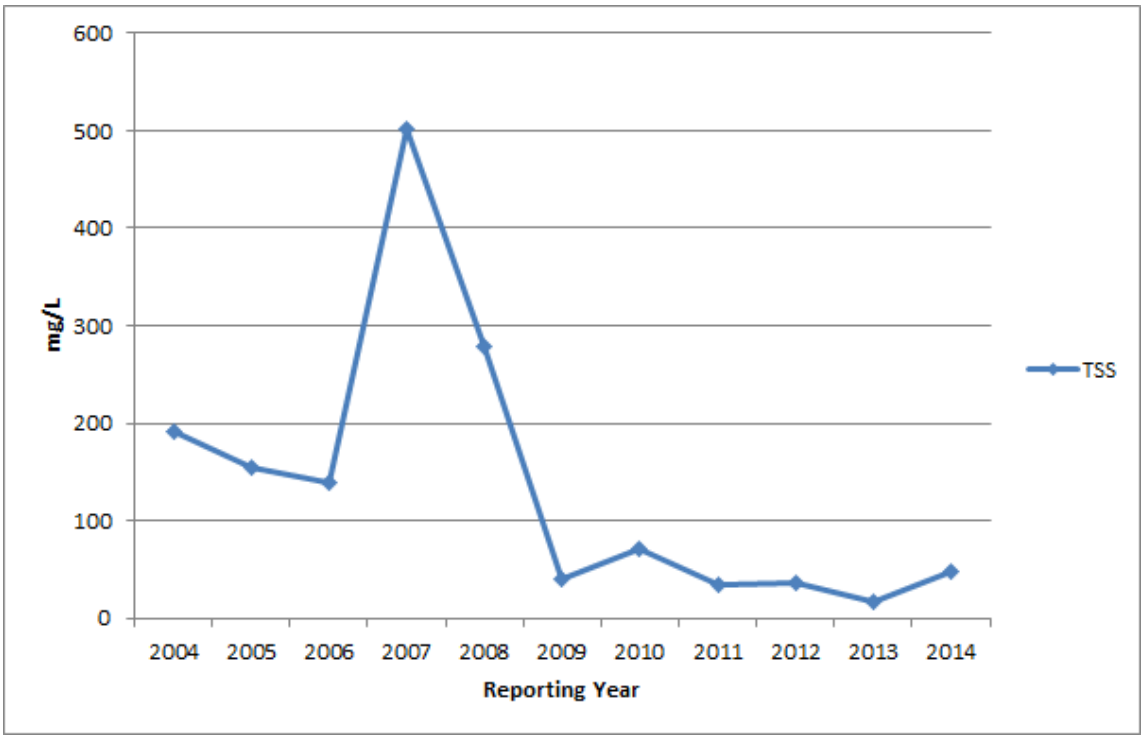


Figure 4-3. Parole station long-term monitoring: annual EMCs (TSS; mg/L)

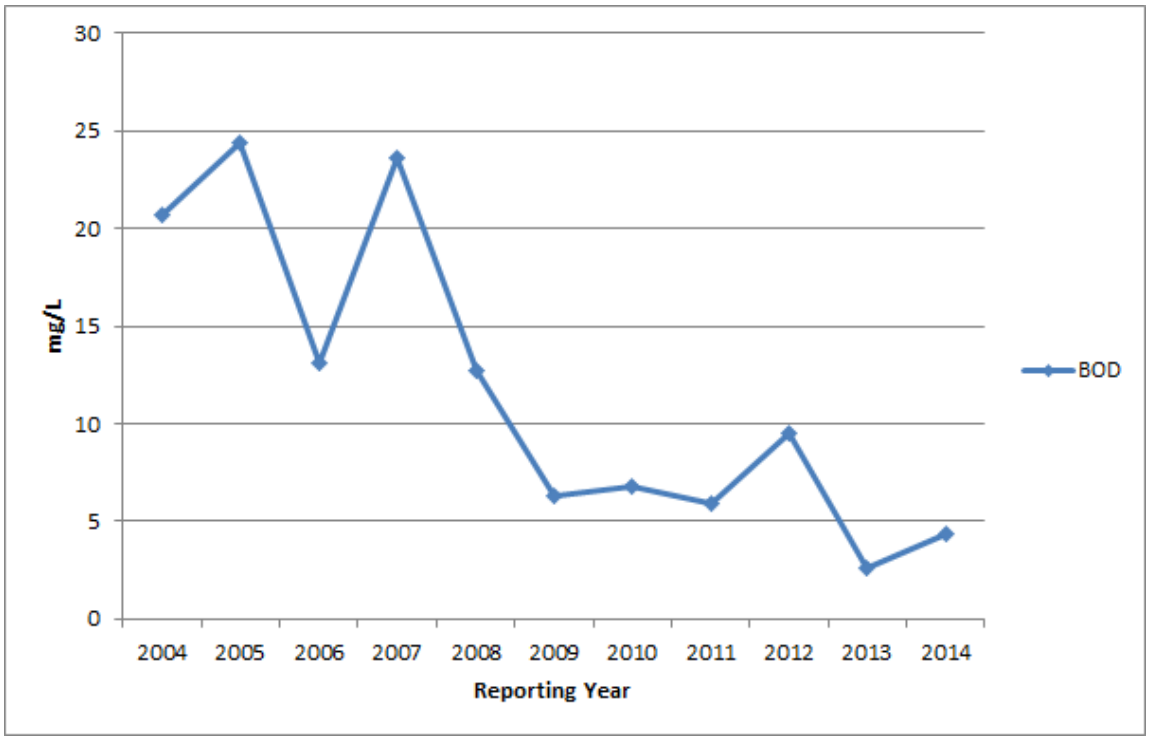


Figure 4-4. Parole station long-term monitoring: annual EMCs (BOD_5; mg/L)

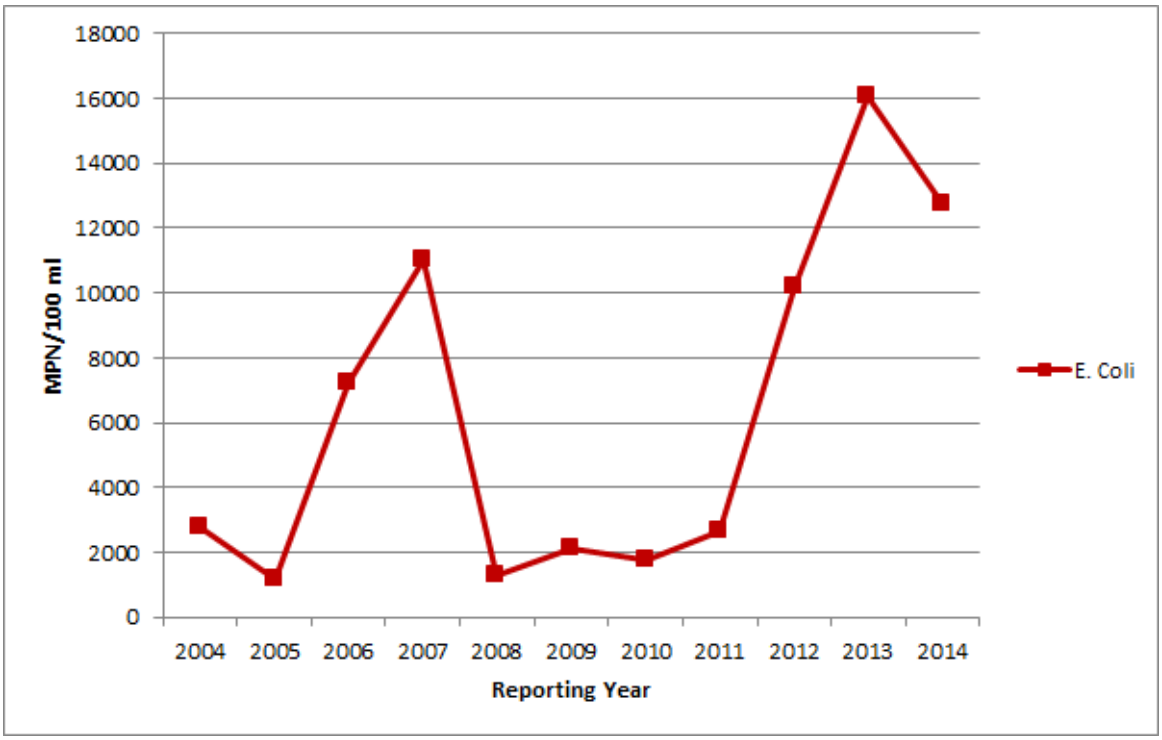


Figure 4-5. Parole station long-term monitoring: annual EMCs (*E. coli*; MPN/100 mL)

Figures 4-6 through 4-10 show similar trends in EMCs for the Church Creek Monitoring Station. Pollutant concentrations at Church Creek increased in 2014 for all monitored parameters, with the exception of TPH, which showed no change from 2013. Note that the apparent rise in TPH at Church Creek in 2013, like Parole Plaza, was due to an increase in the detection limit. Also like Parole Plaza, summer season concentrations were not included with the 2013 EMC data.

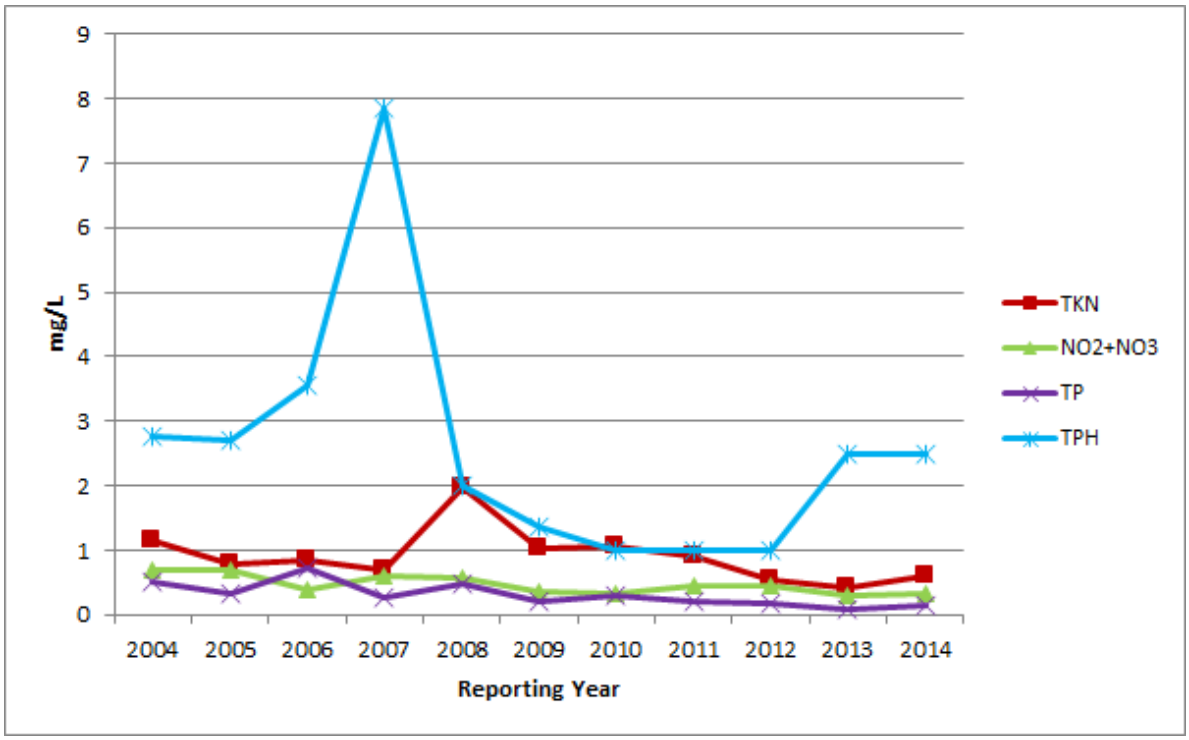


Figure 4-6. Church Creek station long-term monitoring: annual EMCs (TKN, NO_2+NO_3, TP, TPH; mg/L)

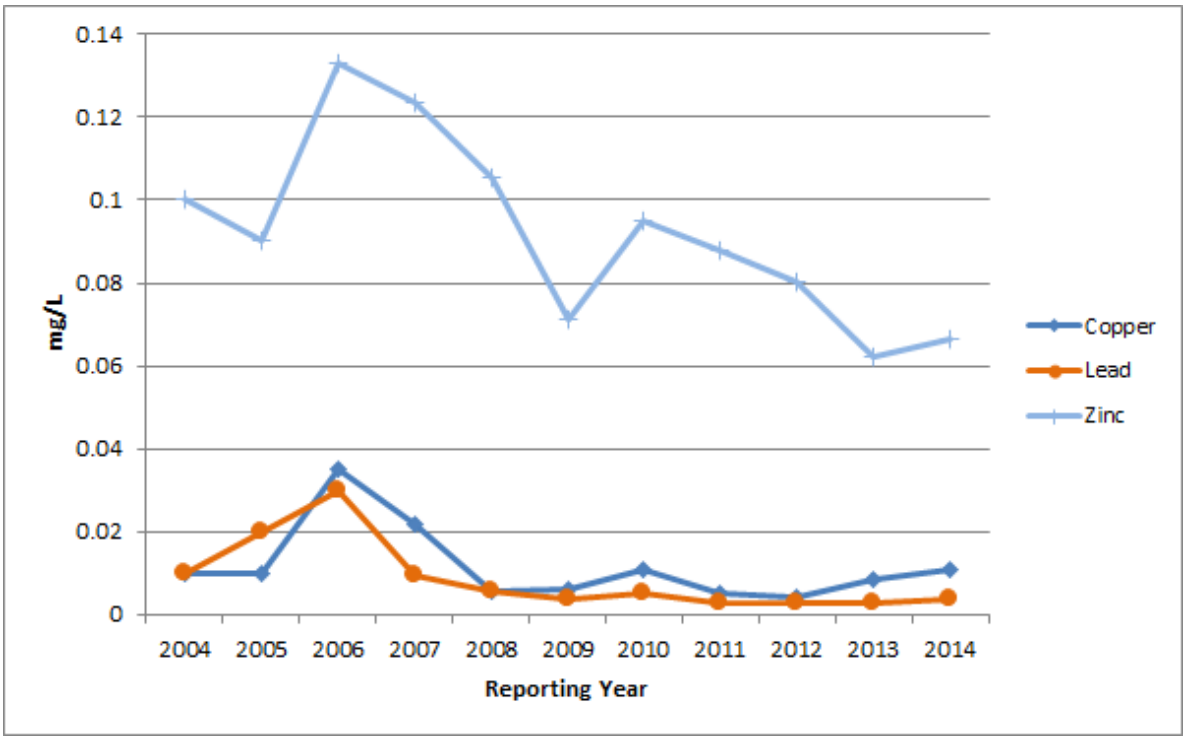


Figure 4-7. Church Creek station long-term monitoring: annual EMCs (Cu, Pb, Zn; mg/L)

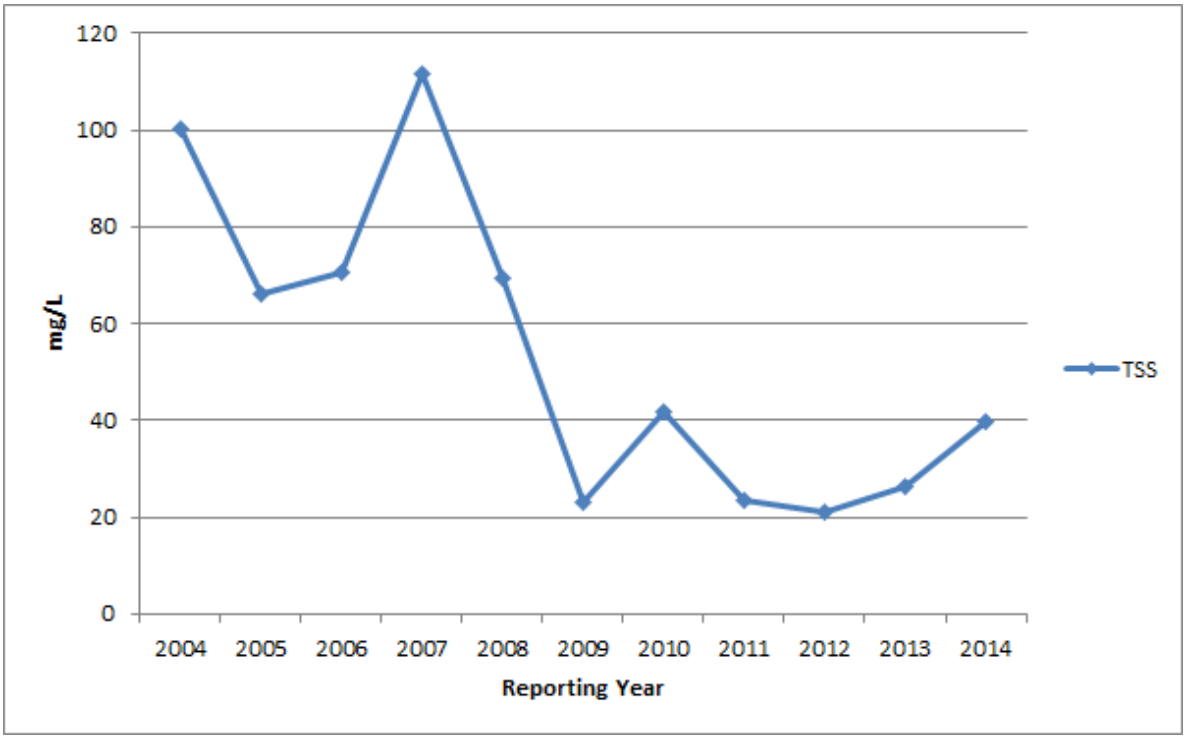


Figure 4-8. Church Creek station long-term monitoring: annual EMCs (TSS; mg/L)

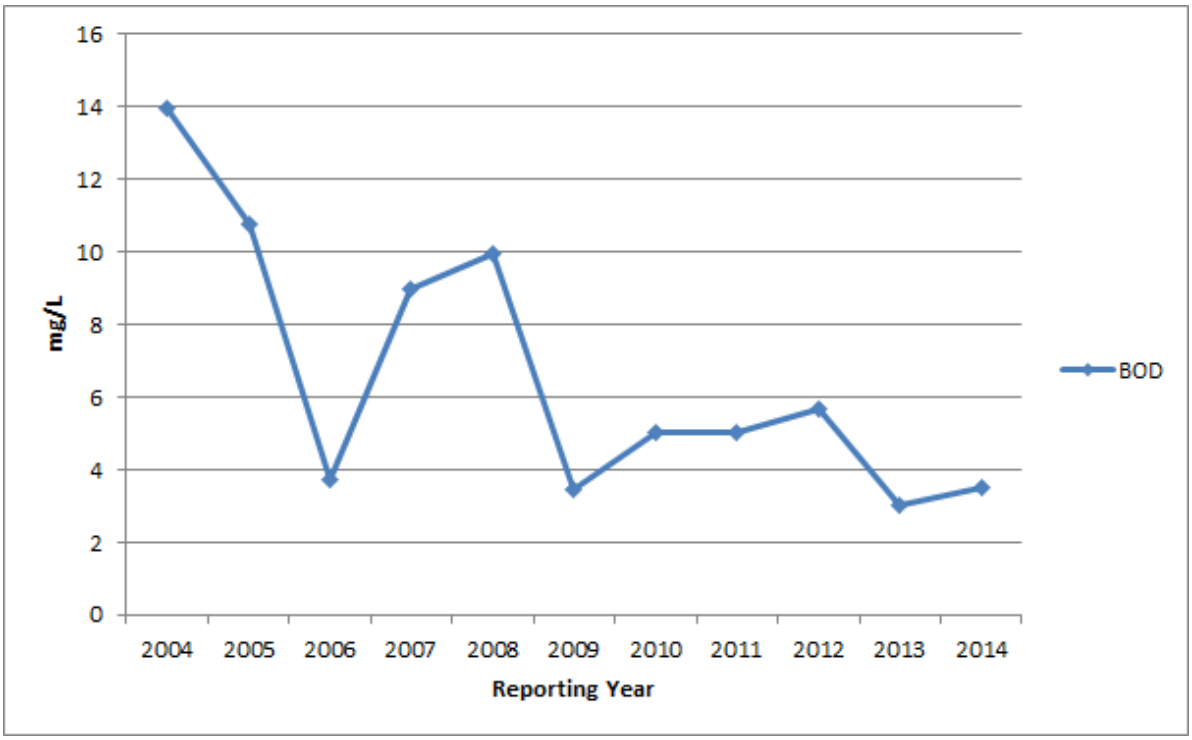


Figure 4-9. Church Creek station long-term monitoring: annual EMCs (BOD_5; mg/L)

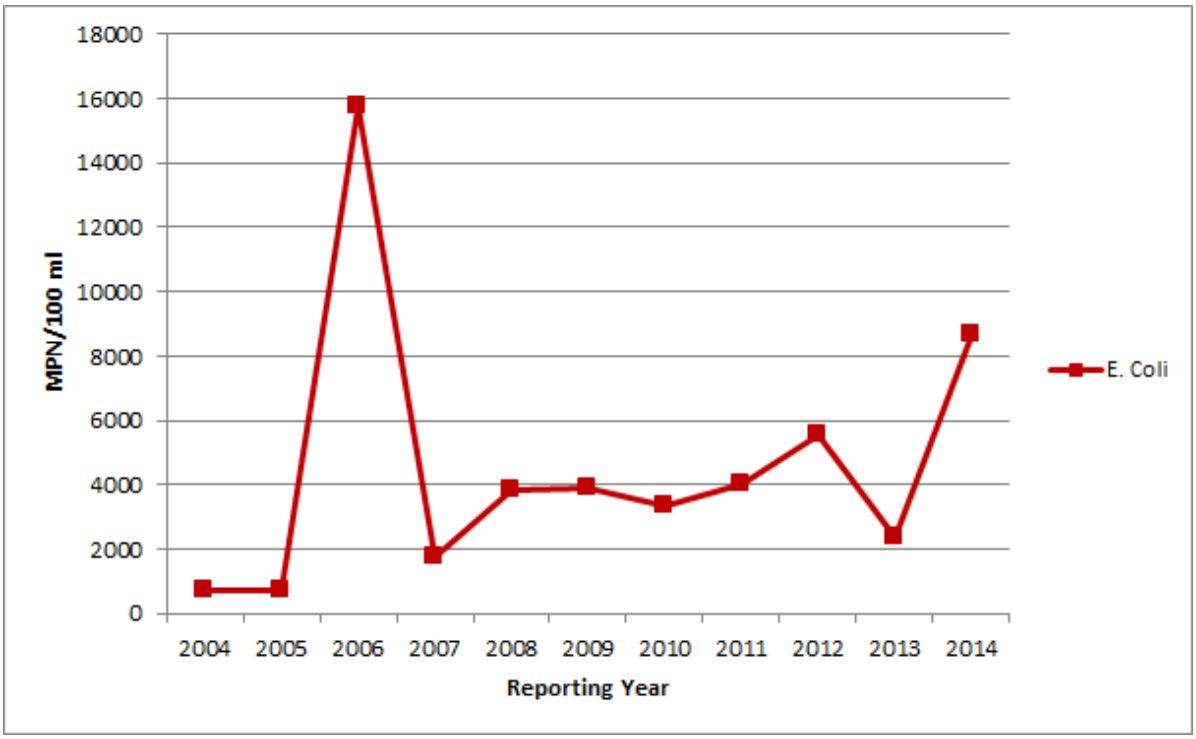


Figure 4-10. Church Creek station long-term monitoring: annual EMCs (*E. coli*; MPN/ 100 mL)

4.2 PHYSICAL HABITAT AND BIOLOGICAL CONDITIONS

Physical habitat and biological conditions within the Church Creek study area continue to be impaired by urbanization within the surrounding watershed. Stream physical habitat remains degraded throughout the entire study reach and appears to have changed very little from the previous year (Table 4-9, Figure 4-11). All four sites were rated the same in 2014 as in 2013 indicating no change in habitat condition. Urban stressors such as hydrologic alteration (i.e., increased runoff, increased frequency of peak flows, reduced infiltration) within the watershed have resulted in a reduction of stable instream habitat as well as increased channel erosion and sedimentation. A general lack of a stable epifaunal substrate further limits the capacity of the stream to support a diverse and healthy macroinvertebrate community. In addition, elevated conductivity levels reflect high levels of dissolved solids during baseflow conditions, which typically indicate the presence of water quality stressors.

Table 4-9. PHI scores from 2006 to 2014

Site		CC-01	CC-02	CC-03	CC-04
2006	PHI Score	51.1	55.4	56.8	No Data
	Rating	Degraded	Degraded	Degraded	Collected
2007	PHI Score	61.2	59.1	65.7	60.8
	Rating	Degraded	Degraded	Degraded	Degraded
2008	PHI Score	57.1	56.8	66.6	62.6
	Rating	Degraded	Degraded	Partially Degraded	Degraded
2009	PHI Score	73.2	59.6	69.2	65.2
	Rating	Partially Degraded	Degraded	Partially Degraded	Degraded
2010	PHI Score	64.3	53.9	65.0	62.3
	Rating	Degraded	Degraded	Degraded	Degraded
2011	PHI Score	67.4	55.3	66.9	61.5
	Rating	Partially Degraded	Degraded	Partially Degraded	Degraded
2012	PHI Score	69.2	51.5	62.5	58.3
	Rating	Partially Degraded	Degraded	Degraded	Degraded
2013	PHI Score	63.0	53.5	66.6	57.5
	Rating	Degraded	Degraded	Partially Degraded	Degraded
2014	PHI Score	65.85	56.16	70.79	61.01
	Rating	Degraded	Degraded	Partially Degraded	Degraded

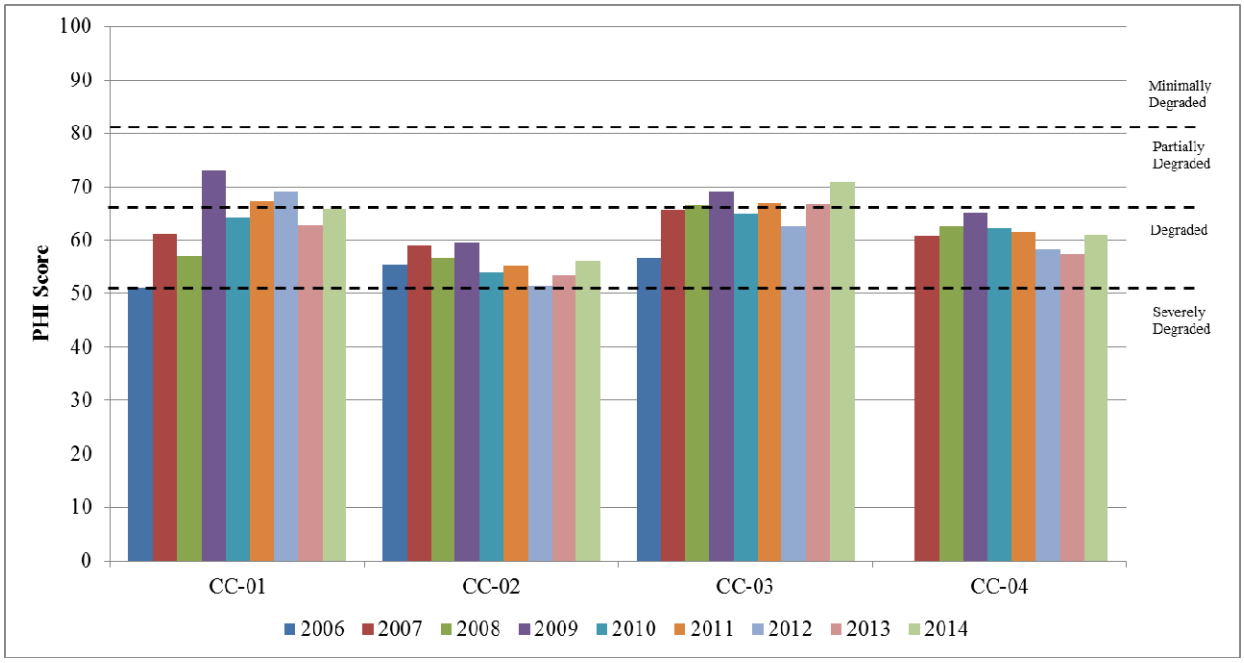


Figure 4-11. Comparison of PHI scores from 2006 to 2014

In 2013 and 2014, the updated MBSS PHI methods (Paul et al. 2003) were used to calculate PHI instead of the original MBSS methods (Hall et al. 2002) which had been used in the Church Creek watershed reports from prior years. Scores for 2006-2012 shown in Table 4-9 and Figure 4-11 were calculated using the original method, while scores for 2013 and 2014 were calculated using the updated method.

Biological impairment is evident within this watershed as reflected by the macroinvertebrate communities found throughout the study reach. A comparison of BIBI scores from 2006 through 2014 (Table 4-10) shows no substantial change in biological conditions throughout the study reach. While BIBI scores tend to fluctuate from year to year, overall classifications have changed very little with sites consistently rating either "Poor" or "Very Poor", no clear trends have been established (Figure 4-12). It appears that the biological community continues to be limited by the presence of urban stressors and the degraded physical condition of the stream, and annual shifts in BIBI scores are likely related to random and systematic variability inherent in the assessment process.

Table 4-10. BIBI scores from 2006 to 2014					
Site		**CC-01**	**CC-02**	**CC-03**	**CC-04**
2006	BIBI Score	1.86	2.43	1.86	No Data
	Rating	Very Poor	Poor	Very Poor	Collected
2007	BIBI Score	1.00	1.86	2.71	2.71
	Rating	Very Poor	Very Poor	Poor	Poor
2008	BIBI Score	2.43	2.43	2.43	2.14
	Rating	Poor	Poor	Poor	Poor
2009	BIBI Score	1.86	1.86	2.14	2.43
	Rating	Very Poor	Very Poor	Poor	Poor
2010	BIBI Score	1.29	1.86	1.57	2.14
	Rating	Very Poor	Very Poor	Very Poor	Poor
2011	BIBI Score	1.57	1.86	1.57	2.14
	Rating	Very Poor	Very Poor	Very Poor	Poor
2012	BIBI Score	1.86	2.43	1.57	2.43
	Rating	Very Poor	Poor	Very Poor	Poor
2013	BIBI Score	1.57	2.43	1.86	1.29
	Rating	Very Poor	Poor	Very Poor	Very Poor
2014	BIBI Score	1.57	1.86	1.29	1.57
	Rating	Very Poor	Very Poor	Very Poor	Very Poor

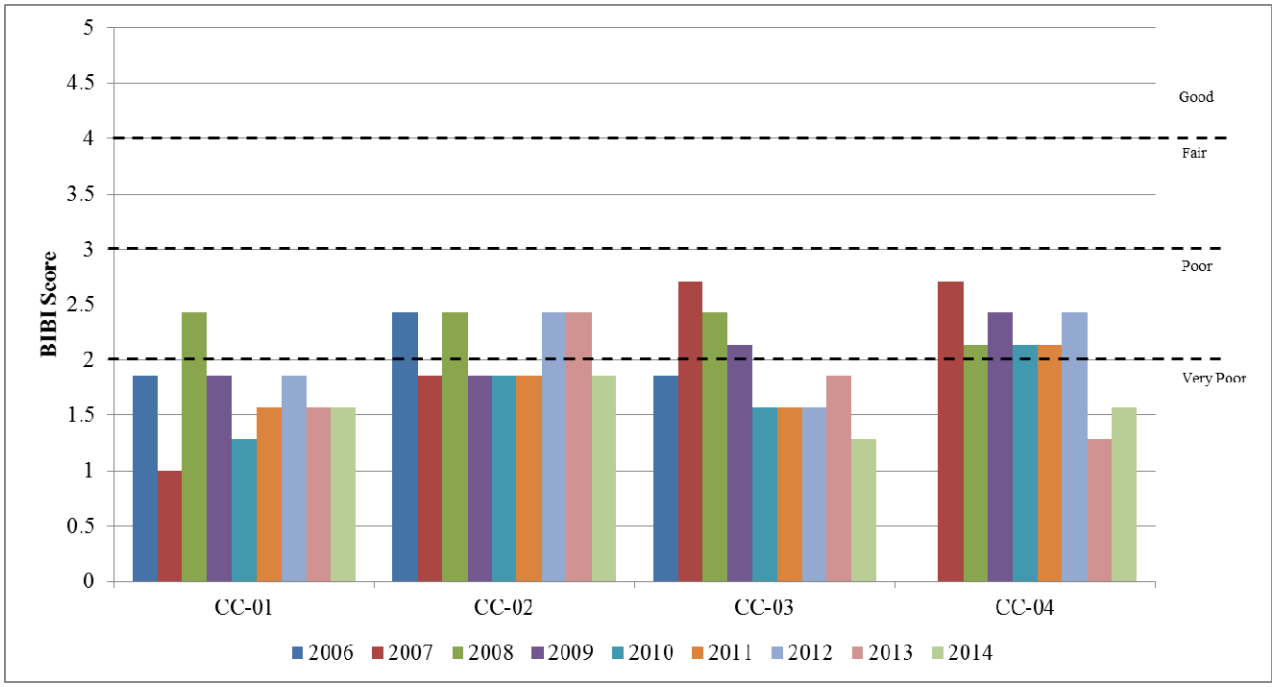


Figure 4-12. Comparison of BIBI scores from 2006 to 2014

4.3 GEOMORPHIC CONDITIONS

The Church Creek study area has a very high percentage of impervious surface cover (approximately 64 percent), and only one reach was classified as a C channel, which are generally considered stable stream types due to adequate floodplain connectivity. In contrast, the other four reaches were classified as either F or G channels, which are more entrenched and less stable. The Parole Plaza Tributary maintains some limited connectivity to its floodplain even though there are significant stormwater inputs feeding into the stream, which typically results in accelerated channel erosion and degradation. Evolution of channel type over the course of the study at each cross section is presented in Table 4-11. It is likely that current stormwater management and wetland storage on the Church Creek mainstem, as well as the presence of an intact riparian vegetative buffer along much of the stream corridor, contributes to minimizing some of the adverse effects of the high imperviousness in the watershed. Additionally, grade controls such as the culvert at Solomon's Island Road and cobble rip-rap armoring at XS-5 likely prevent degradation from occurring in the channel upstream. Nonetheless, there are clear indications of channel instability (i.e., degradation, aggradation, widening) in the upper reaches of the Parole Plaza Tributary, and thus, a need for additional stormwater management to prevent further channel erosion.

Table 4-11. Past Rosgen classifications

Cross Section	2006	2007	2008	2009	2010	2011	2012	2013	2014
XS-1	E5	C5	E4	E5 → C5	E5 → C4/5	C4/5 → F4/5	F5	F4	F5/4
XS-2	E5	E5	E5	E5	E5	G5c	G5c	G5c	G4c
XS-3	G5c	G5c	G5c	G5c	G5c	No Data	No Data	G4c	G4c
XS-4	E5	E5	E5	E5	E5	E5	E5	C5	C5
XS-5	E5b	C5	C5	C5	C3/5	C3/5	C3/5	F4/3	F3

Bankfull channel dimensions (cross sectional area, width, depth) in the Church Creek study area showed significant departure from expected values, as derived from Maryland Coastal Plain regional relationships of bankfull channel geometry (McCandless, 2003). Almost all dimensions were generally larger in the Church Creek study area (see Figures 4-13, 4-14, and 4-15), and were often more similar to relationships of bankfull channel geometry derived from gaged urban watersheds located in the Coastal Plain. These relationships were developed for an urban stream restoration project in Anne Arundel County (AADPW 2002). Values measured in 2014 were roughly consistent with prior assessment results. This reflects the higher level of imperviousness in the study area, as compared to the lower impervious levels in the drainage areas used to develop the regional relationship data. The results suggest that this stream has become enlarged as a result of the high imperviousness, and is both wider and deeper than stable C and E type channels located in rural/suburban watersheds of the coastal plain. It should be noted, however, that locating bankfull elevations in the field on actively eroding, previously stabilized, or incising channels is difficult and not recommended due to unreliable and/or misleading indicators, and instead bankfull elevations should be estimated using the

aforementioned regional curves (Rosgen, personal communication, May 2011). Where bankfull indicators were suspect or questionable, the indicator approximating the rural/ suburban regional curve for bankfull area was used to estimate bankfull elevations. Additionally, the Rosgen method is best used on streams that are free to adjust their lateral boundaries under the current discharge regime experienced by the system (Rosgen 1996). Given the high levels of rip rap and/or concrete rubble armoring found in the reaches containing cross sections 2, 3 and 5, the accurate determination of the bankfull indicators in the field at these locations is problematic.

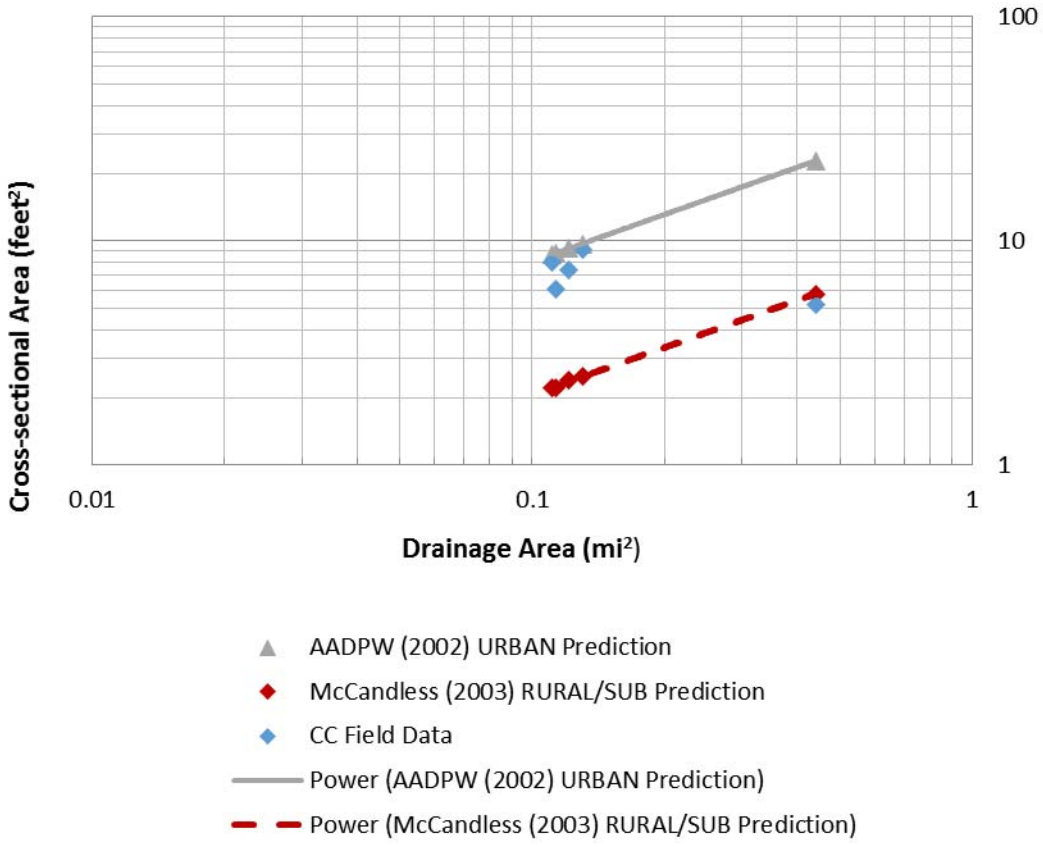


Figure 4-13. Comparison of bankfull channel cross sectional area to drainage area (CC = Church Creek, 2014 data)

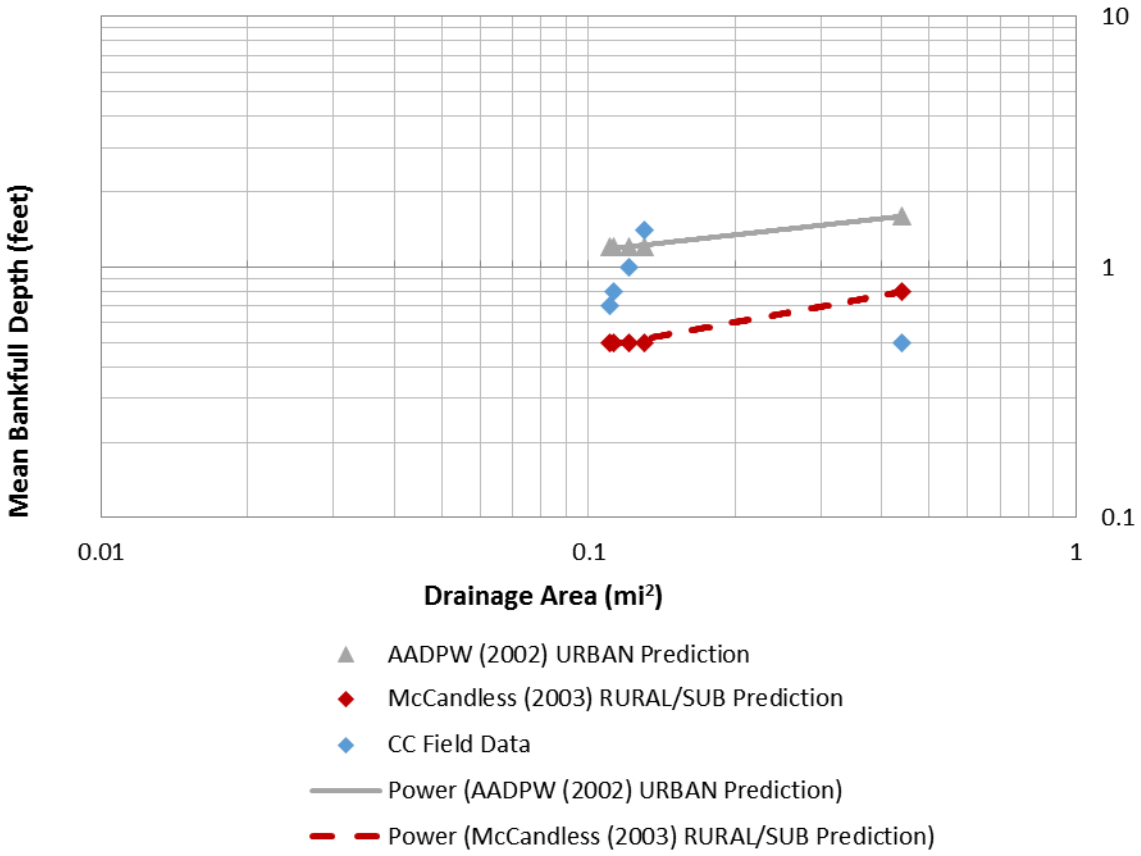


Figure 4-14. Comparison of mean bankfull depth to drainage area (CC = Church Creek, 2014 data)

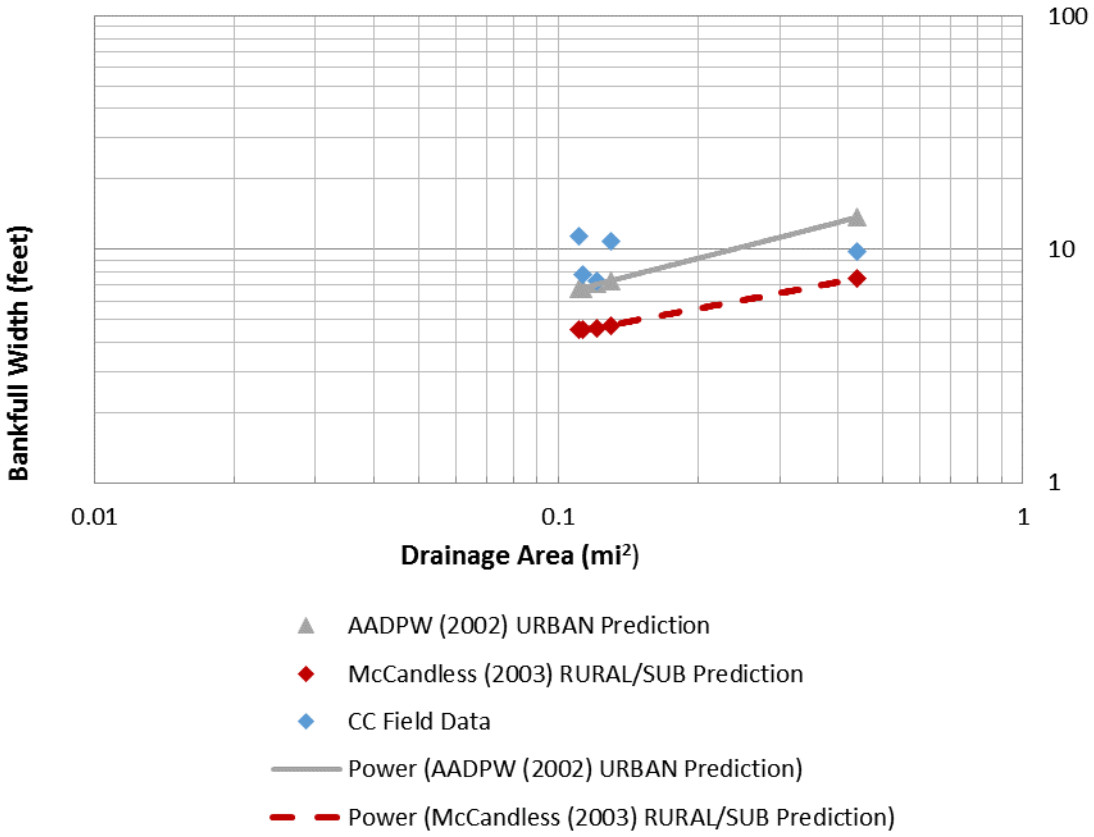


Figure 4-15. Comparison of bankfull width to drainage area (CC = Church Creek, 2014 data)

Three of the five cross sections showed enlargement from channel erosion while the other two showed aggradation as compared to baseline measurements (Table 4-12). Due to the replacement of XS-3 following channel restoration, data were compared to 2007 at this location only, whereas all other comparisons were made to 2003 data. Cross sectional area from 2011 through 2014 was calculated using the top of bank elevation from the baseline survey in order to standardize comparisons and reduce variability among more subjective bankfull elevation reference points, or even changes that can occur to top of bank elevation from year to year. It is important to note that calculations prior to 2011 did not use the baseline reference elevation, instead they used the corresponding year's top of bank elevation for calculating cross sectional area, and consequently these values are not directly comparable to the cross sectional areas reported in 2011 through 2014. Comparison of baseline cross sectional area is however comparable to 2011 through 2014 since all calculations are made using the same top of bank elevation.

Table 4-12. Summary of cross sectional area changes over time.

Cross Section[a]	XS-1	XS-2	XS-3	XS-4	XS-5
July 2003	16.8	8.9	ND	14.3	9.7
Jan 2005	20.7	10.0	ND	14.4	9.9
March 2006	19.4	8.0	ND	18.4	9.5
March 2007	19.4	8.9	19.8	17.4	9.0
May 2008	20.1	10.1	16.7	18.0	8.9
July 2009	19.6	9.8	21.0	15.4	8.3
May 2010	19.8	10.3	20.4	16.4	8.5
July 2011[b]	21.3	15.9	20.6	7.8	10.5
April 2012[b]	21.6	15.4	19.2	11.7	5.9
July 2013[b]	21.0	15.5	20.2	11.7	6.9
June 2014 [b]	22.4	16.2	20.6	6.8	6.7
% Change 2003-2014	33.3	82	4.0[c]	-52.4	-30.9
% Change 2011-2014	5.2	1.9	0	-12.8	-36.2

[a] All values listed here are for top of bank area and are listed in square feet
[b] Values obtained using reference elevations (top of bank) from baseline measurements
[c] % change from 2007
ND = No Data

Using the current reference elevation comparison method, the upstream cross sections (XS-1 and XS-2) showed fairly substantial enlargement, with increases of approximately 33.3%, and 82% respectively, since baseline measurements began in 2003. The bed elevation at XS-1 appears to have dropped more than half a foot since 2003, remaining relatively stable since last year, but with a noticeable amount of bed scour occurring between 2008 and 2009 (Appendix F). With the exception of minor scouring near the left bank, there has been very little overall change in bed elevation between the last two years of monitoring, 2013 to 2014. The channel at XS-2 has widened notably since 2003, with considerable erosion along the right bank and toe of slope on the right bank, although the left bank has not experienced further erosion during the last four years (Appendix F). Although cross section area comparisons between baseline and 2014 show a substantial increase, percent change occurring over the last four years only has been fairly minimal with 5.2% increase at XS-1 and 1.9% increase at XS-2.

Cross section XS-3 has had very minimal changes in cross-sectional area with just a 4% increase since 2003 baseline measurements and 0% change between 2011 and 2014. Between 2009 and 2011, the XS-3 channel appeared to be enlarging, as the right bank and bottom of the right bank experienced some erosion and the cross-sectional area increased (Appendix F). However, during the past three years, the right bank has experienced some aggradation, while the stream bed has downcut slightly (Appendix F). Between 2012 and 2014 monitoring, there has been little change with the exception of slight widening and scouring along the right bank. Cross section XS-3 continues to have yard waste (i.e., grass clippings, leaves, and branches) dumped along the left bank floodplain.

Conversely, the two most downstream cross sections (XS-4, and XS-5) showed varying degrees of aggradation, decreasing from baseline measurements in cross-sectional area 52.4%, and 30.9%, respectively. Between 2010 and 2011 cross section XS-4 had shown moderate signs of aggradation. Within the next year, the channel experienced erosion of the bed particularly along the right hand side of the stream. In the 2013 survey, signs of aggradation were again present and the stream bed characteristics resemble those of the 2011 survey. In 2014 the stream bed remained elevated as in 2011 and 2013 however there was slight widening along the right bank. A significant change at XS-4 first occurred between 2003 and 2006, where the average bed elevation dropped by more than one-half foot (Appendix F). The woody debris jam just downstream of XS-4 which formed between 2011 and 2012 is still present and contributing to debris and sediment accumulation in the channel and on the banks. Between 2011 and 2014 the cross-sectional area has decreased by 12.8% and the overall trend at this location is aggradation (a net 52% decrease in cross-sectional area compared to the baseline study). Cross section XS-5 has been armored with cobble-sized rip rap in its bed to protect the sewer line. Between 2012 and 2013, XS-5 appears to have eroded by several inches of sediment most notably near the left bank. During the past year however, there has been little change in both stream bed elevation and bank stability (Appendix F).

Based upon the data collected in 2014, biological and physical conditions within the Church Creek study area have not improved and remain in a degraded and impaired condition. Although the stream channel has been stabilized along several reaches, the effects on biota are yet to be seen from such efforts.

5 REFERENCES

AADPW. 2002. Cypress Creek Tributary Assessment and Findings Report. Prepared by Bayland Consultants and Designers, Inc., and Clear Creek Consulting. 32 pp., plus Appendices.

Anne Arundel County. 2010. Anne Arundel County Biological Monitoring and Assessment Program: Quality Assurance Project Plan. Revised December 2010. Prepared by KCI Technologies, Inc. for Anne Arundel County Department of Public Works, Watershed Ecosystem and Restoration Services. Annapolis, MD. For additional information, contact Mr. Chris Victoria (410-222-4240, <PWVICT16@aacounty.org>).

Barbour, M.T., J. Gerritsen, B.D. Snyder, J.B. Stribling. 1999. *Rapid bioassessment protocols for use in streams and wadeable rivers: Periphyton, benthic macroinvertebrates and fish, 2nd edition.* EPA841-B-99-002. U.S. Environmental Protection Agency; Office of Water; Washington, D.C.

Cushman, S.F. 2006. Fish movement, habitat selection, and stream habitat complexity in small urban streams. Dissertation submitted to the Faculty of the Graduate School of the University of Maryland, College Park, in partial fulfillment of the requirements for the degree of Doctor of Philosophy.

Greenhorne and O'Mara. 2005. *Annapolis Towne Centre @ Parole Stormwater Management Report.* Prepared for Annapolis Towne Centre @ Parole, LLC, Owings Mills, MD.

Hill, C.R., and M.J. Pieper. 2011. Aquatic Biological Assessment of the Watersheds of Anne Arundel County, Maryland: Round One 2004 – 2008. Anne Arundel County Department of Public Works, Watershed, Ecosystem, and Restoration Services, Annapolis, Maryland.

KCI Technologies. 2009a. Howard County Biological Monitoring and Assessment, Dorsey Run, Hammond Branch, and Rocky Gorge Watersheds – 2009. Prepared for Howard County, Department of Public Works. Stormwater Management Division. Columbia, MD. October 2009.

KCI Technologies. 2009b. Stormwater Management Pond & Infiltration Trench Field Inspection Manual (Draft-Final). Prepared by KCI Technologies, Inc., Laurel, MD, for Anne Arundel County, Infrastructure Management Division, Annapolis, MD. March 4, 2009.

Maryland Department of the Environment (MDE). 2010. Code of Maryland Regulations (COMAR), Water Quality Criteria Specific to Designated Uses. Revised effective date: April 19, 2010.

McCandless, T.L. 2003. *Maryland stream survey: Bankfull discharge and channel characteristics of streams in the Coastal Plain hydrologic region*. U.S. Fish and Wildlife Service, Annapolis, MD. CBFO-S03-02.

Maryland Department of Natural Resources (DNR). 2010. Maryland Biological Stream Survey Sampling Manual: Field Protocols, Rev. Jan. 2010. CBWP-MANTA-EA-07-01. Maryland Department of Natural Resources, Annapolis, MD. Publication # 12-2162007-190.

Maryland DNR. 2005. Maryland Biological Stream Survey 2000-2007 Volume 4: Ecological Assessment of Watersheds Sampled in 2003. CBWP-MANTA-EA-05-01. Maryland Department of Natural Resources, Annapolis, MD. Publication # DNR-12-0105-0038.

Maryland DNR. 2003. Maryland Biological Stream Survey 2000-2007 Volume 2: Ecological Assessment of Watersheds Sampled in 2001. CBWP-MANTA-EA-03-03. Maryland Department of Natural Resources, Annapolis, MD.

Maryland DNR. 2001. Maryland Biological Stream Survey 2000-2007 Volume 1: Ecological Assessment of Watersheds Sampled in 2000. CBWP-MANTA-EA-01-05. Maryland Department of Natural Resources, Annapolis, MD.

Mecklenburg, D. 2006. *The Reference Reach Spreadsheet*. Version 4.1 L. Ohio Department of Natural Resources.

Paul, M.J. and J.L. Meyer. 2001. Streams in the urban landscape. Annual Review of Ecology and Systematics 32:333-365.

Paul, M.J., J.B. Stribling, R.J. Klauda, P. F. Kayzak, M.T. Southerland, and N. E. Roth. 2003. A Physical Habitat Index for Wadeable Streams Maryland. Report to Monitoring and Non-Tidal Assessment Division, Maryland Department of Natural Resources, Annapolis, MD.

Rosgen, D.L. 1996. *Applied River Morphology*. Wildland Hydrology, Pagosa Springs, CO.

Southerland, M., G. Rogers, M. Kline, R. Morgan, D. Boward, P. Kazyak, and S. Stranko. 2005. *Development of New Fish and Benthic Macroinvertebrate Indices of Biotic Integrity for Maryland Streams*. Report to Monitoring and Non-Tidal Assessment Division, Maryland Department of Natural Resources, Annapolis, MD.

Stribling, J.B., E.W. Leppo, and C. Daley. 1999. Biological Assessment of the Streams and Watersheds of Prince George's County, Maryland. Spring Index Period 1999. PGDER Report No. 99-1. Prince George's County, Dept. of Env. Rsrs., Programs and Planning Division, Largo, MD.

United States Environmental Protection Agency (USEPA). 2002. *Urban Stormwater BMP Performance Monitoring: A Guidance Manual for Meeting the National Stormwater BMP Database Requirements*. EPA-821-B-02-001.

USEPA. 2000. Ambient Water Quality Criteria Recommendations Information Supporting the Development of State and Tribal Nutrient Criteria Rivers and Streams in Nutrient Ecoregion IX. Office of Water, 4304. December 2000. EPA 822-B-00-019 [http://www2 .epa .gov/sites/production/files/documents/rivers9.pdf].

USEPA. 1986. Quality Criteria for Water 1986. United States Environmental Protection Agency, Office of Water Regulations and Standards, Washington, DC. May. EPA 440/5-86-001.

USEPA. 1983. Final Report of the Nationwide Urban Runoff Program. United States Environmental Protection Agency, Water Planning Division. Washington, D.C. December.

USEPA. 1974. National Water Quality Inventory. 1974 Report to the Congress. Volume II. United States Environmental Protection Agency, Office of Water Planning and Standards, Washington, D.C. EPA 440/9-74-001.

Versar, Inc. 2013. Chemical, Biological, and Physical Characterization of the Church Creek and Parole Plaza NPDES Monitoring Stations: 2013. Prepared for Anne Arundel County Department of Public Works. December 2013.

Versar, Inc. 2014a. Church Creek/Parole Plaza NPDES Water Chemistry Monitoring – Summer 2013 Quarter Report. Technical Memorandum Prepared by Versar, Inc., Columbia, MD for Janis Markusic, Anne Arundel County Department of Public Works. February 2014.

Versar, Inc. 2014b. Church Creek/Parole Plaza NPDES Water Chemistry Monitoring – Fall 2013 Quarter Report. Technical Memorandum Prepared by Versar, Inc., Columbia, MD for Janis Markusic, Anne Arundel County Department of Public Works. June 2014.

Versar, Inc. 2014c. Church Creek/Parole Plaza NPDES Water Chemistry Monitoring – Winter 2014 Quarter Report. Technical Memorandum Prepared by Versar, Inc., Columbia, MD for Janis Markusic, Anne Arundel County Department of Public Works. July 2014.

APPENDIX A

STORM EVENT HYDROGRAPHS, NARRATIVES AND COMPOSITE SAMPLING METHOD TECHNICAL MEMORANDUM

KCI TECHNOLOGIES

TECHNICAL MEMORANDUM

TO:	Janis Markusic, AACO DPW
FROM:	James Tomlinson
DATE:	5/12/08
SUBJECT:	Proposed Modifications to Sampling Procedures Church Creek/Parole Plaza NPDES Monitoring 2008 KCI Job Order No. 01-032333.38

Dear Ms. Markusic,

Monitoring at the Parole Plaza station has historically entailed collecting storm water samples from a 60" corrugated metal pipe (CMP) outfall draining the Parole Plaza site. The rising, peak, and falling limb of each storm event was sampled and analyzed in the lab. In the summer of 2007, a newly-installed 54" reinforced concrete pipe (RCP) was connected to the Church Creek drainage network (refer to Figure 1). The new 54" RCP drains the *Annapolis Towne Center at Parole* construction site and contains portions of the drainage that had historically been passing through the 60" CMP. Based on plan reviews, on-site discussions with County staff /inspectors, and discussions with Mr. Matthew Kelly of Greenhorne & O'Mara Inc. (Head Engineer) it was determined that runoff from the *Annapolis Towne Centre at Parole* site would be discharging from both the 60" CMP and 54" RCP outfalls under post-construction conditions.

In order to maintain consistency in the characterization of the watershed, samples are being collected from both pipes. As in the 2006-2007 reporting year, the 2007-2008 reporting year has also encountered the challenge of determining the active drainage configuration during each sampled event. To address this problem, samples were collected for each limb of an event and taken to the laboratory for each pipe separately. In 2007, storm samples were collected and analyzed for both outfall pipes for three storm events (9/11/07, 10/9/07, and 10/19/07) at the Parole Plaza station. In 2008, storm samples were collected and analyzed for both outfall pipes for two storm events (1/10/08 and 1/17/08) at the Parole Plaza station.

Stage/discharge relationships were developed for both pipes, to determine the discharge from each pipe based on field-measured depths. The rating tables were used to determine discharges and total flow volumes for each limb of the storm. The reported concentrations for each limb were then weighted by the flow for that limb of the storm to determine the event mean concentration for each pipe. The event mean concentrations for each pipe were then flow weighted again for the total discharge through each pipe to determine the total event mean concentration for the *Annapolis Towne Center at* Parole site.

In March 2008, the sampling methodology was modified such that only one flow-weighted composite sample per event limb is collected and analyzed at the lab. The goal of compositing the discharge from both pipes is to ensure a comprehensive analysis of the storm water leaving the *Annapolis Towne Center at Parole* site during and after construction. The flow-weighted composite sample for each limb of an event is determined by the combined discharge of the 60" CMP and 54"RCP outfalls. Stage/discharge relationships were developed for both pipes, to determine the discharge from each pipe based on field-measured depths. The relationships are based on modeled values and are currently being validated by field-measured data. A sample

is collected for each limb of a storm by proportioning the appropriate volume of RCP/CMP sample into a sample container, based on each pipes contribution to the total runoff. To determine the appropriate amount of sample to collect from each pipe for each limb, the discharge from the CMP and RCP is computed and totaled. The CMP and RCP discharge is then divided by the total discharge to determine the percent contribution to the total discharge. Once the percent contribution is determined, then volumetric containers are utilized to proportion each pipe sample to create one composite sample. The composite sample is then distributed into the laboratory bottles.

At this time, three storm events (3/19/08, 4/20/08, and 4/26/08) have been sampled utilizing the flow-weighted composite method. Currently, no automated equipment is available for the RCP. Level, pH, and temperature are taken manually during sampled events. All of the flow data and discharge characteristics for each outfall pipe are recorded during the storm event into a laptop spreadsheet that automatically calculates the correct sample proportions. General notes, field-measured velocity data, and a hydrograph are also recorded on the laptop spreadsheet during the storm event (see Figure 2).

As discussed in the field on April 10, 2008, KCI feels that this is an appropriate method for maintaining consistency with the historical data, while reducing the costs of sampling and testing both outfalls individually.

If you have any questions or comments, please feel free to contact me at the number below.

Sincerely,

James A. Tomlinson, PE
Project Manager
(410) 316-7864

ND/jt

cc: Christopher Victoria, AACo DPW
Nathan Drescher/KCI

M:\2003\01032333.38\corresp\Technical Memorandum Parole Plaza Sampling.doc

Proposed Modifications to Sampling Procedures
Church Creek/Parole Plaza NPDES Monitoring 2008
KCI Job Order No. 01-032333.38

5/12/08

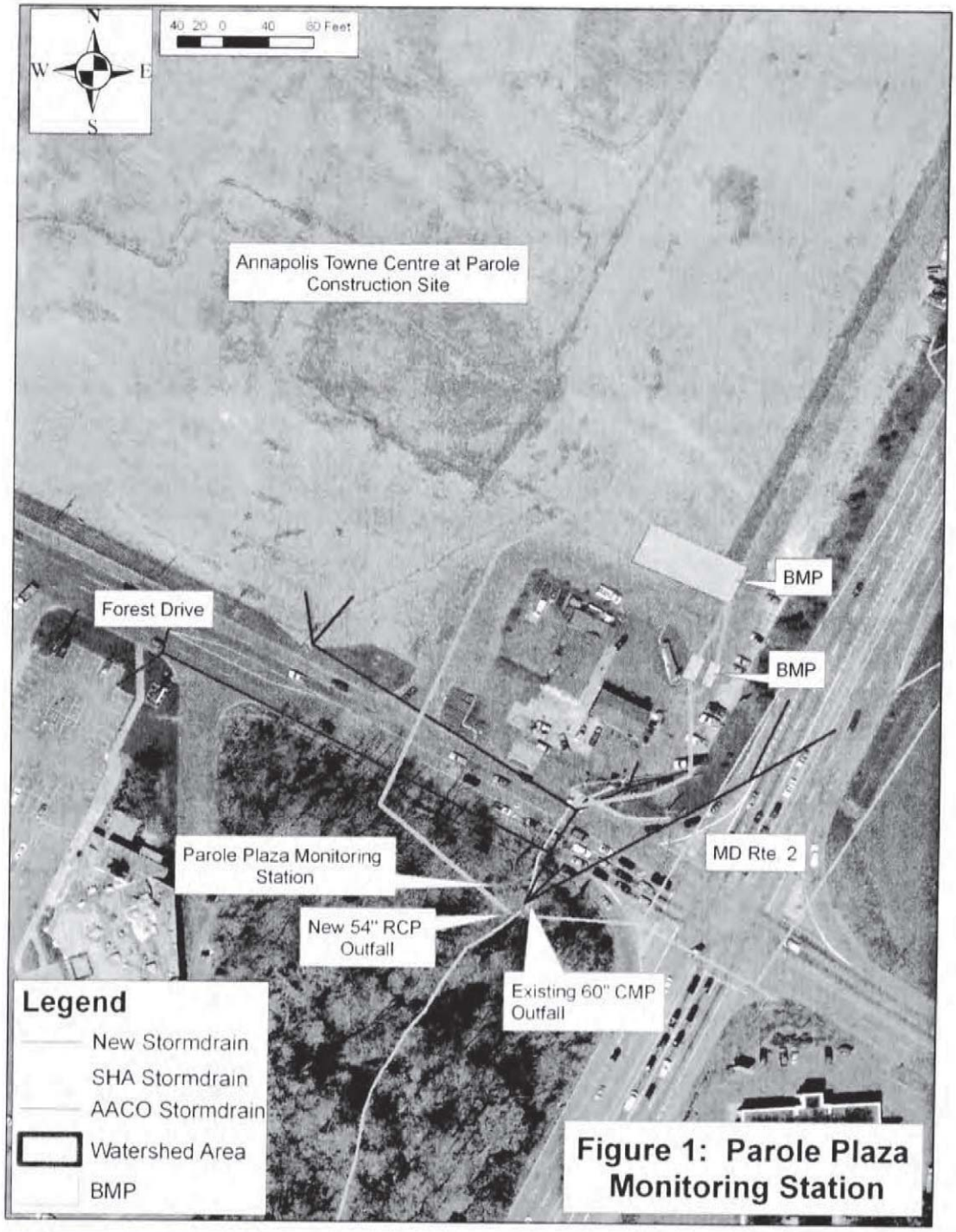
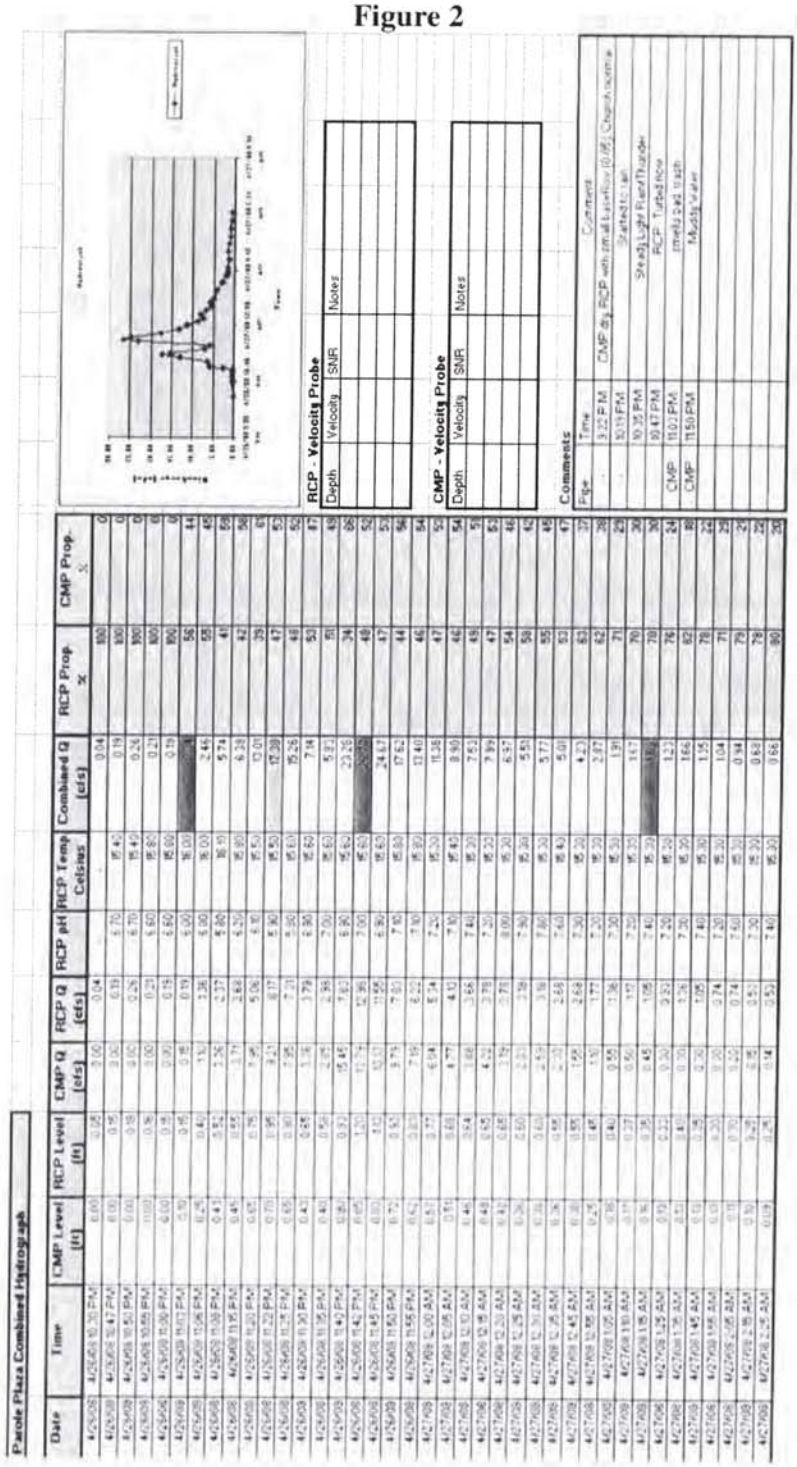


Figure 1: Parole Plaza Monitoring Station

Proposed Modifications to Sampling Procedures
Church Creek/Parole Plaza NPDES Monitoring 2008
KCI Job Order No. 01-032333.38
Page 4 of 4
5/12/08

Figure 2



Storm Event Narratives

- September 12, 2013 – At the Church Creek station, the EMCs of most parameters during the September 12, 2013 storm were greater than the mean annual values for the early months of 2013, except for BOD, TKN, nitrate-nitrite, TPH, and hardness. TPH was not detected in any samples at Church Creek during the event. Since this event was the only storm for this quarter, most EMCs were higher than the overall EMCs for the quarter. Nitrate-nitrite and hardness were lower than the quarterly EMC during the storm and higher during the baseflow sampling event. At the Parole Plaza station, the EMCs of most parameters during the September 12, 2013 storm were greater than the mean annual values for the early months of 2013 except TPH, *E. coli*, and hardness. As was the case at Church Creek, TPH was the only parameter not detected in any samples. Nitrate-nitrite and hardness were lower for the quarterly EMC during the storm than during the baseflow sampling event.

- October 7, 2013 - At the Church Creek station, the EMCs of most parameters during the October 7, 2013 storm were higher than the EMC values for the September 12, 2013 storm, except for TSS, lead, zinc, and hardness. TPH was not detected in any samples at Church Creek during the event. The EMC for pH during this event was neutral at 7.0. Most of the parameter EMCs for this event were higher than the other two fall events except TKN, nitrate-nitrite, zinc, lead and hardness. The same parameters for the fall flow-weighted EMC were high. At the Parole Plaza station, the EMCs of most parameters during the October 7, 2013 storm were lower than the EMC values for the September 12, 2013, except for pH, *E. coli*, and hardness. As was the case at Church Creek, TPH was the only parameter not detected in any samples. EMCs for BOD, nitrate-nitrite, and *E. coli* during this storm were higher than corresponding EMCs for the other two storms monitored this quarter. Lead, BOD, and nitrate-nitrite were higher than the fall flow-weighted EMCs.

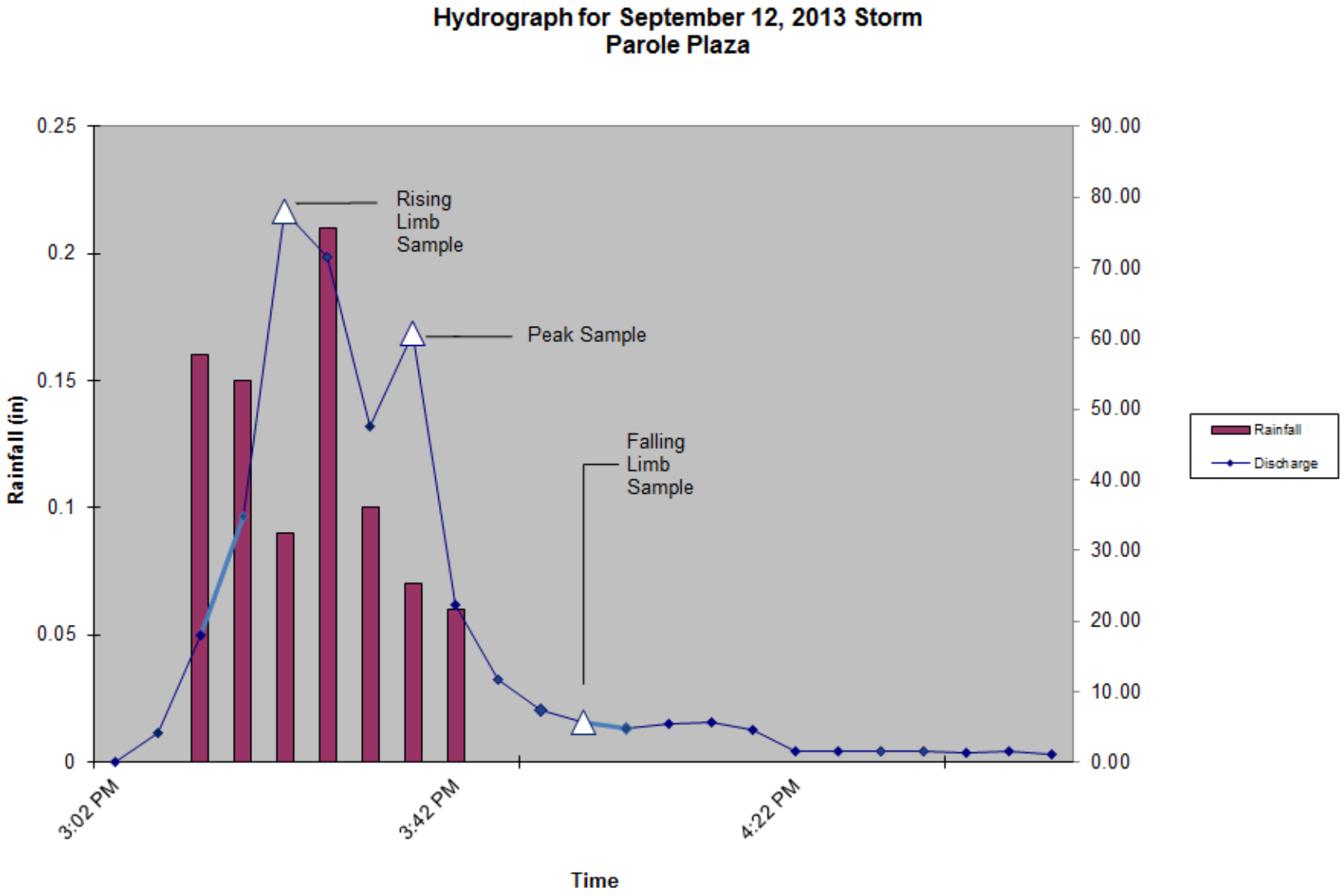
- December 6, 2013 – At the Church Creek station, TKN, nitrate-nitrite, zinc, and hardness EMCs for this event were higher than the other two fall events and the quarterly flow-weighted EMCs. TPH was not detected in any samples at Church Creek during the event. At the Parole Plaza station, in contrast, all of the parameter EMCs were lower than the other two events and the quarterly flow-weighted EMCs. As was the case at Church Creek, TPH was the only parameter not detected in any samples.

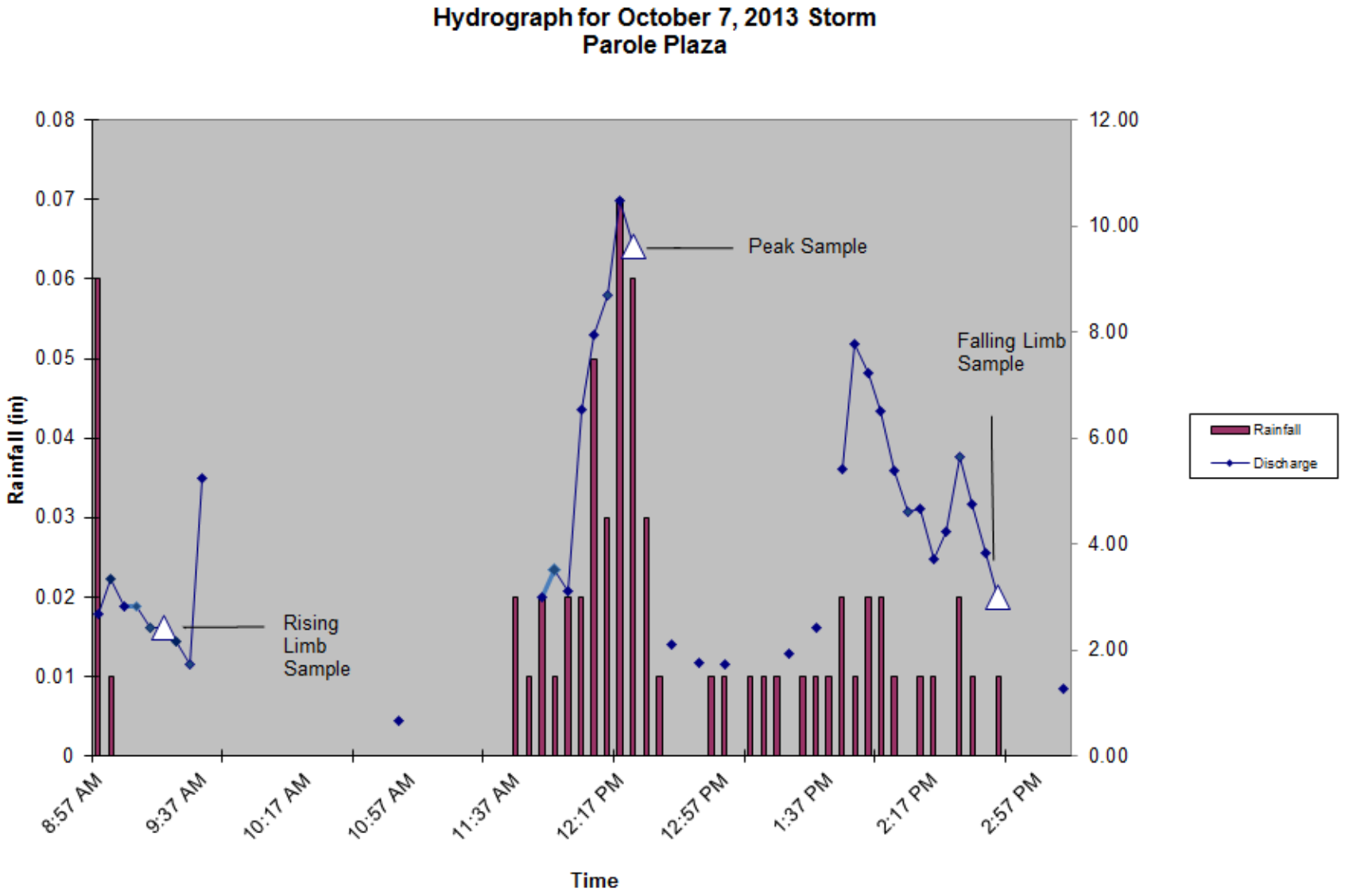
- December 23, 2013 - At Church Creek, the EMCs of all parameters during the December 23, 2013 storm were lower than the other two fall events and the quarterly flow-weighted EMCs with the exception of pH and TSS. TPH was not detected in any samples taken at Church Creek during the event. At the Parole Plaza station, the EMCs of most parameters during the December 23, 2013 storm were higher than the other two events, except for nitrate-nitrite, *E. coli*, and BOD. Concentrations of nitrate-nitrite and *E. coli* were also higher than the quarterly flow-weighted EMCs. As was the case at Church Creek, TPH was not detected in any samples.

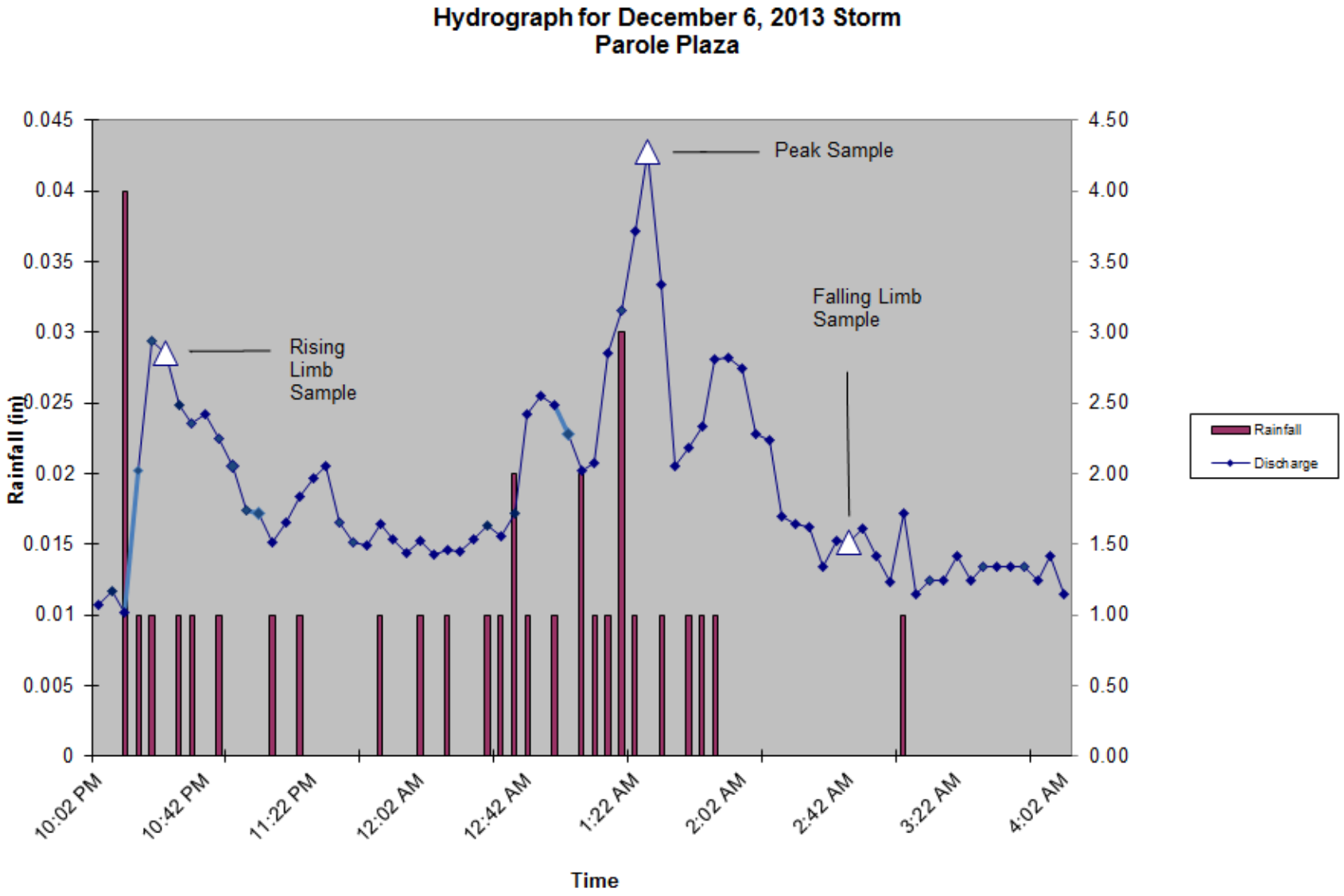
- April 7, 2014 - At the Church Creek station, the EMCs of most parameters during the April 7, 2014 storm were lower than the EMC values for the other storms during the quarter, except for nitrate-nitrite and hardness. TPH was not detected in any samples at Church Creek during the event. At the Parole Plaza station, the EMCs of most parameters during the April 7, 2014 storm were comparable to EMC values for the other storms monitored during the quarter, except for *E. Coli*, which was much lower during this event. As was the case at Church Creek, TPH was the only parameter not detected in any samples.

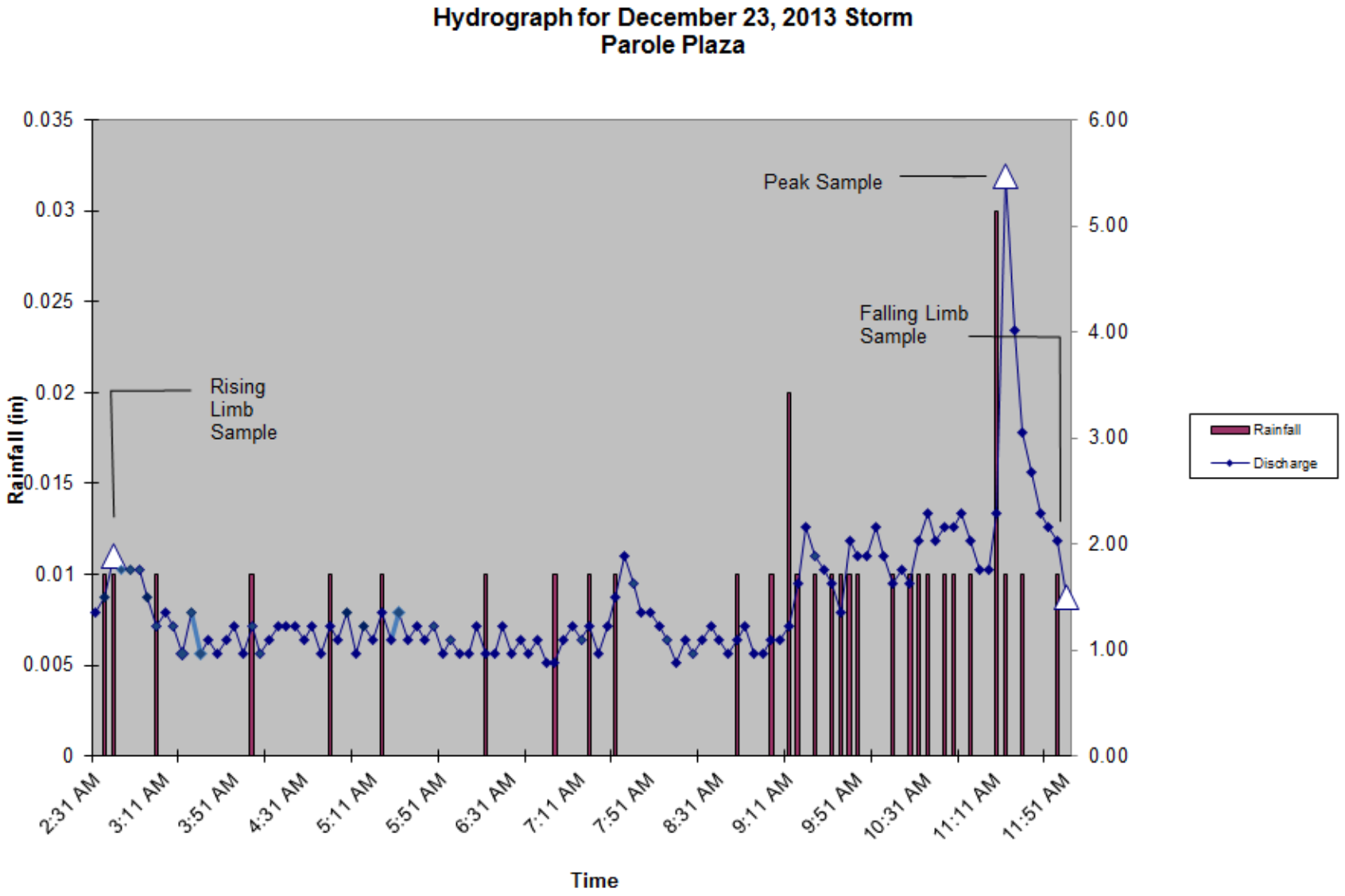
- May 27, 2014 - At the Church Creek station, EMCs for BOD and TKN during the May 27, 2014 storm were higher than the EMC values for the other storms monitored during the quarter. EMCs for nitrite-nitrate, copper, and zinc were lower than EMCs for the other storms monitored during the quarter. TPH was not detected in any samples at Church Creek during the event. At the Parole Plaza station, the EMCs of BOD, TKN, and total phosphorus were higher than EMCs for other storms monitored during the quarter. The EMC for pH was the lowest during this storm. As was the case at Church Creek, TPH was the only parameter not detected in any samples.

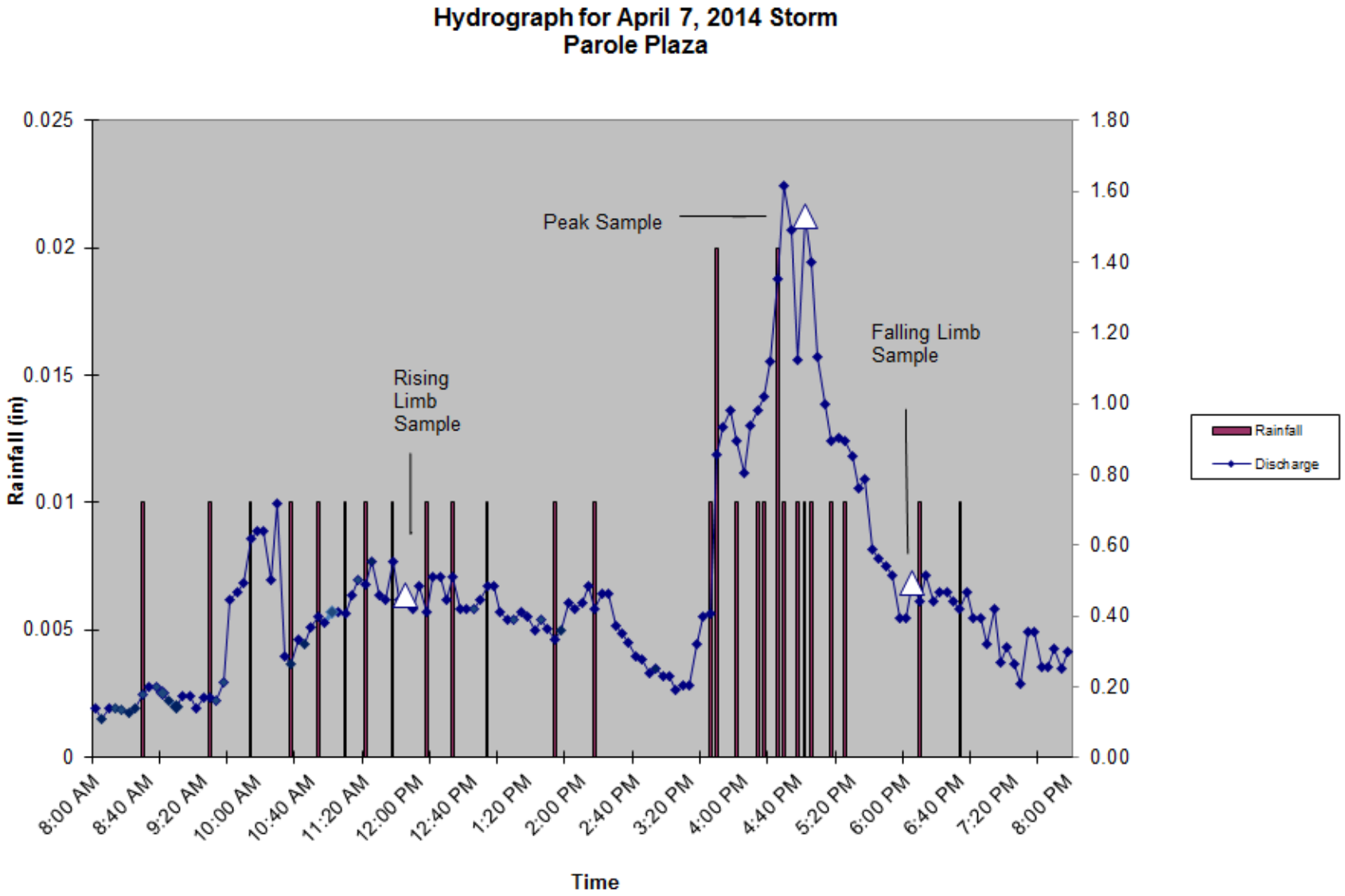
- June 19, 2014 - At the Church Creek station, the EMCs of most parameters, including all of the metals, during the June 19, 2014 storm were higher than the EMC values for the other storms monitored during the quarter. TPH was not detected in any samples at Church Creek during the event. At the Parole Plaza station, the EMCs of most parameters during the June 19, 2014 storm were lower than the EMC values for other storms monitored during the quarter, except for temperature, pH, and *E. coli*, which were the highest. As was the case at Church Creek, TPH was the only parameter not detected in any samples.

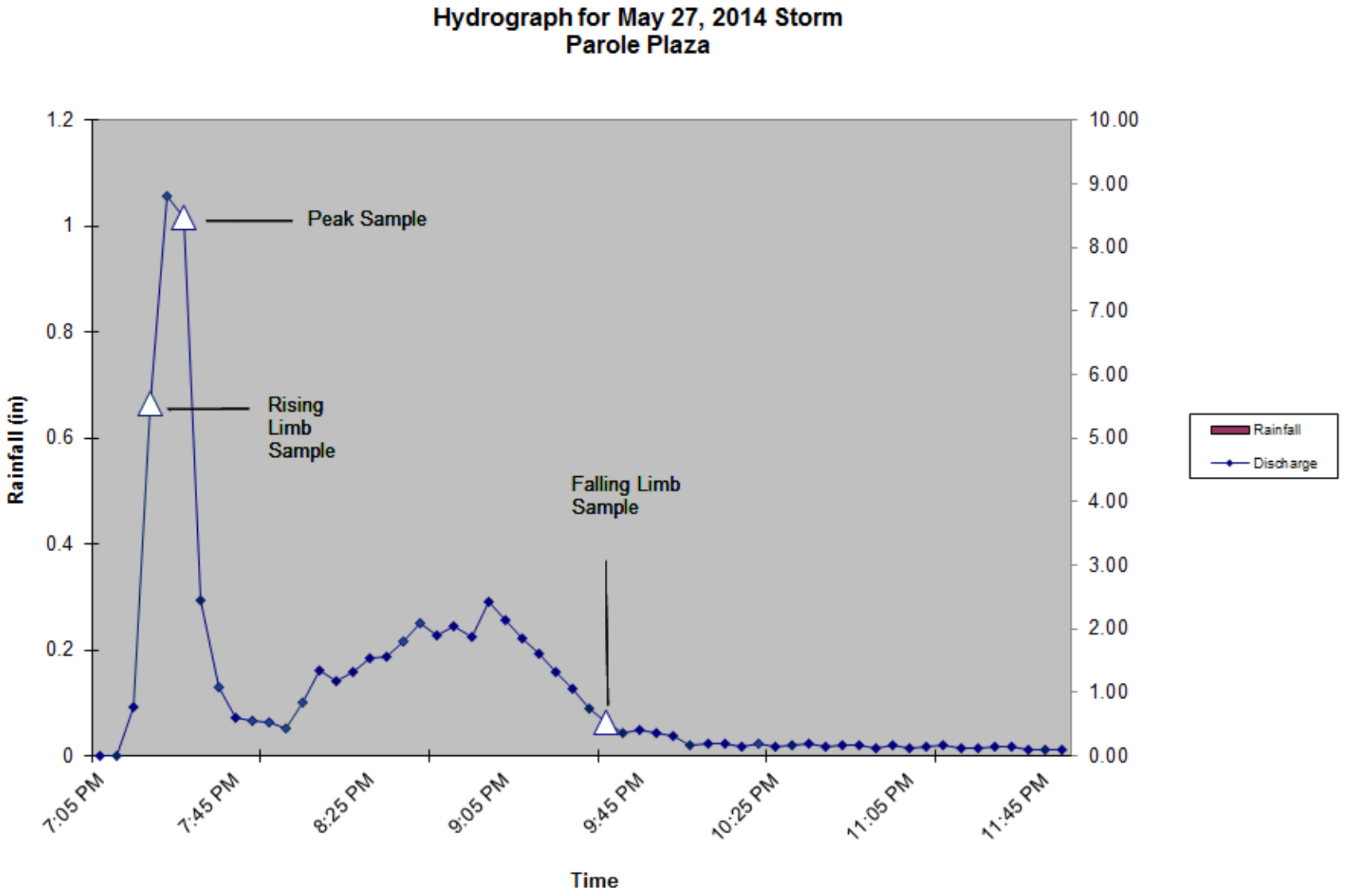

Hydrograph for September 12, 2013 Storm
Parole Plaza
Rainfall (in)
0.25
0.2
0.15
0.1
0.05
0
90.00
80.00
70.00
60.00
50.00
40.00
30.00
20.00
10.00
0.00
Rising Limb Sample
Peak Sample
Falling Limb Sample
3:02 PM
3:42 PM
4:22 PM
Time
Rainfall
Discharge

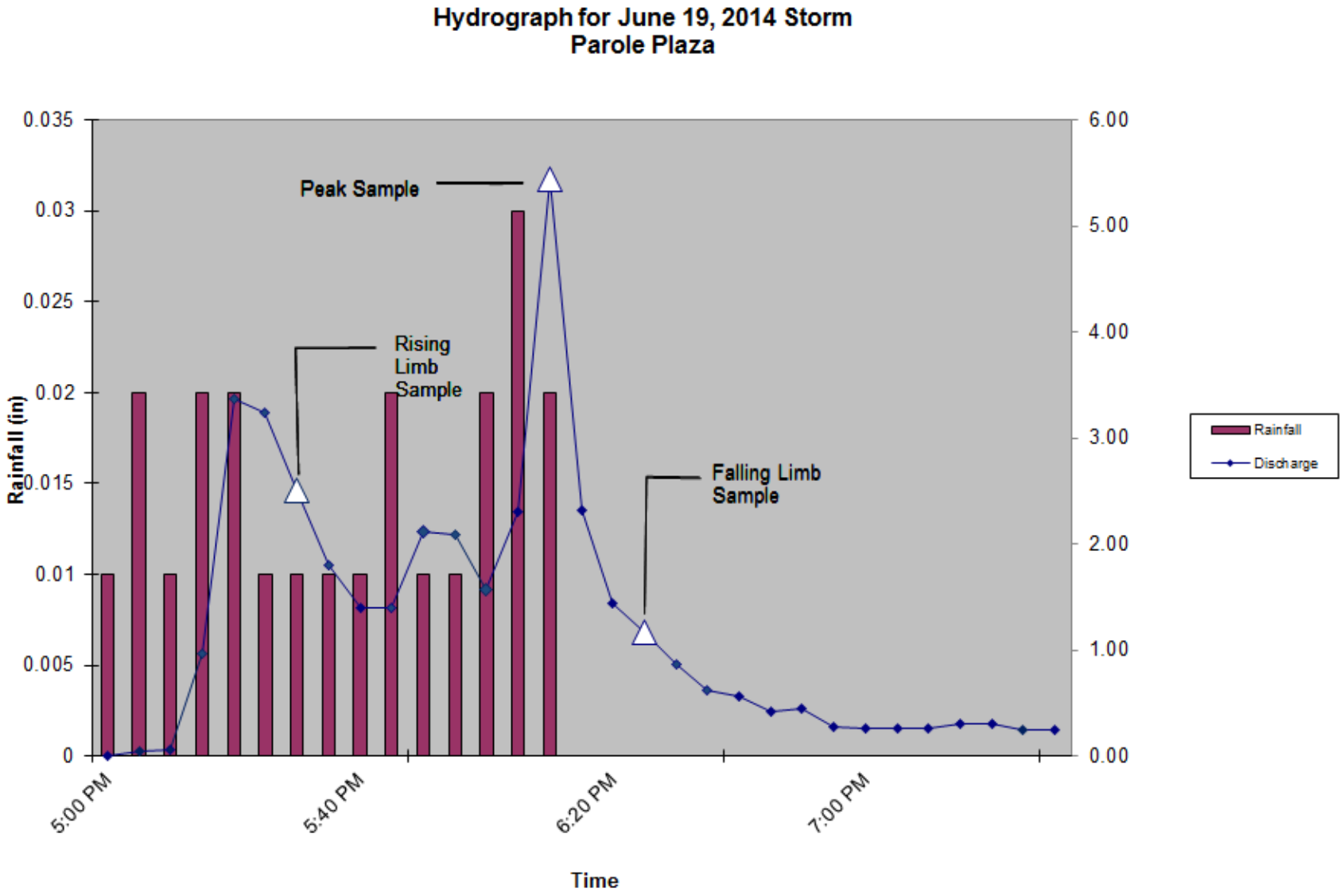

Hydrograph for October 7, 2013 Storm
Parole Plaza
Rainfall (in)
0.08
0.07
0.06
0.05
0.04
0.03
0.02
0.01
0
12.00
10.00
8.00
6.00
4.00
2.00
0.00
Peak Sample
Falling Limb Sample
Rising Limb Sample
Rainfall
Discharge
8:57 AM
9:37 AM
10:17 AM
10:57 AM
11:37 AM
12:17 PM
12:57 PM
1:37 PM
2:17 PM
2:57 PM
Time


Hydrograph for December 6, 2013 Storm
Parole Plaza
Peak Sample
Rising Limb Sample
Falling Limb Sample
Rainfall (in)
Time
Rainfall
Discharge
0.045
0.04
0.035
0.03
0.025
0.02
0.015
0.01
0.005
0
4.50
4.00
3.50
3.00
2.50
2.00
1.50
1.00
0.50
0.00
10:02 PM
10:42 PM
11:22 PM
12:02 AM
12:42 AM
1:22 AM
2:02 AM
2:42 AM
3:22 AM
4:02 AM


Hydrograph for December 23, 2013 Storm
Parole Plaza
Peak Sample
Falling Limb Sample
Rising Limb Sample
Rainfall (in)
0.035
0.03
0.025
0.02
0.015
0.01
0.005
0
6.00
5.00
4.00
3.00
2.00
1.00
0.00
2:31 AM
3:11 AM
3:51 AM
4:31 AM
5:11 AM
5:51 AM
6:31 AM
7:11 AM
7:51 AM
8:31 AM
9:11 AM
9:51 AM
10:31 AM
11:11 AM
11:51 AM
Time
Rainfall
Discharge

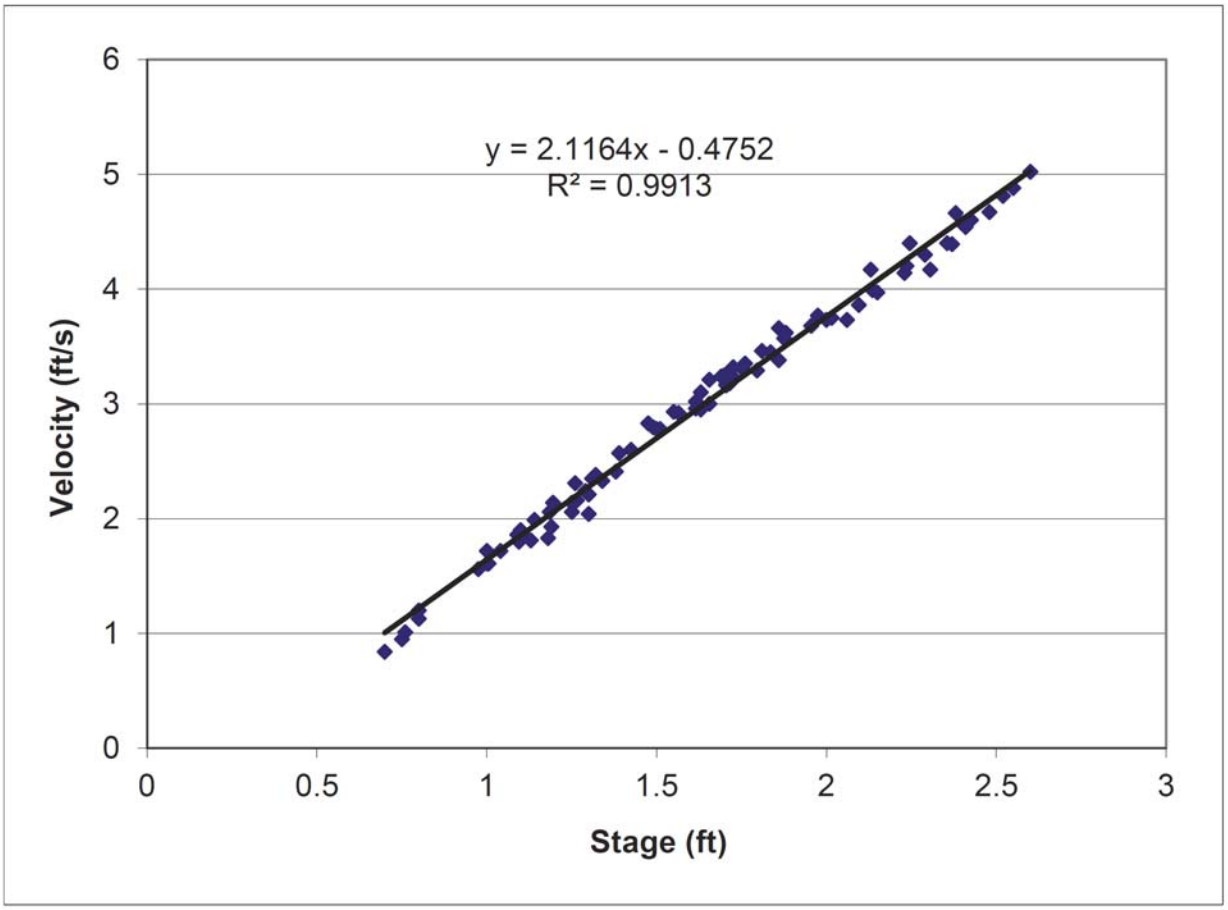

Hydrograph for April 7, 2014 Storm
Parole Plaza
Peak Sample
Rising Limb Sample
Falling Limb Sample
Rainfall (in)
Time
Rainfall
Discharge
0.025
0.02
0.015
0.01
0.005
0
1.80
1.60
1.40
1.20
1.00
0.80
0.60
0.40
0.20
0.00
8:00 AM
8:40 AM
9:20 AM
10:00 AM
10:40 AM
11:20 AM
12:00 PM
12:40 PM
1:20 PM
2:00 PM
2:40 PM
3:20 PM
4:00 PM
4:40 PM
5:20 PM
6:00 PM
6:40 PM
7:20 PM
8:00 PM

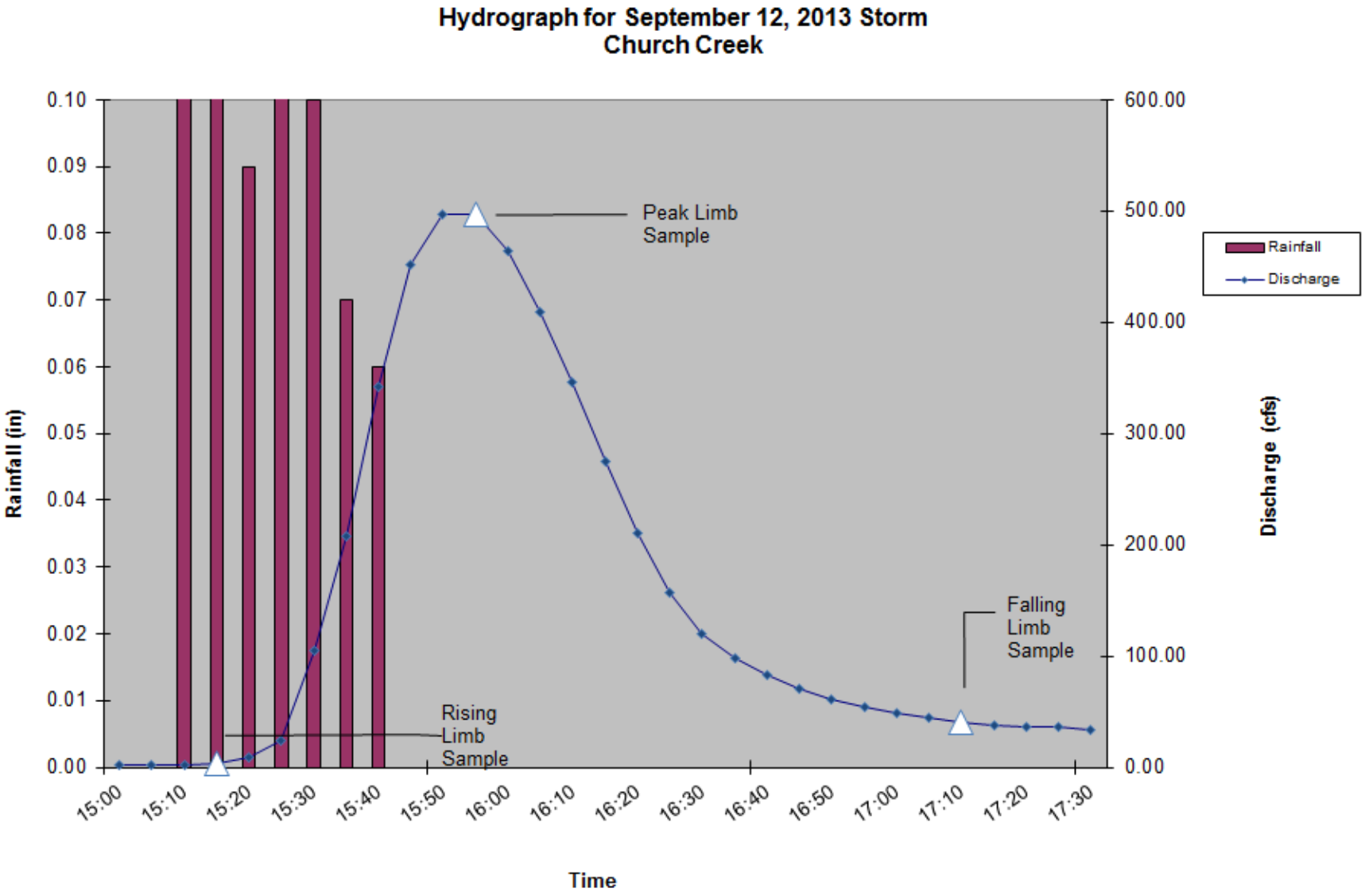

Hydrograph for May 27, 2014 Storm
Parole Plaza
Rainfall (in)
1.2
1
0.8
0.6
0.4
0.2
0
10.00
9.00
8.00
7.00
6.00
5.00
4.00
3.00
2.00
1.00
0.00
Peak Sample
Rising Limb Sample
Falling Limb Sample
7:05 PM
7:45 PM
8:25 PM
9:05 PM
9:45 PM
10:25 PM
11:05 PM
11:45 PM
Time
Rainfall
Discharge

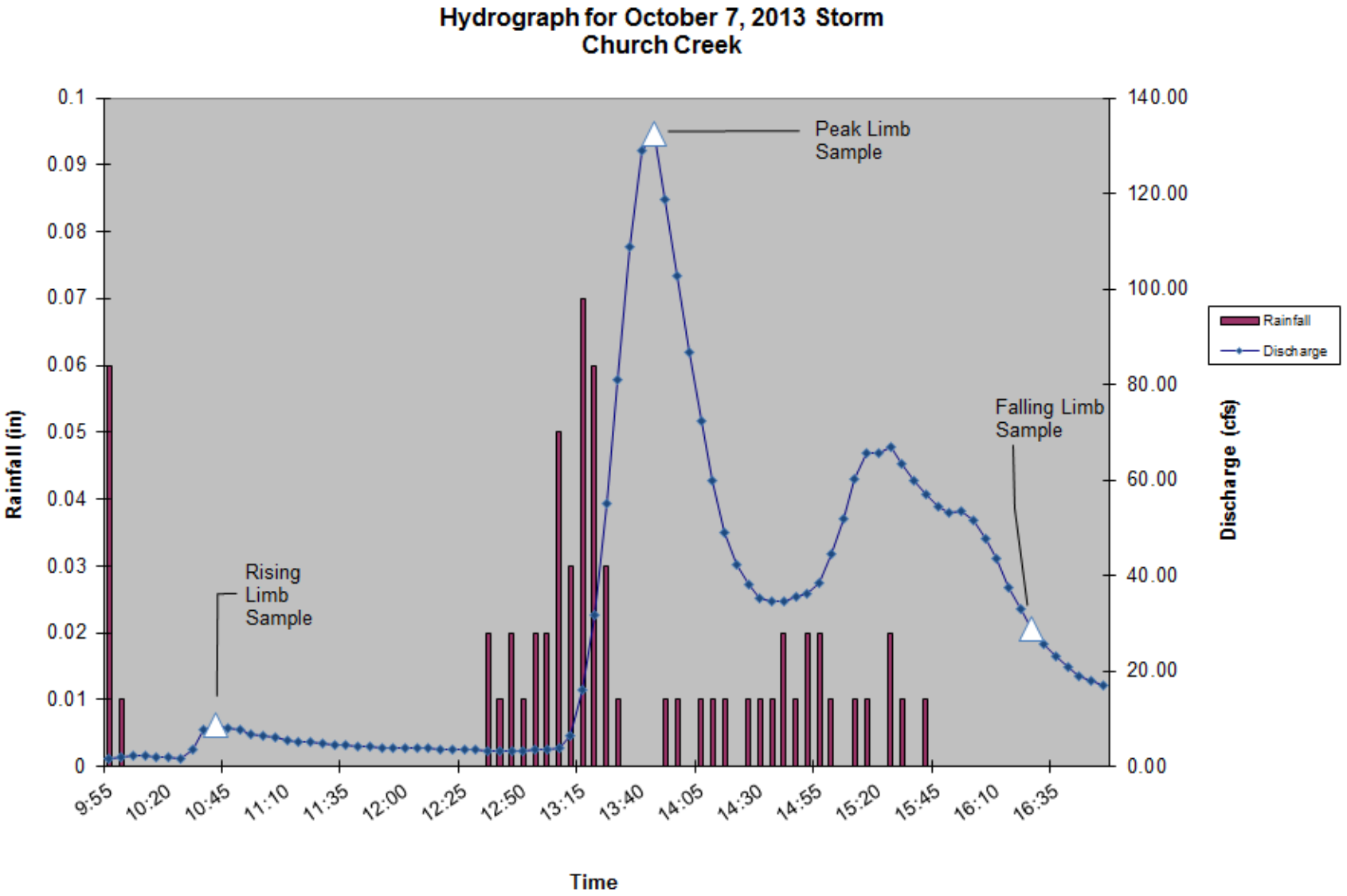

Hydrograph for June 19, 2014 Storm
Parole Plaza
Peak Sample
Rising Limb Sample
Falling Limb Sample
Rainfall (in)
0.035
0.03
0.025
0.02
0.015
0.01
0.005
0
6.00
5.00
4.00
3.00
2.00
1.00
0.00
5:00 PM
5:40 PM
6:20 PM
7:00 PM
Time
Rainfall
Discharge

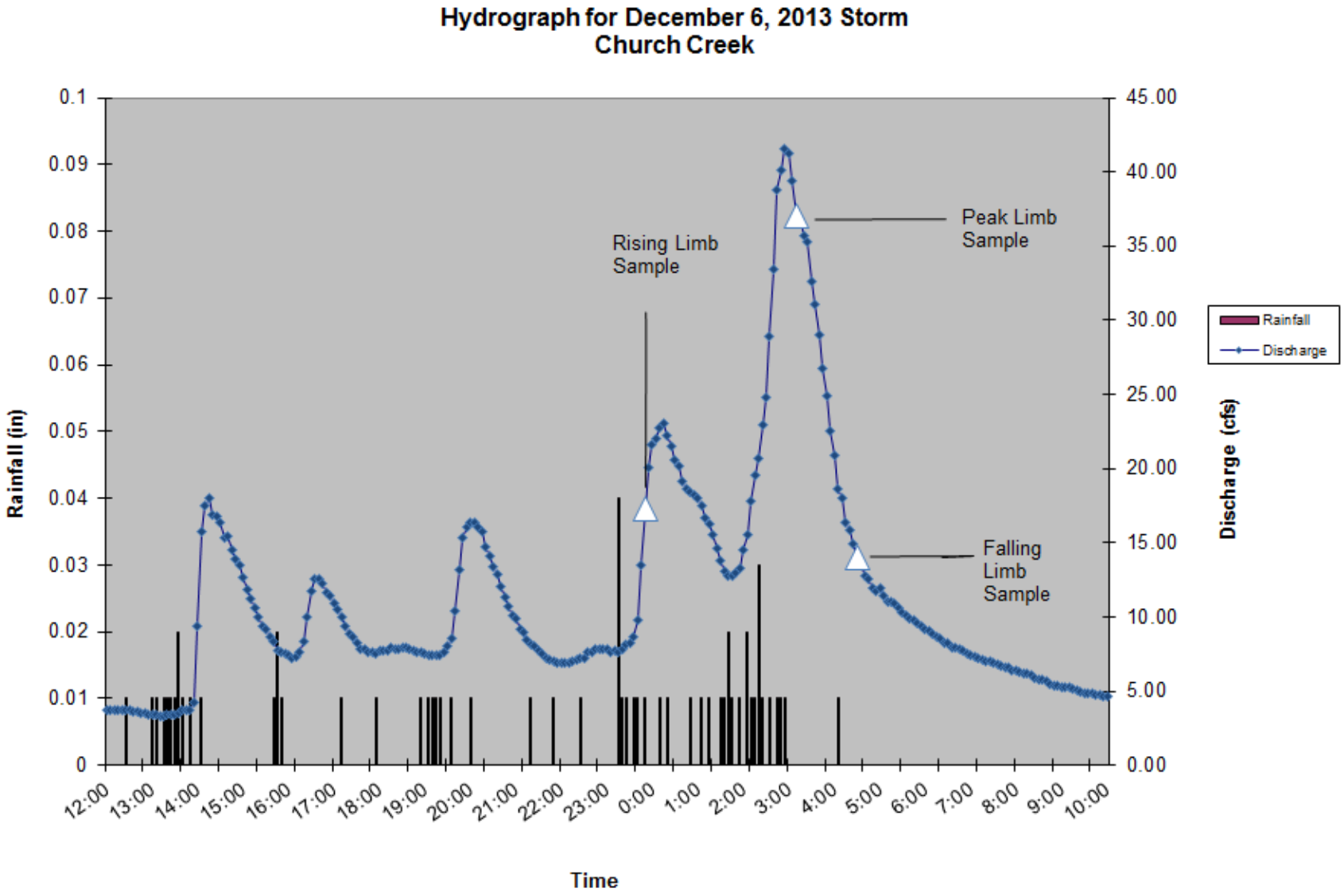
Church Creek Discharge Rating Table

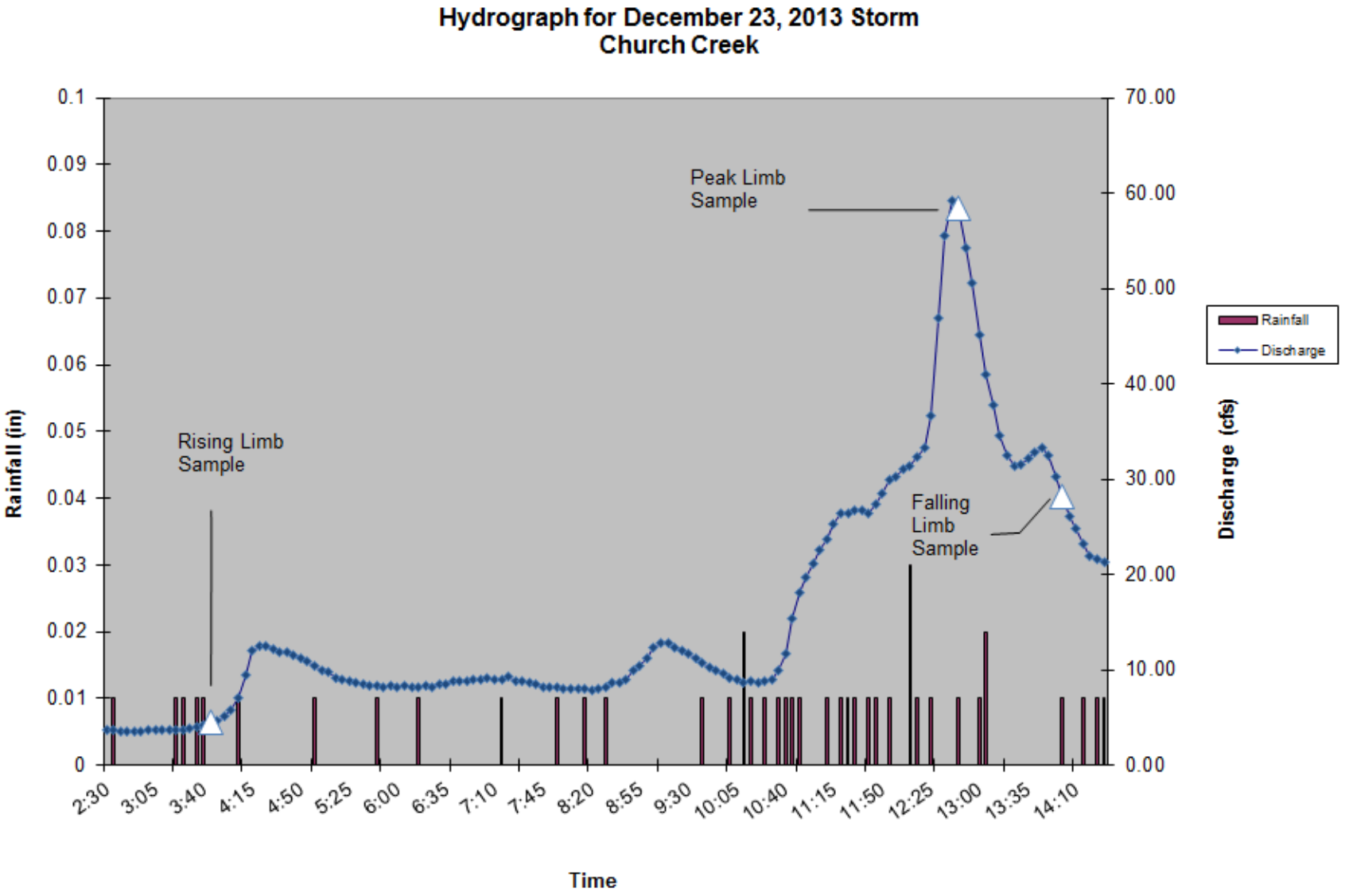
Stage (ft)	Flow Area (ft²)	Wetted Perimeter (ft)	Top Width (ft)	Velocity, (ft/s)	Discharge (cfs)
0.0	0	0	0	0.00	0.00
0.1	0.21	2.77	2.75	0.00	0.00
0.2	0.53	3.62	3.57	0.00	0.00
0.3	0.91	4.03	3.93	0.16	0.15
0.4	1.31	4.36	4.19	0.37	0.49
0.5	1.75	4.83	4.58	0.58	1.02
0.6	2.22	5.09	4.73	0.79	1.76
0.7	2.70	5.34	4.88	1.01	2.72
0.8	3.20	5.73	5.20	1.22	3.90
0.9	3.74	6.14	5.54	1.43	5.35
1.0	4.31	6.48	5.81	1.64	7.07
1.1	4.90	6.75	5.98	1.85	9.08
1.2	5.50	7.01	6.16	2.06	11.35
1.3	6.13	7.28	6.33	2.28	13.95
1.4	6.77	7.53	6.49	2.49	16.84
1.5	7.43	7.80	6.66	2.70	20.06
1.6	8.10	8.08	6.86	2.91	23.58
1.7	8.80	8.37	7.06	3.12	27.48
1.8	9.51	8.65	7.26	3.33	31.71
1.9	10.25	8.93	7.44	3.55	36.35
2.0	11.00	9.15	7.52	3.76	41.33
2.1	11.75	9.35	7.54	3.97	46.64
2.2	12.51	9.55	7.57	4.18	52.30
2.3	13.26	9.75	7.60	4.39	58.24
2.4	14.03	9.96	7.63	4.60	64.60
2.5	14.79	10.16	7.65	4.82	71.23
2.6	15.56	10.36	7.68	5.03	78.23
2.7	16.33	10.56	7.71	5.24	85.55
2.8	17.10	10.76	7.73	5.45	93.21
2.9	17.87	10.96	7.76	5.66	101.19
3.0	18.65	11.17	7.79	5.87	109.55
3.1	19.43	11.37	7.81	6.09	118.24
3.2	20.21	11.57	7.84	6.30	127.27
3.3	21.00	11.77	7.87	6.51	136.69
3.4	21.79	11.97	7.89	6.72	146.44
3.5	22.58	12.18	7.92	6.93	156.53
3.6	23.37	12.38	7.95	7.14	166.95
3.7	24.17	12.58	7.98	7.36	177.78

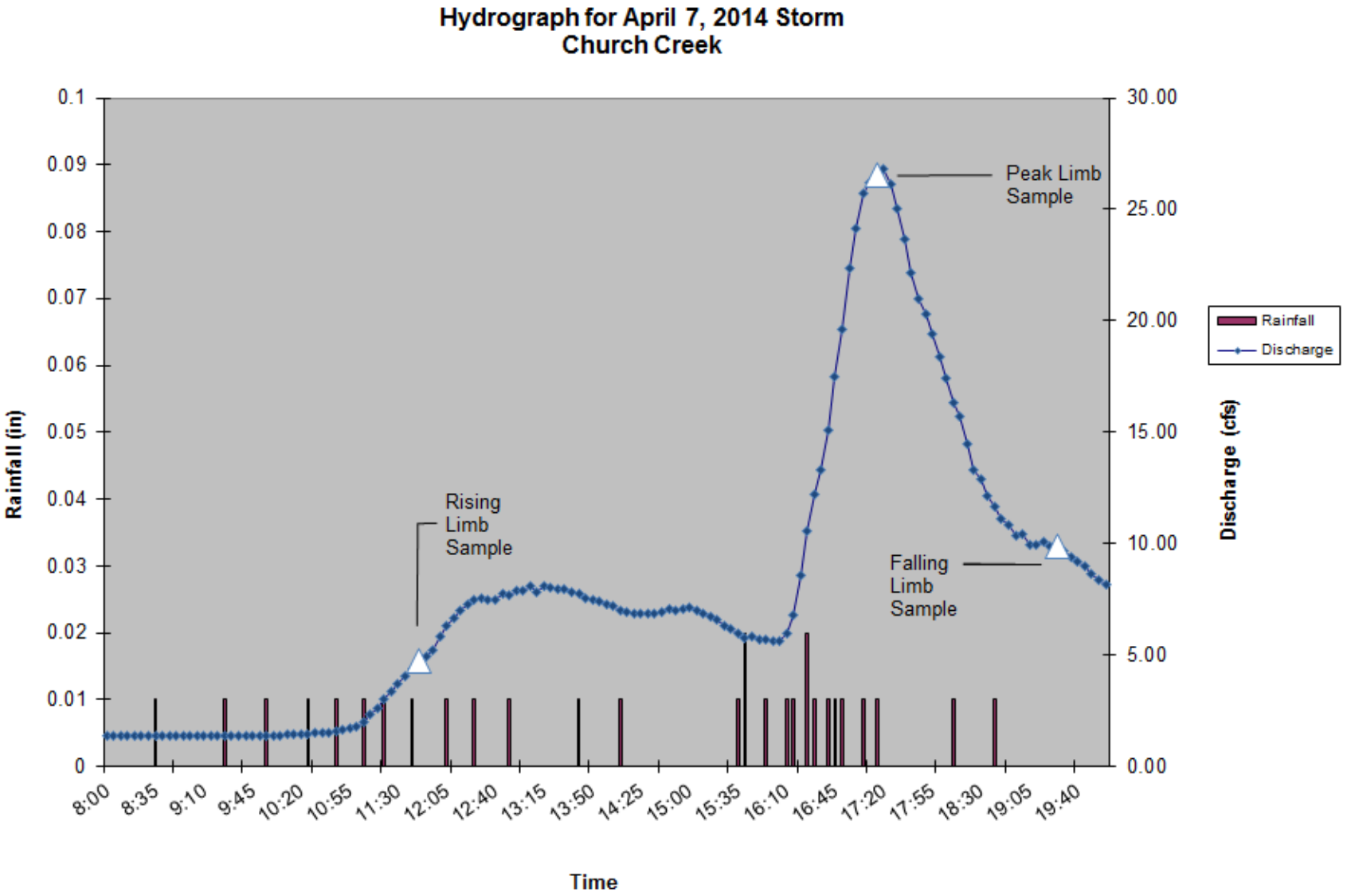

y = 2.1164x - 0.4752
R² = 0.9913
Velocity (ft/s)
Stage (ft)
0
1
2
3
4
5
6
0
0.5
1
1.5
2
2.5
3

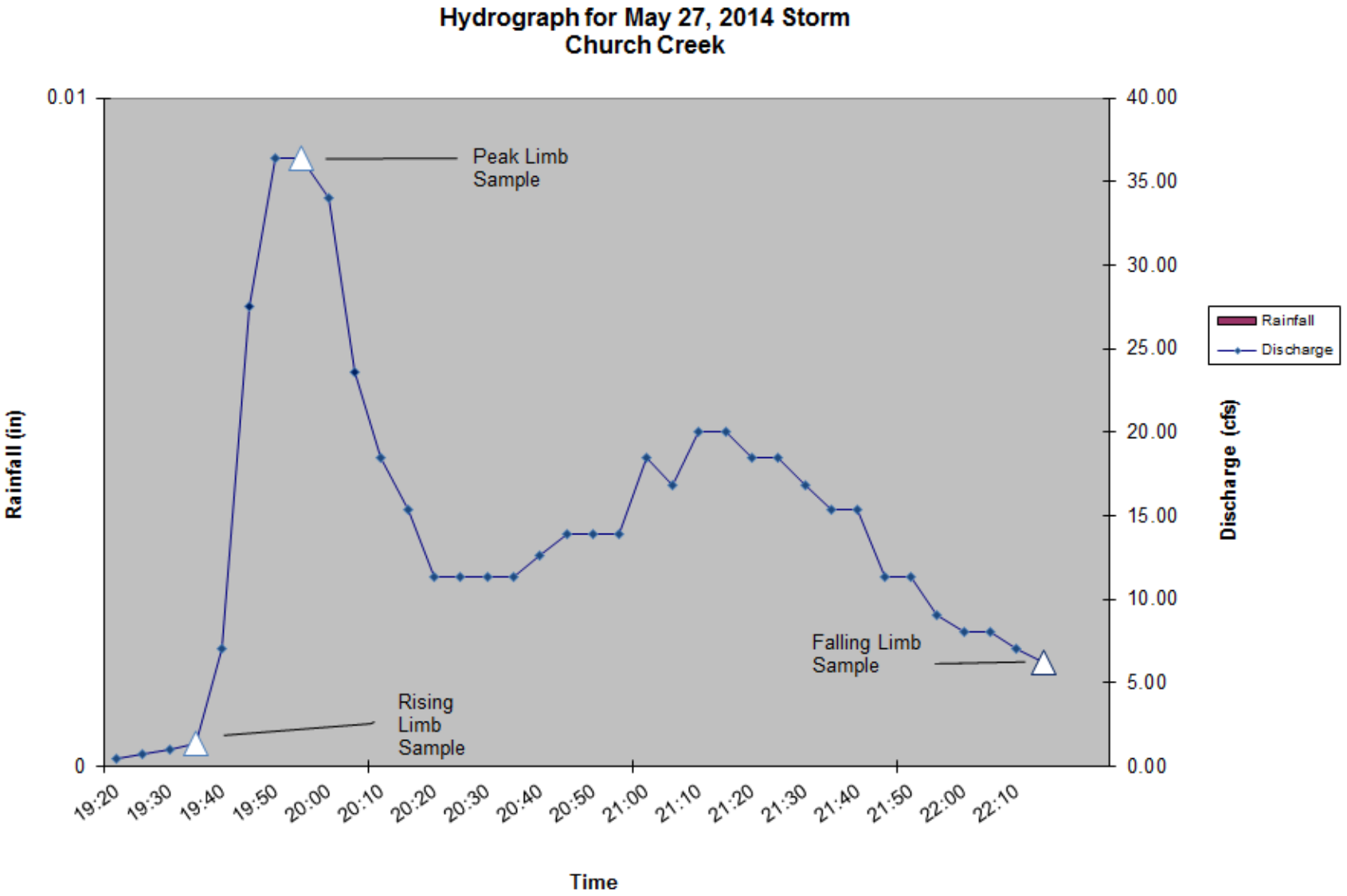

Hydrograph for September 12, 2013 Storm
Church Creek
Rainfall (in)
Discharge (cfs)
Time
Peak Limb Sample
Rising Limb Sample
Falling Limb Sample
Rainfall
Discharge
0.10
0.09
0.08
0.07
0.06
0.05
0.04
0.03
0.02
0.01
0.00
600.00
500.00
400.00
300.00
200.00
100.00
0.00
15:00
15:10
15:20
15:30
15:40
15:50
16:00
16:10
16:20
16:30
16:40
16:50
17:00
17:10
17:20
17:30

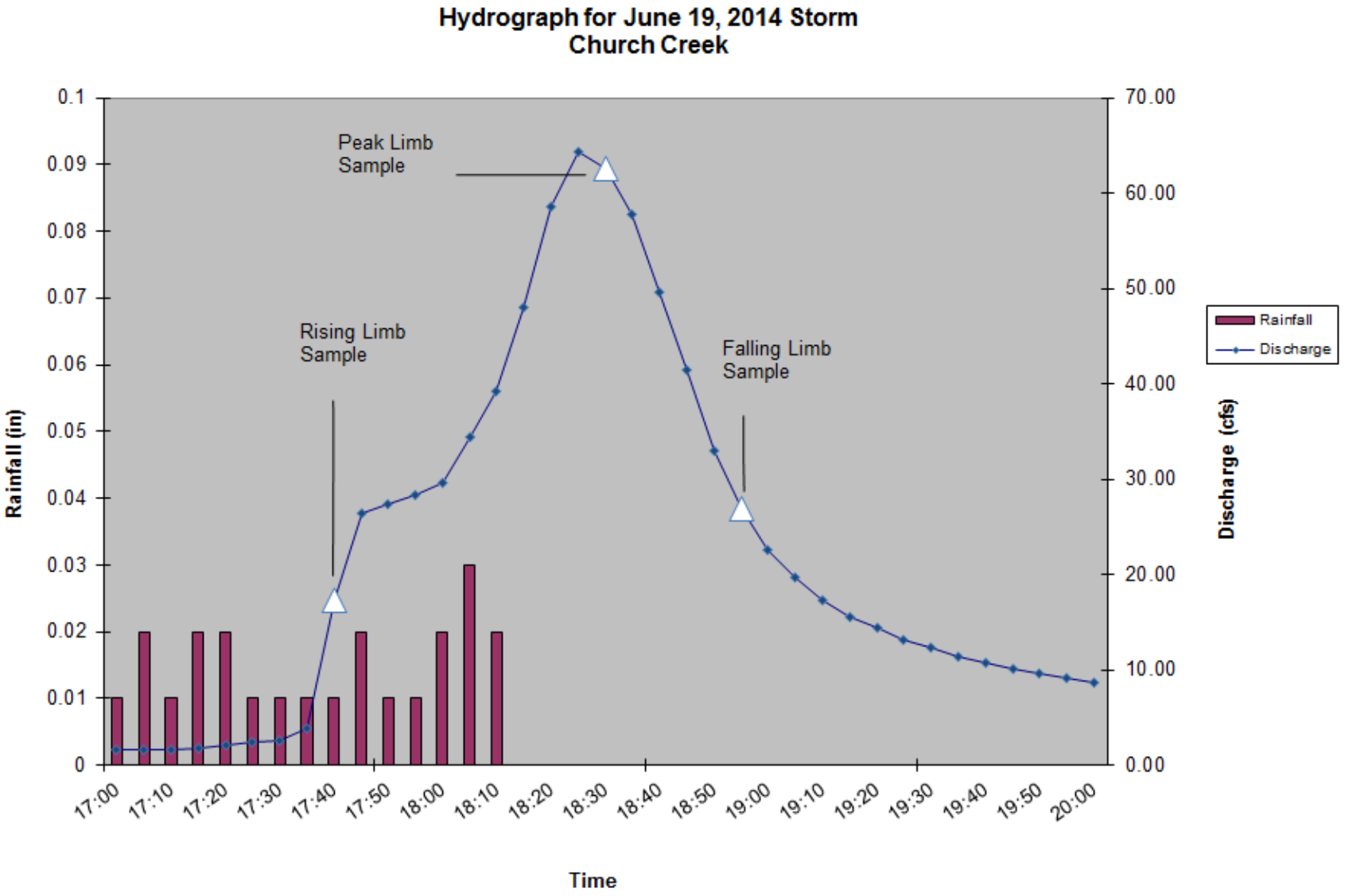

Hydrograph for October 7, 2013 Storm
Church Creek
Peak Limb Sample
Rising Limb Sample
Falling Limb Sample
Rainfall
Discharge
Rainfall (in)
Discharge (cfs)
Time
0.1
0.09
0.08
0.07
0.06
0.05
0.04
0.03
0.02
0.01
0
140.00
120.00
100.00
80.00
60.00
40.00
20.00
0.00
9:55
10:20
10:45
11:10
11:35
12:00
12:25
12:50
13:15
13:40
14:05
14:30
14:55
15:20
15:45
16:10
16:35


Hydrograph for December 6, 2013 Storm
Church Creek
Rainfall (in)
Discharge (cfs)
Time
Rising Limb Sample
Peak Limb Sample
Falling Limb Sample
Rainfall
Discharge
0.1
0.09
0.08
0.07
0.06
0.05
0.04
0.03
0.02
0.01
0
45.00
40.00
35.00
30.00
25.00
20.00
15.00
10.00
5.00
0.00
12:00
13:00
14:00
15:00
16:00
17:00
18:00
19:00
20:00
21:00
22:00
23:00
0:00
1:00
2:00
3:00
4:00
5:00
6:00
7:00
8:00
9:00
10:00


Hydrograph for December 23, 2013 Storm
Church Creek
Rainfall (in)
Discharge (cfs)
Time
Peak Limb Sample
Rising Limb Sample
Falling Limb Sample
Rainfall
Discharge
0.1
0.09
0.08
0.07
0.06
0.05
0.04
0.03
0.02
0.01
0
70.00
60.00
50.00
40.00
30.00
20.00
10.00
0.00
2:30
3:05
3:40
4:15
4:50
5:25
6:00
6:35
7:10
7:45
8:20
8:55
9:30
10:05
10:40
11:15
11:50
12:25
13:00
13:35
14:10


Hydrograph for April 7, 2014 Storm
Church Creek
Rainfall (in)
Discharge (cfs)
Time
Rainfall
Discharge
Peak Limb Sample
Rising Limb Sample
Falling Limb Sample
0.1
0.09
0.08
0.07
0.06
0.05
0.04
0.03
0.02
0.01
0
30.00
25.00
20.00
15.00
10.00
5.00
0.00
8:00
8:35
9:10
9:45
10:20
10:55
11:30
12:05
12:40
13:15
13:50
14:25
15:00
15:35
16:10
16:45
17:20
17:55
18:30
19:05
19:40


Hydrograph for May 27, 2014 Storm
Church Creek
0.01
0
40.00
35.00
30.00
25.00
20.00
15.00
10.00
5.00
0.00
Peak Limb Sample
Rising Limb Sample
Falling Limb Sample
Rainfall
Discharge
Rainfall (in)
Discharge (cfs)
19:20
19:30
19:40
19:50
20:00
20:10
20:20
20:30
20:40
20:50
21:00
21:10
21:20
21:30
21:40
21:50
22:00
22:10
Time


Hydrograph for June 19, 2014 Storm
Church Creek
Peak Limb Sample
Rising Limb Sample
Falling Limb Sample
Rainfall (in)
Discharge (cfs)
Time
Rainfall
Discharge
0.1
0.09
0.08
0.07
0.06
0.05
0.04
0.03
0.02
0.01
0
70.00
60.00
50.00
40.00
30.00
20.00
10.00
0.00
17:00
17:10
17:20
17:30
17:40
17:50
18:00
18:10
18:20
18:30
18:40
18:50
19:00
19:10
19:20
19:30
19:40
19:50
20:00

APPENDIX B

MASTER TAXA LIST

Order	Family	Genus	Final ID	FFG[a]	Habit[b]	Tolerance Value[c]
Amphipoda	Crangonyctidae	Crangonyx	Crangonyx	Collector	sp	6.7
Amphipoda	Gammaridae	Gammarus	Gammarus	Shredder	sp	6.7
Basommatophora	Lymnaeidae		Lymnaeidae	Scraper	cb	6.9
Basommatophora	Lymnaeidae	Fossaria	Fossaria	Scraper	cb	6.9
Basommatophora	Physidae	Physa	Physa	Scraper	cb	7
Coleoptera	Dryopidae	Helichus	Helichus	Scraper	cn	6.4
Coleoptera	Dytiscidae		Dytiscidae	Predator	sw, dv	5.4
Coleoptera	Elmidae	Stenelmis	Stenelmis	Scraper	cn	7.1
Diptera	Chironomidae	Chaetocladius	Chaetocladius	Collector	sp	7
Diptera	Chironomidae	Chironomini	Chironomini			5.9
Diptera	Chironomidae	Chironomus	Chironomus	Collector	bu	4.6
Diptera	Chironomidae	Conchapelopia	Conchapelopia	Predator	sp	6.1
Diptera	Chironomidae	Cricotopus	Cricotopus	Shredder	cn, bu	9.6
Diptera	Chironomidae	Dicrotendipes	Dicrotendipes	Collector	bu	9
Diptera	Chironomidae	Hydrobaenus	Hydrobaenus	Scraper	sp	7.2
Diptera	Chironomidae	Micropsectra	Micropsectra	Collector	cb, sp	2.1
Diptera	Chironomidae	Orthocladius	Orthocladius	Collector	sp, bu	9.2
Diptera	Chironomidae	Parametriocnemus	Parametriocnemus	Collector	sp	4.6
Diptera	Chironomidae	Paraphaenocladius	Paraphaenocladius	Collector	sp	4
Diptera	Chironomidae	Paratanytarsus	Paratanytarsus	Collector	sp	7.7
Diptera	Chironomidae	Phaenopsectra	Phaenopsectra	Collector	cn	8.7
Diptera	Chironomidae	Polypedilum	Polypedilum	Shredder	cb, cn	6.3
Diptera	Chironomidae	Procladius	Procladius	Predator	sp	1.2
Diptera	Chironomidae	Prodiamesa	Prodiamesa	Collector	bu, sp	6.6
Diptera	Chironomidae	Rheotanytarsus	Rheotanytarsus	Filterer	cn	7.2
Diptera	Chironomidae	Tanypodinae	Tanypodinae	Predator		7.5
Diptera	Chironomidae	Thienemannimyia group	Thienemannimyia group	Predator	sp	8.2
Diptera	Chironomidae	Zavrelimyia	Zavrelimyia	Predator	sp	5.3
Diptera	Empididae		Empididae	Predator	sp, bu	7.5
Diptera	Empididae	Hemerodromia	Hemerodromia	Predator	sp, bu	7.9
Diptera	Simuliidae	Stegopterna	Stegopterna	Filterer	cn	2.4
Diptera	Stratiomyidae		Stratiomyidae	Collector		
Diptera	Tipulidae		Tipulidae	Predator	bu, sp	4.8
Diptera	Tipulidae	Helius	Helius	Predator	sp, bu	3.6
Diptera	Tipulidae	Limnophila	Limnophila	Predator	bu	4.8
Haplotaxida	Enchytraeidae		Enchytraeidae	Collector	bu	9.1
Hemiptera	Noteridae		Noteridae			
Hoplonemertea	Tetrastemmatidae	Prostoma	Prostoma	Predator		7.3
Isopoda	Asellidae	Caecidotea	Caecidotea	Collector	sp	2.6
Lumbriculida	Lumbriculidae		Lumbriculidae	Collector	bu	6.6
Megaloptera	Corydalidae	Nigronia	Nigronia	Predator	cn, cb	1.4
Odonata	Calopterygidae	Calopteryx	Calopteryx	Predator	cb	8.3
Odonata	Coenagrionidae	Argia	Argia	Predator	cn, cb, sp	9.3
Odonata	Coenagrionidae	Ischnura	Ischnura	Predator	cb	9
Odonata	Gomphidae		Gomphidae	Predator	bu	2.2
Trichoptera	Hydropsychidae	Cheumatopsyche	Cheumatopsyche	Filterer	cn	6.5
Trichoptera	Limnephilidae		Limnephilidae	Shredder	cb, sp, cn	3.4
Trichoptera	Limnephilidae	Pycnopsyche	Pycnopsyche	Shredder	sp, cb, cn	3.1
Trichoptera	Molannidae	Molanna	Molanna	Scraper	sp, cn	6
Trichoptera	Philopotamidae	Chimarra	Chimarra	Filterer	cn	4.4
Trichoptera	Polycentropodidae	Polycentropus	Polycentropus	Filterer	cn	1.1
Trichoptera	Psychomyiidae		Psychomyiidae			4.9
Tricladida	Dugesiidae	Girardia	Girardia	Predator	sp	9.3
Tubificida	Tubificidae		Tubificidae	Collector	cn	8.4
Veneroida	Pisidiidae		Pisidiidae	Filterer		6.5
Veneroida	Pisidiidae	Pisidium	Pisidium	Filterer	bu	5.7

(a) Functional Feeding Group
(b) Primary habit or form of locomotion, includes bu - burrower, cn - clinger, cb - climber, sk - skater, sp - sprawler, sw – swimmer information for the particular taxa was not available.
(c) Tolerance Values, based on Hilsenhoff, modified for Maryland; na indicates information for the particular taxa was not available.

APPENDIX C

BIOLOGICAL ASSESSMENT RESULTS

Church Creek Site CC-01

Sampled: 3/14/2014

Biological Condition

Benthic Macroinvertebrate IBI

Narrative Rating	Very Poor
BIBI Score	1.57

Metric	Value	Score
Total Taxa	4	1
EPT Taxa	0	1
Number Ephemeroptera	0	1
% Intolerant to Urban	0	1
% Ephemeroptera	0	1
Scraper Taxa	0	1
% Climbers	44.44	5

Benthic Macroinvertebrate Taxa List

Taxa	Count
Argia	8
Noteridae	1
Tipulidae	1
Tubificidae	8

Physical Habitat

Maryland Biological Stream Survey PHI

Narrative Rating	Degraded
PHI Score	65.85

Metric	Score
Drainage area (acres)	70.40
Remoteness	18.60
Percent Shading	68.32
Epifaunal Substrate	63.35
Instream Habitat	81.54
Instream Wood Debris	100.00
Bank Stability	63.28

Rapid Bioassessment Protocal

Narrative Rating	Partially Supporting
RBP Score	70

Metric	Score
Epifaunal Substrate / Cover	9
Embeddedness	9
Velocity / Depth Regime	7
Sediment Deposition	9
Channel Flow Status	14
Channel Alteration	19
Frequency of Riffles	16
Bank Stability	5(Left)/4(Right)
Vegetative Protection	5(Left)/6(Right)
Riparian Veg Zone Width	9(Left)/6(Right)

Water Chemistry

Dissolved Oxygen (mg/L)	9.4
pH	6.73
Specific Conductance (µS/cm)	3493
Temperature (°C)	9.84
Turbidity (NTUs)	21.7

Church Creek Site CC-02

Sampled: 3/14/2014

Biological Condition

Benthic Macroinvertebrate IBI

Narrative Rating	Very Poor
BIBI Score	1.86

Metric	Value	Score
Total Taxa	16	3
EPT Taxa	1	1
Number Ephemeroptera	0	1
% Intolerant to Urban	13.68	3
% Ephemeroptera	0	1
Scraper Taxa	0	1
% Climbers	5.13	3

Benthic Macroinvertebrate Taxa List

Taxa	Count
Argia	4
Caecidotea	15
Calopteryx	1
Cheumatopsyche	2
Conchapelopia	6
Enchytraeidae	1
Gammarus	14
Hemerodromia	1
Orthocladius	25
Paratanytarsus	2
Pisidium	9
Polypedilum	1
Prostoma	1
Rheotanytarsus	1
Stegopterna	1
Tubificidae	33

Physical Habitat

Maryland Biological Stream Survey PHI

Narrative Rating	Degraded
PHI Score	56.16

Metric	Score
Drainage area (acres)	282.24
Remoteness	23.05
Percent Shading	63.55
Epifaunal Substrate	42.69
Instream Habitat	67.33
Instream Wood Debris	87.41
Bank Stability	52.92

Rapid Bioassessment Protocal

Narrative Rating	Partially Supporting
RBP Score	65

Metric	Score
Epifaunal Substrate / Cover	6
Embeddedness	7
Velocity / Depth Regime	9
Sediment Deposition	13
Channel Flow Status	15
Channel Alteration	13
Frequency of Riffles	14
Bank Stability	5(Left)/6(Right)
Vegetative Protection	2(Left)/3(Right)
Riparian Veg Zone Width	8(Left)/8(Right)

Water Chemistry

Dissolved Oxygen (mg/L)	11.03
pH	7.09
Specific Conductance (µS/cm)	3384
Temperature (°C)	3.08
Turbidity (NTUs)	15.2

Church Creek Site CC-03

Sampled: 3/14/2014

Biological Condition

Benthic Macroinvertebrate IBI

Narrative Rating	Very Poor
BIBI Score	1.29

Metric	Value	Score
Total Taxa	13	1
EPT Taxa	0	1
Number Ephemeroptera	0	1
% Intolerant to Urban	5.38	1
% Ephemeroptera	0	1
Scraper Taxa	0	1
% Climbers	6.45	3

Benthic Macroinvertebrate Taxa List

Taxa	Count
Caecidotea	5
Calopteryx	1
Chironomus	1
Crangonyx	1
Cricotopus	4
Dicrotendipes	2
Enchytraeidae	1
Gammarus	52
Ischnura	5
Orthocladius	5
Pisidium	2
Thienemannimyia group	1
Tubificidae	13

Physical Habitat

Maryland Biological Stream Survey PHI

Narrative Rating	Partially Degraded
PHI Score	70.79

Metric	Score
Drainage area (acres)	282.24
Remoteness	18.60
Percent Shading	40.96
Epifaunal Substrate	94.97
Instream Habitat	95.07
Instream Wood Debris	100.00
Bank Stability	75.11

Rapid Bioassessment Protocal

Narrative Rating	Supporting
RBP Score	81

Metric	Score
Epifaunal Substrate / Cover	13
Embeddedness	11
Velocity / Depth Regime	13
Sediment Deposition	15
Channel Flow Status	17
Channel Alteration	18
Frequency of Riffles	9
Bank Stability	8(Left)/8(Right)
Vegetative Protection	5(Left)/4(Right)
Riparian Veg Zone Width	7(Left)/8(Right)

Water Chemistry

Dissolved Oxygen (mg/L)	8.97
pH	6.87
Specific Conductance (µS/cm)	3356
Temperature (°C)	5.17
Turbidity (NTUs)	14.8

Church Creek Site CC-04

Sampled: 3/14/2014

Biological Condition

Benthic Macroinvertebrate IBI

Narrative Rating	Very Poor
BIBI Score	1.57

Metric	Value	Score
Total Taxa	7	1
EPT Taxa	1	1
Number Ephemeroptera	0	1
% Intolerant to Urban	20.35	3
% Ephemeroptera	0	1
Scraper Taxa	0	1
% Climbers	1.77	3

Benthic Macroinvertebrate Taxa List

Taxa	Count
Caecidotea	23
Cheumatopsyche	1
Gammarus	26
Ischnura	1
Lumbriculidae	1
Polypedilum	1
Tubificidae	60

Physical Habitat

Maryland Biological Stream Survey PHI

Narrative Rating	Degraded
PHI Score	61.01

Metric	Score
Drainage area (acres)	110.53
Remoteness	20.96
Percent Shading	40.96
Epifaunal Substrate	54.61
Instream Habitat	82.47
Instream Wood Debris	100.00
Bank Stability	67.08

Rapid Bioassessment Protocal

Narrative Rating	Partially Supporting
RBP Score	70

Metric	Score
Epifaunal Substrate / Cover	5
Embeddedness	7
Velocity / Depth Regime	6
Sediment Deposition	7
Channel Flow Status	18
Channel Alteration	19
Frequency of Riffles	16
Bank Stability	8(Left)/7(Right)
Vegetative Protection	4(Left)/4(Right)
Riparian Veg Zone Width	9(Left)/8(Right)

Water Chemistry

Dissolved Oxygen (mg/L)	11.01
pH	6.69
Specific Conductance (µS/cm)	3526
Temperature (°C)	7.41
Turbidity (NTUs)	19.5

APPENDIX D

QA/QC INFORMATION

Quality Assurance/Quality Control Summary for NPDES Monitoring Activities

This section describes all Quality Assurance/Quality Control (QA/QC) procedures implemented for this project including field sampling, laboratory sorting and subsampling, data entry, metric calculation, final IBI calculation, geomorphic field sampling, and classification of stream types.

Field Sampling
Initial QA/QC procedures for benthic macroinvertebrate field sampling included formal training for field crew leaders in MBSS Sampling Protocols. All field crew members have attended at least one MBSS Spring Index Period Training. At least one crew member extensively trained and certified in MBSS sampling protocols was present for each field sampling day. Also during field sampling, each data sheet was double checked for completeness and sample bottle labels were double checked for accuracy. Geomorphic assessment field crews have more than one year of experience conducting similar assessment using the Rosgen Stream Classification Methodology.

Geomorphic assessment survey equipment is calibrated annually and regularly inspected to ensure proper functioning. Cross section and profile data were digitally plotted and analyzed in Ohio Department of Natural Resources (ODNR) Reference Reach Spreadsheet Version 4.3L for accuracy.

Water quality QA/QC procedures included calibration of the YSI multiprobe meter daily during the sampling season. Dissolved oxygen probe membranes were inspected regularly and replaced when dirty or damaged.

Laboratory Sorting and Subsampling
Sorting QA/QC was conducted on one sample since only seven samples were collected for this survey. This check consisted of entirely resorting one randomly selected sample to a sorting consistency above ninety percent efficiency. This QC resulted in a sorting efficiency above 95%, so no further action was required. As a taxonomic QC, one sample was re-identified completely by another Versar SFS-certified taxonomist following the same identification methods stated above. The Percent Difference in Enumeration (PDE) and the Percent Taxonomic Disagreement (PTD) were calculated and no further action was required since both the PDE and PTD met MBSS requirements.

Data Entry
All data entered were double checked by someone other than the person who performed the initial data entry. Any errors found during QA/QC were corrected to ensure 100% accuracy of the data.

Metric and IBI Calculations
Ten percent of metric and IBI calculations were checked by hand using a calculator to ensure correct calculation by the Access database. Any discrepancies were addressed at that time.

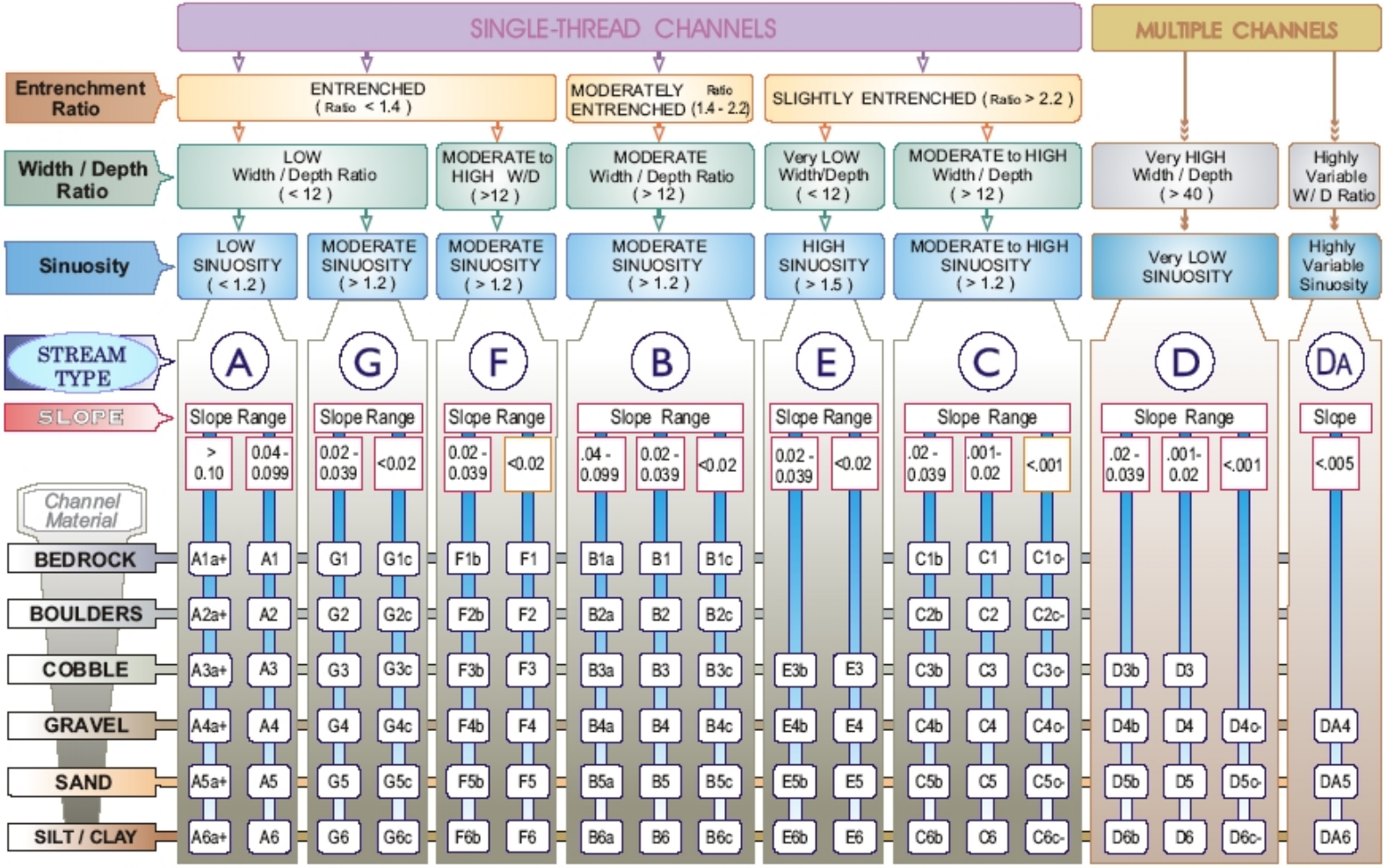
Identification of Stream Types

All stream types were determined by hand based on the methods of the Rosgen Stream Classification (Rosgen, 1996). Due to the natural variability, or continuum, of streams, adjustments in the values of Width Depth Ratio (+/- 2.0) and Entrenchment Ratio (+/-0.2) are allowed, which may result in assigning a different stream type. Therefore, all stream types assigned were checked and any necessary adjustments were made.

APPENDIX E

ROSGEN CLASSIFICATION SCHEME

The Key to the Rosgen Classification of Natural Rivers



KEY to the ROSGEN CLASSIFICATION of NATURAL RIVERS. As a function of the *"continuum of physical variables"* within stream reaches, values of ***Entrenchment*** and ***Sinuosity*** ratios can vary by +/- 0.2 units; while values for ***Width / Depth*** ratios can vary by +/- 2.0 units.

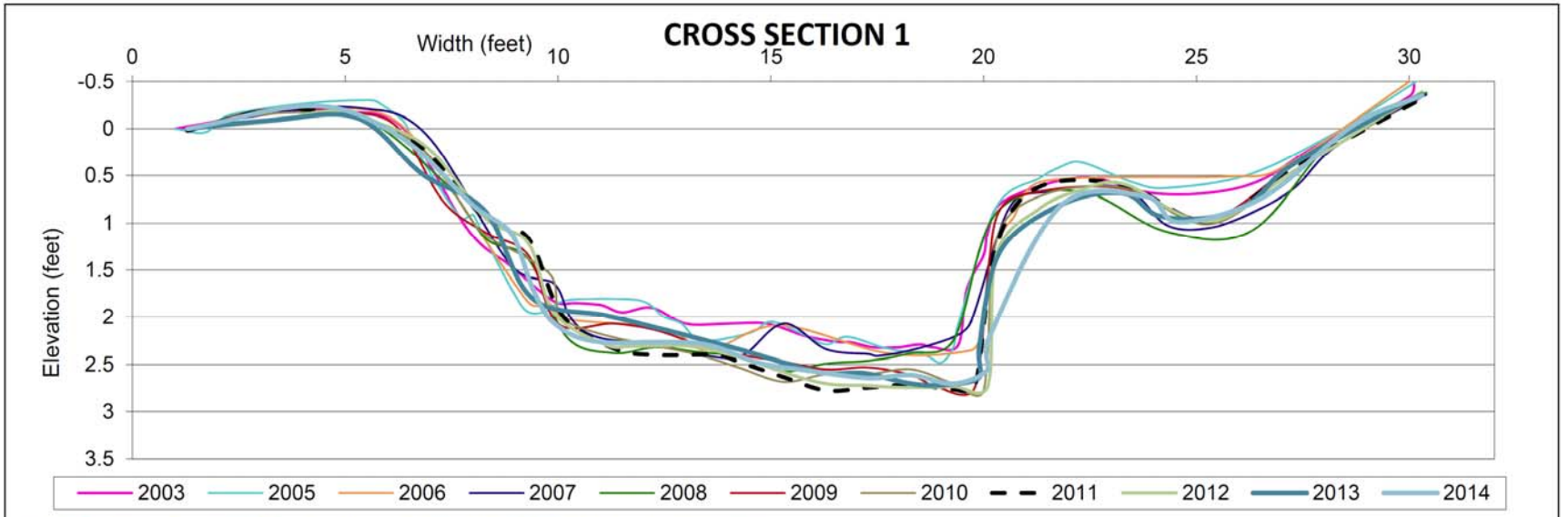
Source: Rosgen, D.L. 1996. *Applied River Morphology*. Wildland Hydrology, Pagosa Springs, CO.

APPENDIX F

GEOMORPHOLOGICAL DATA

Church Creek
2014 Geomorphic Assessment Results Summary

Assessment Parameter	Cross Section				
	XS-1 Pool @ sta 3+70	**XS-2 Pool @ sta 6+82**	**XS-3 Pool @ sta 11+00**	**XS-4 Pool @ sta 13+53**	**XS-5 Riffle @ sta 17+36**
Classification	F5/4	G4c	G4c	C5	F3
Bankfull Width (ft)	11.4	7.8	7.3	10.8	9.8
Mean Depth (ft)	0.7	0.8	1.0	1.4	0.5
Bankfull X-Sec Area (sq ft)	8.0	6.1	7.4	9.1	5.2
Width:Depth Ratio	16.1	9.9	7.3	12.8	18.5
Flood-Prone Width (ft)	19.0	12.1	9.6	38.0	15.9
Entrenchment Ratio	1.7	1.6	1.3	3.5	1.6
D50(mm)	0.89	11	9	0.74	75
Water Surface Slope (ft/ft)	0.003	0.014	0.003	0.001	0.013
Sinuosity	<1.2	<1.2	<1.2	<1.2	<1.2
Drainage Area (mi2)	0.111	0.113	0.121	0.130	0.441
Adjustments?	Sin ↑, ER ↓	Sin ↑, ER ↓	Sin ↑	Sin ↑	Sin ↑, ER ↓





Upstream View



Downstream View

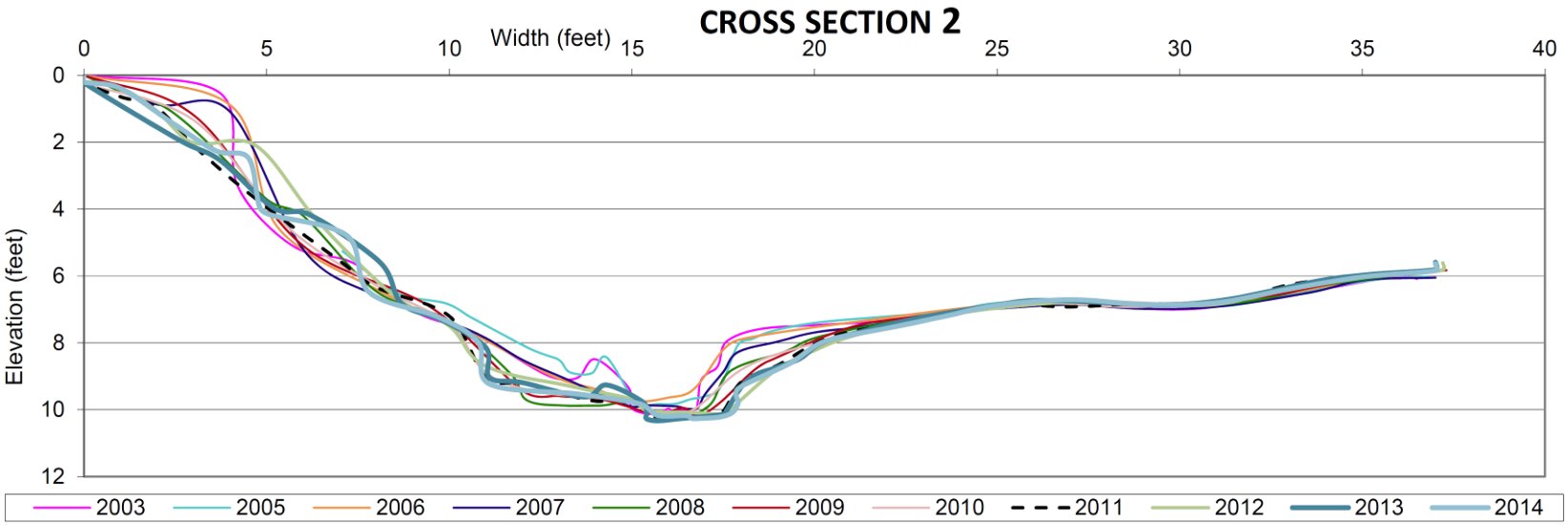


Left Bank View



Right Bank View

2014 Geomorphic Assessment Results	
Bankfull Width (W_{bkf}) (feet)	11.4
Mean Depth (d_{bkf}) (feet)	0.7
Bankfull Cross-sectional Area (A_{bkf}) ($feet_2$)	8.0
Width/Depth Ratio (W_{bkf}/d_{bkf})	16.1
Width of Flood-prone Area (W_{fpa}) (feet)	19.0
Entrenchment Ratio (ER) = W_{fpa}/W_{bkf}	1.7
Channel Materials D_{50} (millimeters)	0.89
Water Surface Slope (S)	0.003
Sinuosity (K) = stream length/valley length	<1.2
Adjustments?	Sin ↑ ER ↓
STREAM TYPE	**F5/4**





Upstream View



Downstream View

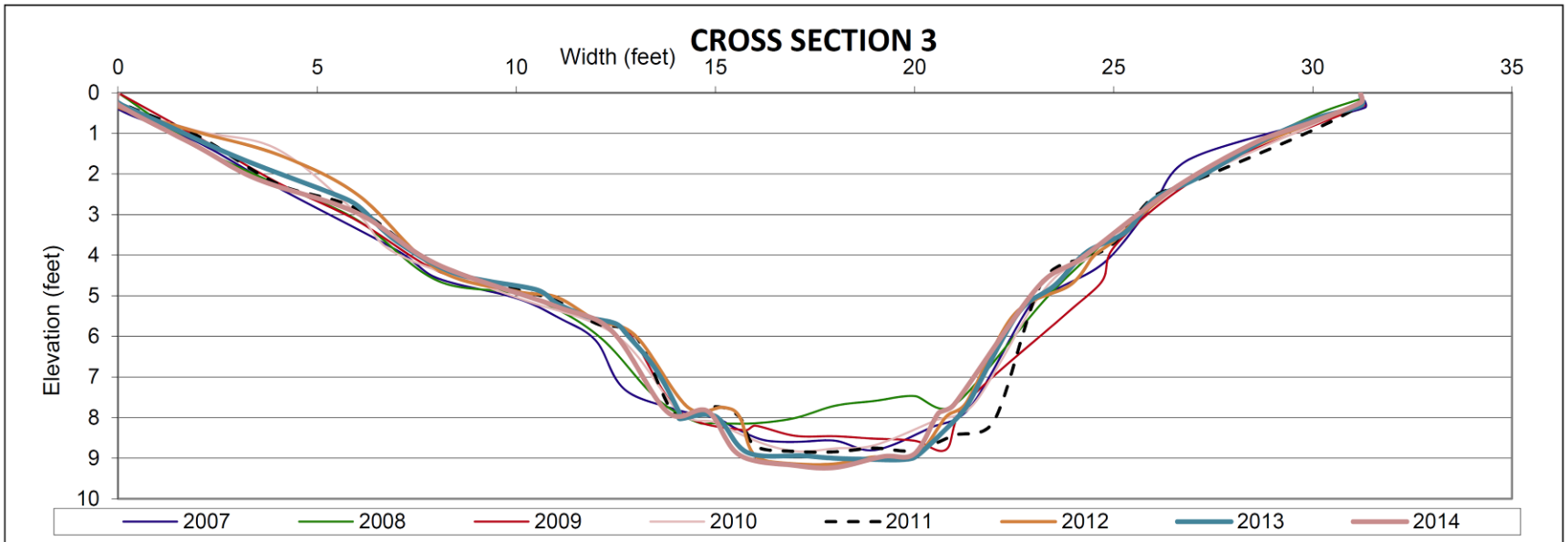


Left Bank View



Right Bank View

2014 Geomorphic Assessment Results	
Bankfull Width (W_{bkf}) (feet)	7.8
Mean Depth (d_{bkf}) (feet)	0.8
Bankfull Cross-sectional Area (A_{bkf}) ($feet_2$)	6.1
Width/Depth Ratio (W_{bkf}/d_{bkf})	9.9
Width of Flood-prone Area (W_{fpa}) (feet)	12.1
Entrenchment Ratio (ER) = W_{fpa}/W_{bkf}	1.6
Channel Materials D_{50} (millimeters)	11
Water Surface Slope (S)	0.014
Sinuosity (K) = stream length/valley length	<1.2
Adjustments?	Sin ↑ ER ↓
STREAM TYPE	**G4c**





Upstream View



Downstream View

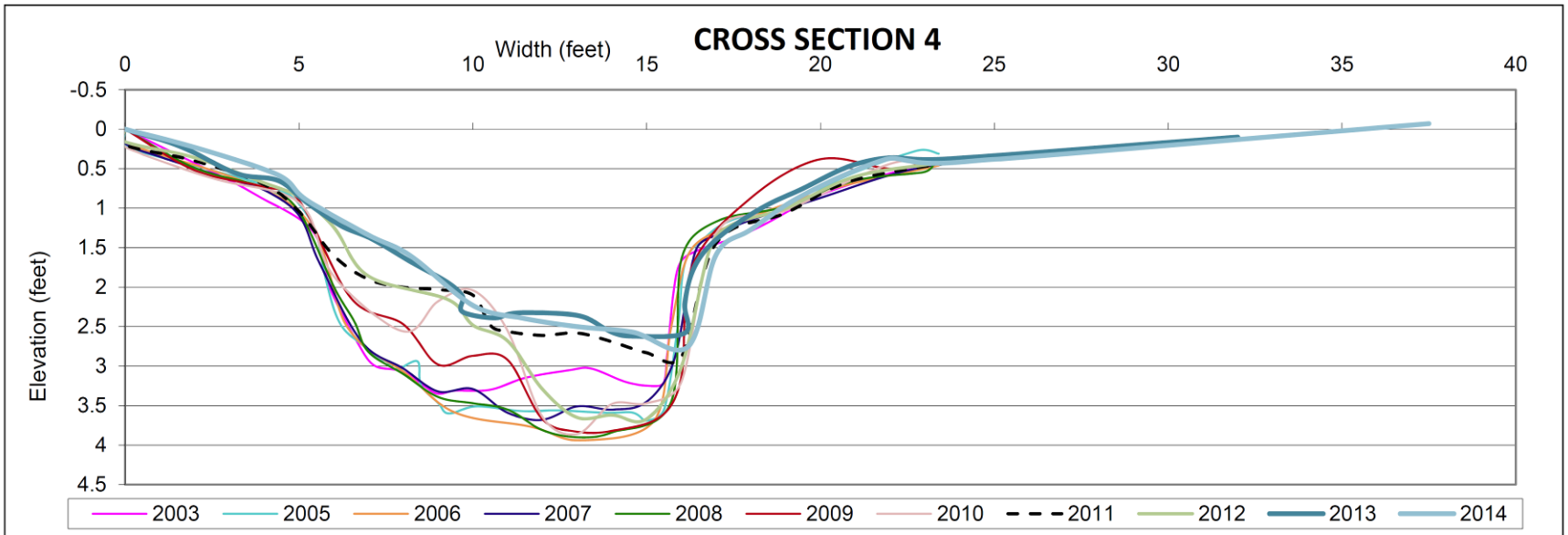


Left Bank View



Right Bank View

2014 Geomorphic Assessment Results	
Bankfull Width (W_{bkf}) (feet)	7.3
Mean Depth (d_{bkf}) (feet)	1.0
Bankfull Cross-sectional Area (A_{bkf}) ($feet_2$)	7.4
Width/Depth Ratio (W_{bkf}/d_{bkf})	7.3
Width of Flood-prone Area (W_{fpa}) (feet)	9.6
Entrenchment Ratio (ER) = W_{fpa}/W_{bkf}	1.3
Channel Materials D_{50} (millimeters)	9
Water Surface Slope (S)	0.003
Sinuosity (K) = stream length/valley length	<1.2
Adjustments?	Sin ↑
STREAM TYPE	**G4c**





Upstream View



Downstream View

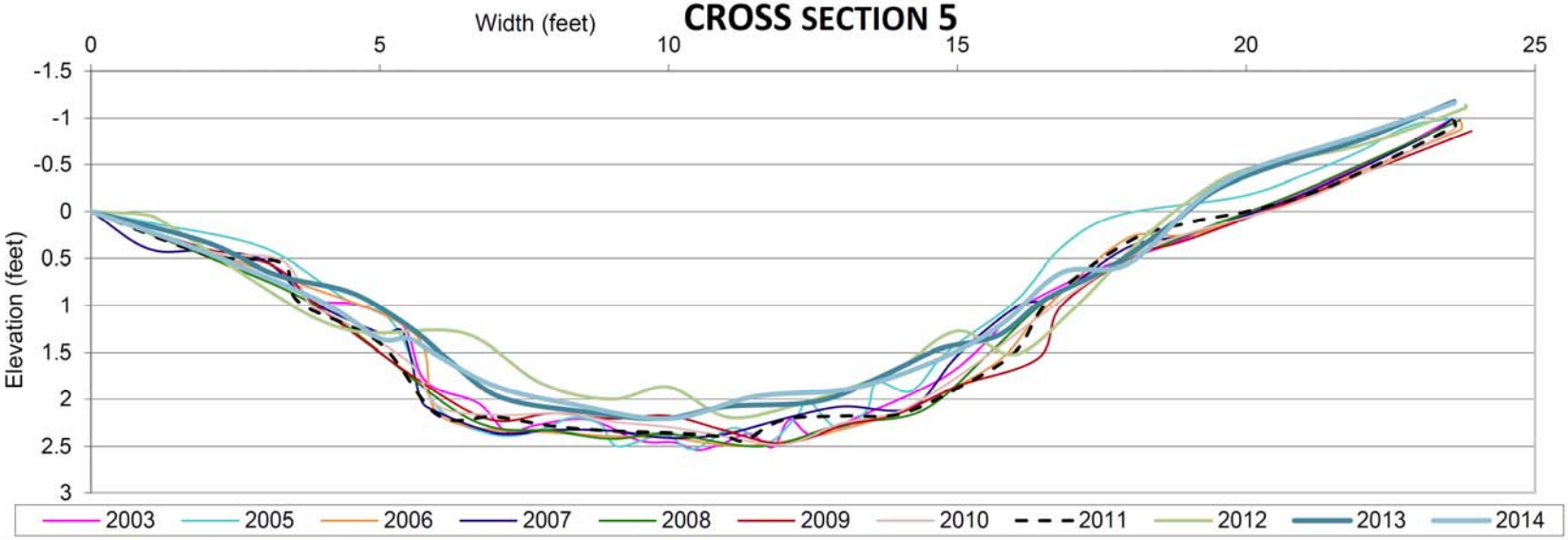


Left Bank View



Right Bank View

2014 Geomorphic Assessment Results	
Bankfull Width (W_{bkf}) (feet)	10.8
Mean Depth (d_{bkf}) (feet)	1.4
Bankfull Cross-sectional Area (A_{bkf}) ($feet_2$)	9.1
Width/Depth Ratio (W_{bkf}/d_{bkf})	12.8
Width of Flood-prone Area (W_{fpa}) (feet)	38.0
Entrenchment Ratio (ER) = W_{fpa}/W_{bkf}	3.5
Channel Materials D_{50} (millimeters)	0.74
Water Surface Slope (S)	0.001
Sinuosity (K) = stream length/valley length	<1.2
Adjustments?	Sin ↑
STREAM TYPE	**C5**





Upstream View



Downstream View



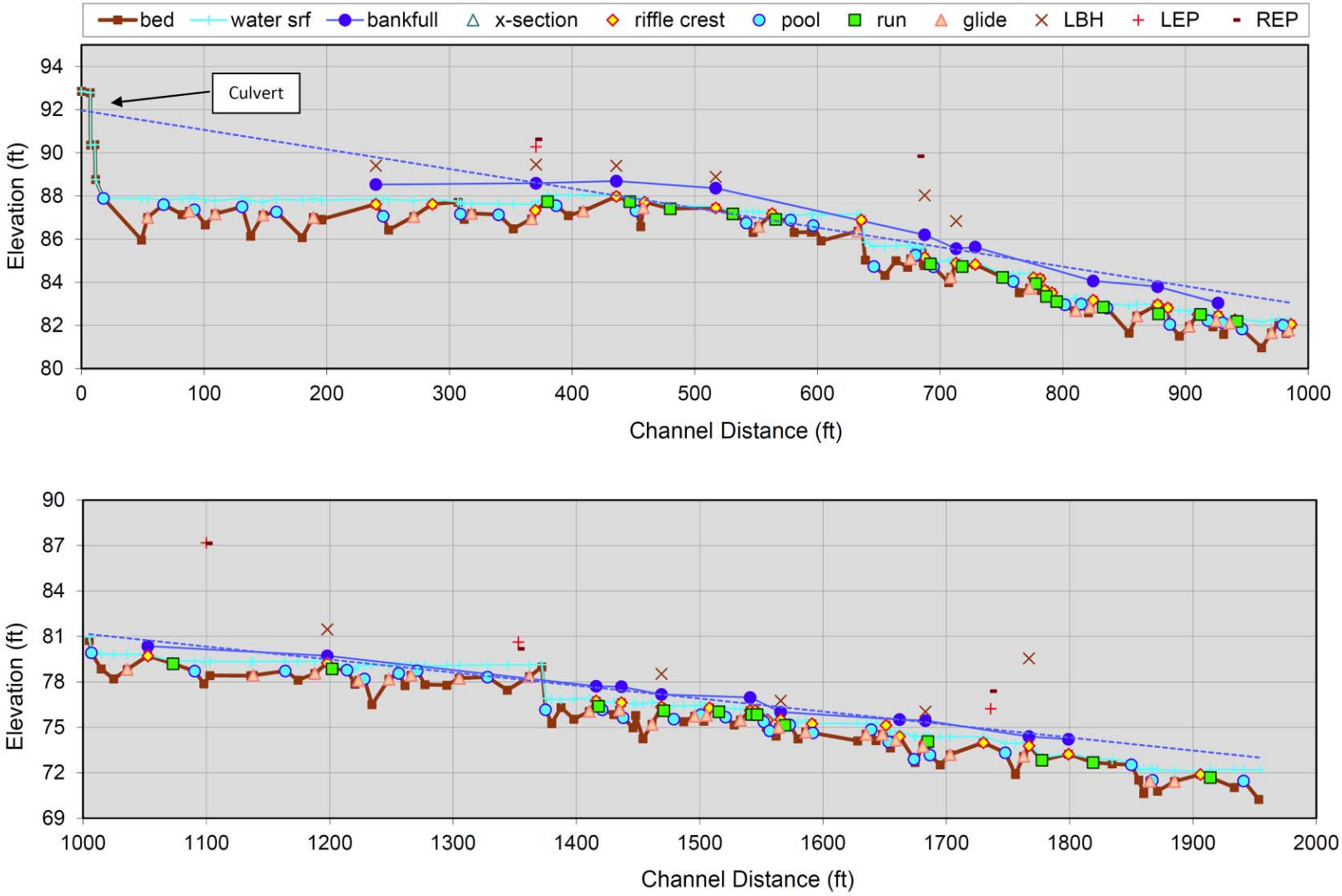
Left Bank View

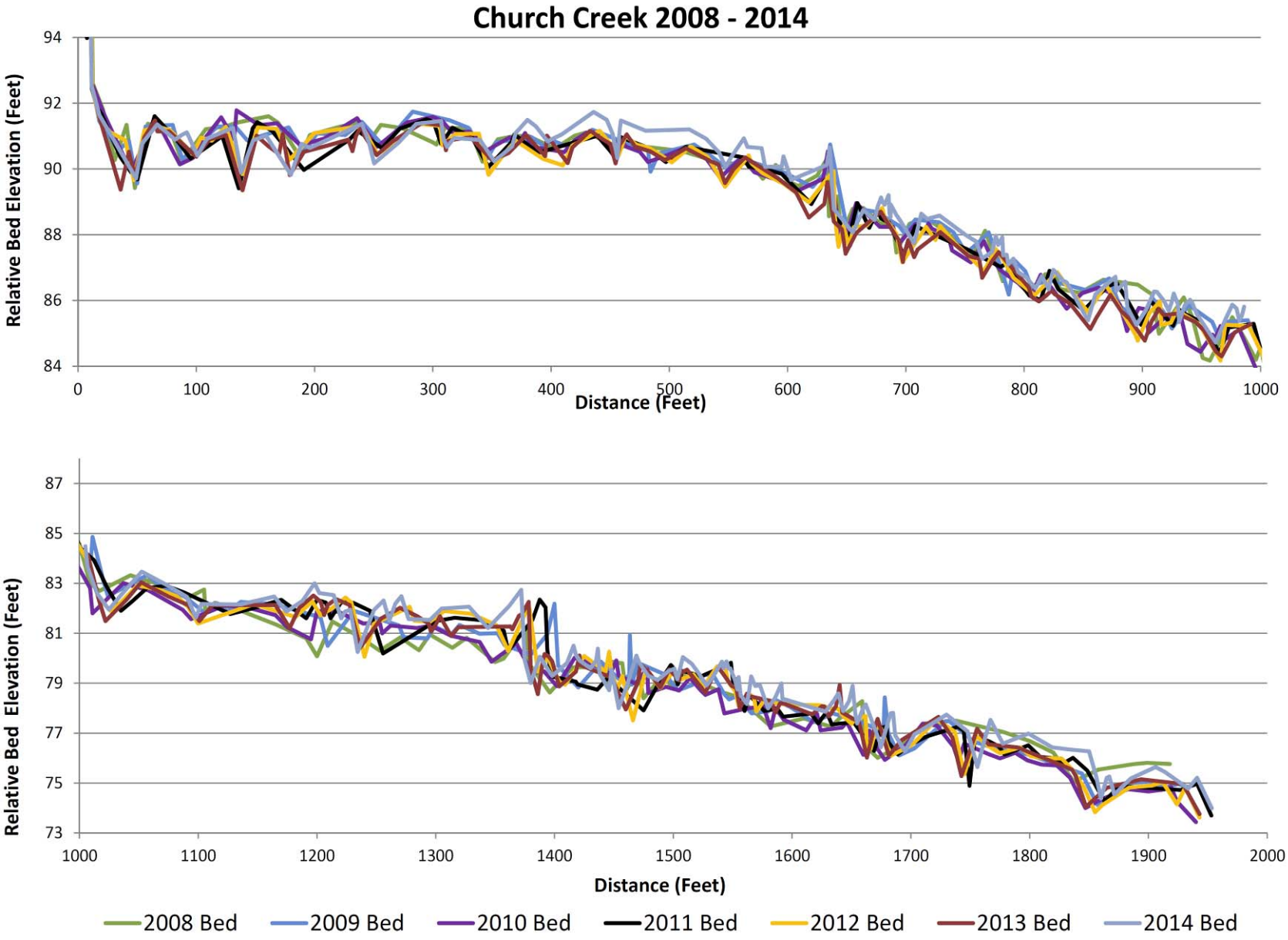


Right Bank View

2014 Geomorphic Assessment Results	
Bankfull Width (W_{bkf}) (feet)	9.8
Mean Depth (d_{bkf}) (feet)	0.5
Bankfull Cross-sectional Area (A_{bkf}) (feet$_2$)	5.2
Width/Depth Ratio (W_{bkf}/d_{bkf})	18.5
Width of Flood-prone Area (W_{fpa}) (feet)	15.9
Entrenchment Ratio (ER) = W_{fpa}/W_{bkf}	1.6
Channel Materials D_{50} (millimeters)	75
Water Surface Slope (S)	0.013
Sinuosity (K) = stream length/valley length	<1.2
Adjustments?	Sin ↑ ER ↓
STREAM TYPE	**F3**

Church Creek Longitudinal Profile




Church Creek 2008 - 2014
Relative Bed Elevation (Feet)
94
92
90
88
86
84
0
100
200
300
400
500
600
700
800
900
1000
Distance (Feet)
Relative Bed Elevation (Feet)
87
85
83
81
79
77
75
73
1000
1100
1200
1300
1400
1500
1600
1700
1800
1900
2000
Distance (Feet)
2008 Bed
2009 Bed
2010 Bed
2011 Bed
2012 Bed
2013 Bed
2014 Bed

APPENDIX G

CHEMICAL MONITORING RESULTS

Anne Arundel County NPDES
Sampling and EMC Data – 2014 Reporting Year
Parole Plaza Station

Sampler	ID	Jurisdiction	Date	Time	Site	Outfall or Instream	Storm or Baseflow	Depth	Duration	Intensity	Temperature - field	Flow	pH - field	dt for BOD	BOD	BOD	dt for Total Kjeldahl Nitrogen	Total Kjeldahl Nitrogen	Total Kjeldahl Nitrogen	dt for Nitrate+ Nitrite - N	Nitrate+ Nitrite - N	Nitrate+ Nitrite - N	dt for Total Phosphorus	Total Phosphorus	Total Phosphorus	dt for TSS	TSS	TSS	dt for Copper	Copper	Copper	dt for Lead	Lead	Lead	dt for Zinc	Zinc	Zinc	dt for TPH	TPH	TPH	dt for E-COLI	E-COLI	E-COLI	dt for HARDNESS	HARDNESS	HARDNESS
								inches	Hours	In/Hr	oC	cf	pH	mg/L	(0) mg/L	(dt) mg/L	mg/L	(0) mg/L	(dt) mg/L	mg/L	(0) mg/L	(dt) mg/L	mg/L	(0) mg/L	(dt) mg/L	mg/L	(0) mg/L	(dt) mg/L	mg/L	(0) mg/L	(dt) mg/L	mg/L	(0) mg/L	(dt) mg/L	mg/L	(0) mg/L	(dt) mg/L	mg/L	(0) mg/L	(dt) mg/L	MPN	(0) MPN	(dt) MPN	mg/L	(0) mg/L	(dt) mg/L
Versar	1	AP	8/28/2013	1400	101	O	B				21.98	13	7.32	4.00	0.00	4.00	0.50	0.90	0.90	0.05	3.20	3.20	0.01	0.04	0.04	7.0	0.0	7.0	0.002	0.012	0.012	0.002	0.000	0.002	0.02	0.077	0.077	5.0	0.0	5.0	1.0	3873.0	3873.0	1.0	110.0	110.0
										Event Mean Concentration:	**21.98**		**7.32**	**4.00**	**0.00**	**4.00**	**0.50**	**0.90**	**0.90**	**0.05**	**3.20**	**3.20**	**0.01**	**0.04**	**0.04**	**7.0**	**0.0**	**7.0**	**0.002**	**0.012**	**0.012**	**0.002**	**0.000**	**0.002**	**0.02**	**0.077**	**0.077**	**5.0**	**0.0**	**5.0**	**1.0**	**3873.0**	**3873.0**	**1.0**	**110.0**	**110.0**
Versar	1	AP	9/12/2013	1522	101	O	S	0.84	2.0	0.42	23.34	31892	6.90	2.00	5.00	5.00	0.50	1.80	1.80	0.05	0.590	0.590	0.01	0.42	0.420	3.0	86.0	86.0	0.002	0.022	0.022	0.002	0.007	0.007	0.02	0.170	0.170	5.0	0.0	5.0	10.0	4611.0	4611.0	1.0	25.0	25.0
Versar	2	AP	9/12/2013	1537	101	O	S				23.59	93991	6.85	2.00	4.00	4.00	0.50	0.00	0.50	0.05	0.450	0.450	0.01	0.10	0.100	3.0	36.0	36.0	0.002	0.015	0.015	0.002	0.003	0.003	0.02	0.091	0.091	5.0	0.0	5.0	10.0	5794.0	5794.0	1.0	20.0	20.0
Versar	3	AP	9/12/2013	1554	101	O	S				23.61	116291	6.92	2.00	5.00	5.00	0.50	1.20	1.20	0.05	0.910	0.910	0.01	0.18	0.180	3.0	44.0	44.0	0.002	0.029	0.029	0.002	0.002	0.002	0.02	0.120	0.120	5.0	0.0	5.0	10.0	24196.0	24196.0	1.0	40.0	40.0
COMBINED 9/12/2013										**Event Mean Concentration:**	**23.57**		**6.89**	**2.00**	**4.61**	**4.61**	**0.50**	**0.813**	**1.01**	**0.05**	**0.689**	**0.689**	**0.01**	**0.181**	**0.181**	**3.0**	**46.4**	**46.4**	**0.002**	**0.023**	**0.023**	**0.002**	**0.003**	**0.003**	**0.02**	**0.115**	**0.115**	**5.0**	**0.0**	**5.0**	**10.0**	**14474.8**	**14474.8**	**1.0**	**30.3**	**30.3**
Versar	1	AP	9/27/2013	1055	101	O	B				18.20	2	7.10	2.00	4.00	4.00	0.50	0.00	0.50	0.05	6.70	6.70	0.01	0.04	0.04	8.0	0.0	8.0	0.002	0.003	0.003	0.002	0.000	0.002	0.02	0.067	0.067	5.0	0.0	5.0	10.0	20.0	20.0	1.0	150.0	150.0
										Event Mean Concentration:	**18.20**		**7.10**	**2.00**	**4.00**	**4.00**	**0.50**	**0.00**	**0.50**	**0.05**	**6.70**	**6.70**	**0.01**	**0.04**	**0.04**	**8.0**	**0.0**	**8.0**	**0.002**	**0.003**	**0.003**	**0.002**	**0.000**	**0.002**	**0.02**	**0.067**	**0.067**	**5.0**	**0.0**	**5.0**	**10.0**	**20.0**	**20.0**	**1.0**	**150.0**	**150.0**
Versar	1	AP	10/7/2013	1020	101	O	S	0.64	7.0	0.09	22.95	4179	6.80	2.00	25.00	25.00	0.50	4.30	4.30	0.05	6.00	6.00	0.01	0.37	0.37	3.0	100.0	100.0	0.002	0.068	0.068	0.002	0.007	0.007	0.02	0.031	0.031	5.0	0.0	5.0	10.0	24196.0	24196.0	1.0	92.0	92.0
Versar	2	AP	10/7/2013	1310	101	O	S				20.73	37667	7.31	2.00	4.00	4.00	0.50	0.00	0.50	0.05	0.27	0.27	0.01	0.12	0.12	3.0	33.0	33.0	0.002	0.021	0.021	0.002	0.003	0.003	0.02	0.140	0.140	5.0	0.0	5.0	10.0	4569.0	4569.0	1.0	26.0	26.0
Versar	3	AP	10/7/2013	1540	101	O	S				20.48	69715	7.37	2.00	3.00	3.00	0.50	0.00	0.50	0.05	0.48	0.48	0.01	0.10	0.10	3.0	14.0	14.0	0.002	0.015	0.015	0.002	0.000	0.002	0.02	0.086	0.086	5.0	0.0	5.0	10.0	24196.0	24196.0	1.0	31.0	31.0
COMBINED 10/7/2013										**Event Mean Concentration:**	**20.66**		**7.33**	**2.00**	**4.16**	**4.16**	**0.50**	**0.16**	**0.64**	**0.05**	**0.616**	**0.616**	**0.01**	**0.117**	**0.117**	**3.0**	**23.6**	**23.6**	**0.002**	**0.019**	**0.019**	**0.002**	**0.001**	**0.003**	**0.02**	**0.102**	**0.102**	**5.0**	**0.0**	**5.0**	**10.0**	**17569.2**	**17569.2**	**1.0**	**31.6**	**31.6**
Versar	1	AP	12/6/2013	2225	101	O	S	0.61	10.0	0.06	8.54	2733	7.53	2.00	5.00	5.00	0.50	0.90	0.90	0.05	0.73	0.73	0.01	0.12	0.12	3.0	61.0	61.0	0.002	0.025	0.025	0.002	0.004	0.004	0.02	0.190	0.190	5.0	0.0	5.0	10.0	4611.0	4611.0	1.0	38.0	38.0
Versar	2	AP	12/7/2013	0129	101	O	S				6.83	24551	7.55	2.00	0.00	2.00	0.50	0.60	0.60	0.05	0.18	0.18	0.01	0.07	0.07	3.0	26.0	26.0	0.002	0.011	0.011	0.002	0.000	0.002	0.02	0.095	0.095	5.0	0.0	5.0	10.0	4611.0	4611.0	1.0	20.0	20.0
Versar	3	AP	12/7/2013	240	101	O	S				7.73	34601	7.39	2.00	0.00	2.00	0.50	0.00	0.50	0.05	0.45	0.45	0.01	0.08	0.08	17.0	0.0	17.0	0.002	0.011	0.011	0.002	0.000	0.002	0.02	0.073	0.073	5.0	0.0	5.0	10.0	17329.0	17329.0	1.0	30.0	30.0
COMBINED 12/6/2013										**Event Mean Concentration:**	**7.41**		**7.46**	**2.00**	**0.22**	**2.13**	**0.50**	**0.28**	**0.56**	**0.05**	**0.355**	**0.355**	**0.01**	**0.078**	**0.078**	**10.8**	**13.0**	**22.5**	**0.002**	**0.012**	**0.012**	**0.002**	**0.000**	**0.002**	**0.02**	**0.087**	**0.087**	**5.0**	**0.0**	**5.0**	**10.0**	**11721.9**	**11721.9**	**1.0**	**26.39**	**26.39**
Versar	1	AP	12/23/2013	240	101	O	S	0.43	12.0	0.04	14.05	935	7.50	2.00	0.00	2.00	0.50	0.80	0.80	0.05	0.48	0.48	0.01	0.13	0.13	3.0	33.0	33.0	0.002	0.017	0.017	0.002	0.000	0.002	0.02	0.140	0.140	5.0	0.0	5.0	10.0	4884.0	4884.0	1.0	54.0	54.0
Versar	2	AP	12/23/2013	1115	101	O	S				15.23	43119	7.66	2.00	0.00	2.00	0.50	1.20	1.20	0.05	0.22	0.22	0.01	0.27	0.27	3.0	250.0	250.0	0.002	0.047	0.047	0.002	0.010	0.010	0.02	0.290	0.290	5.0	0.0	5.0	10.0	4352.0	4352.0	1.0	100.0	100.0
Versar	3	AP	12/23/2013	1150	101	O	S				14.63	49030	7.48	2.00	7.00	7.00	0.50	0.90	0.90	0.05	0.33	0.33	0.01	0.09	0.09	3.0	18.0	18.0	0.002	0.010	0.010	0.002	0.000	0.002	0.02	0.083	0.083	5.0	0.0	5.0	10.0	3076.0	3076.0	1.0	50.0	50.0
COMBINED 12/23/2013										**Event Mean Concentration:**	**14.90**		**7.6**	**2.00**	**3.69**	**4.63**	**0.50**	**1.04**	**1.04**	**0.05**	**0.281**	**0.281**	**0.01**	**0.174**	**0.174**	**3.0**	**125.6**	**125.6**	**0.002**	**0.027**	**0.027**	**0.002**	**0.005**	**0.006**	**0.02**	**0.179**	**0.179**	**5.0**	**0.0**	**5.0**	**10.0**	**3685.2**	**3685.2**	**1.0**	**73.2**	**73.2**
Versar	1	AP	3/6/2014	1155	101	O	B				6.98	5	7.06	2.00	0.00	2.00	0.50	2.00	2.00	0.05	3.10	3.10	0.01	0.08	0.08	1.0	19.0	19.0	0.002	0.006	0.006	0.002	0.000	0.002	0.02	0.054	0.054	5.0	0.0	5.0	10.0	20.0	20.0	1.0	260.0	260.0
										Event Mean Concentration:	**6.98**		**7.06**	**2.00**	**0.00**	**2.00**	**0.50**	**2.00**	**2.00**	**0.05**	**3.10**	**3.10**	**0.01**	**0.08**	**0.08**	**1.0**	**19.0**	**19.0**	**0.002**	**0.006**	**0.006**	**0.002**	**0.000**	**0.002**	**0.02**	**0.054**	**0.054**	**5.0**	**0.0**	**5.0**	**10.0**	**20.0**	**20.0**	**1.0**	**260.0**	**260.0**
Versar	1	AP	3/18/2014	1420	101	O	B				6.68	16	5.97	2.00	10.00	10.00	0.50	3.80	3.80	0.05	2.10	2.10	0.01	0.18	0.18	1.0	73.0	73.0	0.002	0.025	0.025	0.002	0.003	0.003	0.02	0.180	0.180	5.0	6.0	6.0	10.0	1017.0	1017.0	1.0	180.0	180.0
										Event Mean Concentration:	**6.68**		**5.97**	**2.00**	**10.00**	**10.00**	**0.50**	**3.80**	**3.80**	**0.05**	**2.10**	**2.10**	**0.01**	**0.18**	**0.18**	**1.0**	**73.0**	**73.0**	**0.002**	**0.025**	**0.025**	**0.002**	**0.003**	**0.003**	**0.02**	**0.180**	**0.180**	**5.0**	**6.0**	**6.0**	**10.0**	**1017.0**	**1017.0**	**1.0**	**180.0**	**180.0**
Versar	1	AP	3/28/2014	1430	101	O	B				10.69	15	7.34	2.00	6.00	6.00	0.50	2.20	2.20	0.05	3.90	3.90	0.01	0.13	0.13	1.0	40.0	40.0	0.002	0.022	0.022	0.002	0.000	0.002	0.02	0.150	0.150	5.0	0.0	5.0	10.0	292.0	292.0	1.0	260.0	260.0
										Event Mean Concentration:	**10.69**		**7.34**	**2.00**	**6.00**	**6.00**	**0.50**	**2.20**	**2.20**	**0.05**	**3.90**	**3.90**	**0.01**	**0.13**	**0.13**	**1.0**	**40.0**	**40.0**	**0.002**	**0.022**	**0.022**	**0.002**	**0.000**	**0.002**	**0.02**	**0.150**	**0.150**	**5.0**	**0.0**	**5.0**	**10.0**	**292.0**	**292.0**	**1.0**	**260.0**	**260.0**
Versar	1	AP	4/7/2014	1150	101	O	S	0.29	12.0	0.02	9.18	4659	7.56	2.00	8.00	8.00	0.50	1.60	1.60	0.05	1.10	1.10	0.01	0.12	0.12	1.0	27.0	27.0	0.002	0.031	0.031	0.002	0.000	0.002	0.02	0.170	0.170	5.0	0.0	5.0	10.0	292.0	292.0	1.0	50.0	50.0
Versar	2	AP	4/7/2014	1645	101	O	S				11.71	14342	7.87	2.00	4.00	4.00	0.50	0.80	0.80	0.05	0.36	0.36	0.01	0.14	0.14	1.0	51.0	51.0	0.002	0.024	0.024	0.002	0.003	0.003	0.02	0.140	0.140	5.0	0.0	5.0	10.0	404.0	404.0	1.0	38.0	38.0
Versar	3	AP	4/7/2014	1805	101	O	S				11.48	18128	7.52	2.00	4.00	4.00	0.50	0.80	0.80	0.05	1.20	1.20	0.01	0.09	0.09	1.0	16.0	16.0	0.002	0.016	0.016	0.002	0.000	0.002	0.02	0.095	0.095	5.0	0.0	5.0	10.0	1043.0	1043.0	1.0	52.0	52.0
COMBINED 4/7/2014										**Event Mean Concentration:**	**11.28**		**7.66**	**2.00**	**4.50**	**4.50**	**0.50**	**0.90**	**0.90**	**0.05**	**0.863**	**0.863**	**0.01**	**0.113**	**0.113**	**1.0**	**30.9**	**30.9**	**0.002**	**0.021**	**0.021**	**0.002**	**0.001**	**0.002**	**0.02**	**0.122**	**0.122**	**5.0**	**0.0**	**5.0**	**10.0**	**701.9**	**701.9**	**1.0**	**46.3**	**46.3**
Versar	1	AP	5/27/2014	1920	101	O	S	0.58	3.0	0.19	22.75	1068	7.01	2.00	57.00	57.00	0.50	4.40	4.40	0.05	1.80	1.80	0.01	0.40	0.40	1.0	170.0	170.0	0.002	0.051	0.051	0.002	0.006	0.006	0.02	0.340	0.340	5.0	0.0	5.0	10.0	275.0	275.0	1.0	90.0	90.0
Versar	2	AP	5/27/2014	1930	101	O	S				24.03	5812	7.31	2.00	19.00	19.00	0.50	1.80	1.80	0.05	0.61	0.61	0.01	0.07	0.07	1.0	27.0	27.0	0.002	0.027	0.027	0.002	0.002	0.002	0.02	0.150	0.150	5.0	0.0	5.0	10.0	749.0	749.0	1.0	30.0	30.0
Versar	3	AP	5/27/2014	2135	101	O	S				21.58	17460	7.35	2.00	4.00	4.00	0.50	0.70	0.70	0.05	0.58	0.58	0.01	0.12	0.12	1.0	14.0	14.0	0.002	0.017	0.017	0.002	0.000	0.002	0.02	0.081	0.081	5.0	0.0	5.0	10.0	14136.0	14136.0	1.0	36.0	36.0
COMBINED 5/27/2014										**Event Mean Concentration:**	**22.22**		**7.33**	**2.00**	**9.91**	**9.91**	**0.50**	**1.13**	**1.13**	**0.05**	**0.641**	**0.641**	**0.01**	**0.120**	**0.120**	**1.0**	**23.9**	**23.9**	**0.002**	**0.021**	**0.021**	**0.002**	**0.001**	**0.002**	**0.02**	**0.109**	**0.109**	**5.0**	**0.0**	**5.0**	**10.0**	**10331.2**	**10331.2**	**1.0**	**36.94**	**36.94**
Versar	1	AP	6/19/2014	1730	101	O	S	0.23	3.0	0.08	25.63	2683	7.62	2.00	6.00	6.00	0.50	1.00	1.00	0.05	0.56	0.56	0.01	0.06	0.06	1.0	16.0	16.0	0.002	0.018	0.018	0.002	0.000	0.002	0.02	0.086	0.086	5.0	0.0	5.0	100.0	1580.0	1580.0	1.0	26.0	26.0
Versar	2	AP	6/19/2014	1810	101	O	S				25.40	7675	7.82	2.00	4.00	4.00	0.50	0.00	0.50	0.05	0.28	0.28	0.01	0.07	0.07	1.0	22.0	22.0	0.002	0.017	0.017	0.002	0.004	0.004	0.02	0.130	0.130	5.0	0.0	5.0	100.0	2490.0	2490.0	1.0	30.0	30.0
Versar	3	AP	6/19/2014	1825	101	O	S				24.64	9795	7.65	2.00	6.00	6.00	0.50	0.00	0.50	0.05	0.45	0.45	0.01	0.09	0.09	1.0	18.0	18.0	0.002	0.017	0.017	0.002	0.000	0.002	0.02	0.089	0.089	5.0	0.0	5.0	100.0	68670.0	68670.0	1.0	32.0	32.0
COMBINED 6/19/2014										**Event Mean Concentration:**	**25.06**		**7.7**	**2.00**	**5.24**	**5.24**	**0.50**	**0.13**	**0.57**	**0.05**	**0.400**	**0.400**	**0.01**	**0.078**	**0.078**	**1.0**	**19.3**	**19.3**	**0.002**	**0.017**	**0.017**	**0.002**	**0.001**	**0.003**	**0.02**	**0.104**	**0.104**	**5.0**	**0.0**	**5.0**	**100.0**	**34534.4**	**34534.4**	**1.0**	**30.4**	**30.4**

Anne Arundel County NPDES
Sampling and EMC Data – 2014 Reporting Year
Parole Plaza Station

	Sampler	ID	Jurisdiction	Date	Time	Site	Outfall or Instream	Storm or Baseflow	Depth	Duration	Intensity	Temperature - field	Flow	pH - field	dt for BOD	BOD	BOD	dt for Total Kjeldahl Nitrogen	Total Kjeldahl Nitrogen	Total Kjeldahl Nitrogen	dt for Nitrate+ Nitrite - N	Nitrate+ Nitrite - N	Nitrate+ Nitrite - N	dt for Total Phosphorus	Total Phosphorus	Total Phosphorus	dt for TSS	TSS	TSS	dt for Copper	Copper	Copper	dt for Lead	Lead	Lead	dt for Zinc	Zinc	Zinc	dt for TPH	TPH	TPH	dt for E-COLI	E-COLI	E-COLI	dt for HARDNESS	HARDNESS	HARDNESS
									Inches	Hours	In/Hr	oC	cf	pH	mg/L	(O) mg/L	(dt) mg/L	mg/L	(O) mg/L	(dt) mg/L	mg/L	(O) mg/L	(dt) mg/L	mg/L	(O) mg/L	(dt) mg/L	mg/L	(O) mg/L	(dt) mg/L	mg/L	(O) mg/L	(dt) mg/L	mg/L	(O) mg/L	(dt) mg/L	mg/L	(O) mg/L	(dt) mg/L	mg/L	(O) mg/L	(dt) mg/L	MPN	(O) MPN	(dt) MPN	mg/L	(O) mg/L	(dt) mg/L
SUMMER QUARTER (JULY, AUGUST, SEPTEMBER)																																														
Summer Quarter Flow-Weighted EMC (9/12/13):												23.57		6.89		4.61	4.61		0.81	1.01		0.69	0.69		0.18	0.18		46.42	46.42		0.02	0.02		0.00	0.00		0.12	0.12		0.00	5.00		14474.08	14474.08		30.27	30.27
Average:																4.61	mg/l		0.91	mg/l		0.69	mg/l		0.18	mg/l		46.42	mg/l		0.023	mg/l		0.003	mg/l		0.115	mg/l		2.50	mg/l		14474.08	MPN/100mL		30.27	mg/l
																0.0002878	lb/cf		0.0000568	lb/cf		0.0000430	lb/cf		0.0000113	lb/cf		0.0028976	lb/cf		0.0000014	lb/cf		0.0000002	lb/cf		0.0000072	lb/cf		0.0001560	lb/cf					0.0018892	lb/cf
Total Volume (Quarter Events):																242,189	cf																														
Pollutant Load (Quarter Events):																69.7	lbs		13.76	lbs		10.42	lbs		2.73	lbs		701.76	lbs		0.34	lbs		0.05	lbs		1.74	lbs		37.79	lbs					457.54	
Total Volume (Quarter):																960,592	cf																														
Pollutant Load (Quarter):																277	lbs		55	lbs		41	lbs		11	lbs		2,783	lbs		1.4	lbs		0.2	lbs		7	lbs		150	lbs					1,815	
FALL QUARTER (OCTOBER, NOVEMBER, DECEMBER)																																													
Fall Quarter Flow-Weighted EMC (10/7/13), (12/6/13), (12/23/13):												15.57		7.44		3.08	3.86		0.49	0.76		0.438	0.438		0.128	0.128		56.79	58.99		0.020	0.020		0.002	0.004		0.126	0.126		0.0	5.0		11362.66	11362.66		44.92	44.92
Average:																3.47	mg/l		0.63	mg/l		0.44	mg/l		0.13	mg/l		57.89	mg/l		0.020	mg/l		0.003	mg/l		0.126	mg/l		2.50	mg/l		11362.66	MPN/100mL		44.92	mg/l
																0.0002165	lb/cf		0.0000392	lb/cf		0.0000274	lb/cf		0.0000080	lb/cf		0.0036132	lb/cf		0.0000013	lb/cf		0.0000002	lb/cf		0.0000078	lb/cf		0.0001560	lb/cf					0.0028035	lb/cf
Total Volume (Quarter Events):																266,529	cf																														
Pollutant Load (Quarter Events):																57.7	lbs		10.44	lbs		7.29	lbs		2.12	lbs		963.02	lbs		0.34	lbs		0.05	lbs		2.09	lbs		41.59	lbs					747.23	
Total Volume (Quarter):																2,103,820	cf																														
Extrapolated Volume (Quarter):																2,317,982																															
Pollutant Load (Quarter):																502	lbs		91	lbs		63	lbs		18	lbs		8,375	lbs		2.9	lbs		0.4	lbs		18	lbs		362	lbs					6,499	
WINTER QUARTER (JANUARY, FEBRUARY, MARCH)																																													
Fall Quarter Flow-Weighted EMC:												8.39		6.69		6.94	7.22		2.88	2.88		2.99	2.99		0.15	0.15		51.75	51.75		0.02	0.02		0.00	0.00		0.15	0.15		2.67	5.44		576.44	576.44		224.44	224.44
Average:																7.08	mg/l		2.88	mg/l		2.99	mg/l		0.15	mg/l		51.75	mg/l		0.021	mg/l		0.002	mg/l		0.150	mg/l		4.06	mg/l		576.44	MPN/100mL		224.44	mg/l
																0.0004421	lb/cf		0.0001800	lb/cf		0.0001866	lb/cf		0.0000091	lb/cf		0.0032300	lb/cf		0.0000013	lb/cf		0.0000001	lb/cf		0.0000094	lb/cf		0.0002531	lb/cf					0.0140089	lb/cf
Total Volume (Quarter Events):																36	cf																														
Pollutant Load (Quarter Events):																0.016	lbs		0.006	lbs		0.007	lbs		0.000	lbs		0.116	lbs		0.000	lbs		0.000	lbs		0.000	lbs		0.009	lbs					0.504	
Total Volume (Quarter):																1,689,634	cf																														
Extrapolated Volume (Quarter):																1,843,238																															
Pollutant Load (Quarter):																815	lbs		332	lbs		344	lbs		17	lbs		5,954	lbs		2.4	lbs		0.2	lbs		17	lbs		467	lbs					25,822	
SPRING QUARTER (APRIL, MAY, JUNE)																																													
Fall Quarter Flow-Weighted EMC (4/7/14), (5/27/14), (6/19/14):												17.94		7.57		6.30	6.30		0.778	0.885		0.682	0.682		0.107	0.107		25.95	25.95		0.02	0.02		0.001	0.002		0.114	0.114		0.00	5.00		11926.88	11926.88		39.61	39.61
Average:																6.30	mg/l		0.83	mg/l		0.68	mg/l		0.11	mg/l		25.95	mg/l		0.020	mg/l		0.002	mg/l		0.114	mg/l		2.50	mg/l		11926.88	MPN/100mL		39.61	mg/l
																0.0003929	lb/cf		0.0000519	lb/cf		0.0000426	lb/cf		0.0000067	lb/cf		0.0016198	lb/cf		0.0000012	lb/cf		0.0000001	lb/cf		0.0000071	lb/cf		0.0001560	lb/cf					0.0024723	lb/cf
Total Volume (Quarter Events):																81,622	cf																														
Pollutant Load (Quarter Events):																32.1	lbs		4.24	lbs		3.48	lbs		0.54	lbs		132.22	lbs		0.10	lbs		0.01	lbs		0.58	lbs		12.74	lbs					201.80	
Total Volume (Quarter):																1,136,586	cf																														
Pollutant Load (Quarter):																447	lbs		59	lbs		48	lbs		8	lbs		1,841	lbs		1.4	lbs		0.1	lbs		8	lbs		177	lbs					2,810	
AVERAGE ANNUAL EMCs:												19.18		7.23		4.33	mg/l		0.772	mg/l		0.575	mg/l		0.146	mg/l		48.77	mg/l		0.021	mg/l		0.003	mg/l		0.120	mg/l		2.50	mg/l		12716.40	mg/l		38.18	mg/l
TOTAL ANNUAL POLLUTANT LOAD (EVENTS):																159.50	lbs		28.44	lbs		21.20	lbs		5.40	lbs		1,797.11	lbs		0.78	lbs		0.102	lbs		4.412	lbs		92.126	lbs					1407.066	lbs
Per Acre:																2.64			0.47			0.35			0.09			29.75			0.01			0.00			0.07			1.53						23.29	
TOTAL 2014 POLLUTANT LOAD:																2,039.81	lbs		536.08	lbs		497.02	lbs		53.58	lbs		18,953.49	lbs		8.12	lbs		0.95	lbs		50.40	lbs		1,155.52	lbs					36,945.03	lbs

Anne Arundel County NPDES
Sampling and EMC Data – 2014 Reporting Year
Church Creek Station

Sampler	ID	Jurisdiction	Date	Time	Site	Outfall or Instream	Storm or Baseflow	Depth	Duartion	Intensity	Temperature - field	Flow	pH - field	dt for BOD	BOD	BOD	dt for Total Kjeldahl Nitrogen	Total Kjeldahl Nitrogen	Total Kjeldahl Nitrogen	dt for Nitrate+ Nitrite - N	Nitrate+ Nitrite - N	Nitrate+ Nitrite - N	dt for Total Phosphorus	Total Phosphorus	Total Phosphorus	dt for TSS	TSS	TSS	dt for Copper	Copper	Copper	dt for Lead	Lead	Lead	dt for Zinc	Zinc	Zinc	dt for TPH	TPH	TPH	dt for E-COLI	E-COLI	E-COLI	dt for HARDNESS	HARDNESS	HARDNESS
								Inches	Hours	In/Hr	oC	cf	pH	mg/L	(0) mg/L	(dt) mg/L	mg/L	(0) mg/L	(dt) mg/L	mg/L	(0) mg/L	(dt) mg/L	mg/L	(0) mg/L	(dt) mg/L	mg/L	(0) mg/L	(dt) mg/L	mg/L	(0) mg/L	(dt) mg/L	mg/L	(0) mg/L	(dt) mg/L	mg/L	(0) mg/L	(dt) mg/L	mg/L	(0) mg/L	(dt) mg/L	MPN	(0) MPN	(dt) MPN	(dt) mg/L	mg/L	(0) mg/L
Versar	1	AC	8/28/2013	1435	102	I	B				22.2	495	6.9	4.00	0.00	4.00	0.50	0.00	0.50	0.05	1.20	1.200	0.01	0.06	0.060	8.0	0.00	8.0	0.002	0.000	0.002	0.002	0.000	0.002	0.02	0.000	0.020	5.0	0.0	5.0	10.0	420.0	420.0	1.0	120.0	120.0
										Event Mean Concentration:	**22.20**		**6.9**	**4.00**	**0.00**	**4.00**	**0.50**	**0.00**	**0.50**	**0.05**	**1.20**	**1.200**	**0.01**	**0.06**	**0.060**	**8.0**	**0.00**	**8.0**	**0.002**	**0.000**	**0.002**	**0.00**	**0.000**	**0.002**	**0.02**	**0.000**	**0.020**	**5.0**	**0.0**	**5.0**	**10.0**	**420.0**	**420.0**	**1.0**	**120.0**	**120.0**
Versar	1	AC	9/12/2013	1515	102	I	S	0.84	2.0	0.42	23.00	1731	6.9	2.00	0.00	2.00	0.50	0.00	0.50	0.05	1.10	1.100	0.01	1.00	1.00	3.0	14.0	14.0	0.002	0.000	0.002	0.002	0.000	0.002	0.02	0.023	0.023	5.0	0.0	5.0	10.0	1450.0	1450.0	1.0	120.0	120.0
Versar	2	AC	9/12/2013	1555	102	I	S				23.80	565667	7.2	4.00	5.00	5.00	0.50	0.00	0.50	0.02	0.09	0.090	0.01	0.20	0.20	1.0	79.0	79.0	0.002	0.017	0.017	0.002	0.007	0.007	0.01	0.110	0.110	5.0	0.0	5.0	10.0	12030.0	12030.0	1.0	38.0	38.0
Versar	3	AC	9/12/2013	1710	102	I	S				24.40	812893	6.9	4.00	0.00	4.00	0.50	0.00	0.50	0.02	0.12	0.120	0.01	0.09	0.09	1.0	18.0	18.0	0.002	0.008	0.008	0.002	0.002	0.002	0.01	0.040	0.040	5.0	0.0	5.0	10.0	12997.0	12997.0	1.0	32.0	32.0
COMBINED 9/12/2013										**Event Mean Concentration:**	**24.15**		**7.0**	**4.00**	**2.05**	**4.41**	**0.50**	**0.00**	**0.50**	**0.02**	**0.109**	**0.109**	**0.01**	**0.136**	**0.136**	**1.0**	**43.0**	**43.0**	**0.002**	**0.012**	**0.012**	**0.002**	**0.004**	**0.004**	**0.01**	**0.069**	**0.069**	**5.0**	**0.0**	**5.0**	**10.0**	**12586.2**	**12586.2**	**1.0**	**34.6**	**34.6**
Versar	1	AC	9/27/2013	1150	102	I	B				16.50	541	6.8	2.00	0.00	2.00	0.50	0.00	0.50	0.05	1.30	1.300	0.01	0.06	0.06	7.0	0.00	7.0	0.002	0.000	0.002	0.002	0.000	0.002	0.02	0.021	0.021	5.0	0.0	5.0	10.0	146.0	146.0	1.0	110.0	110.0
										Event Mean Concentration:	**16.50**		**6.8**	**2.00**	**0.00**	**2.00**	**0.50**	**0.00**	**0.50**	**0.05**	**1.30**	**1.300**	**0.01**	**0.060**	**0.060**	**7.0**	**0.00**	**7.0**	**0.002**	**0.000**	**0.002**	**0.002**	**0.000**	**0.002**	**0.02**	**0.021**	**0.021**	**5.0**	**0.0**	**5.0**	**10.0**	**146.0**	**146.0**	**1.0**	**110.0**	**110.0**
Versar	1	AC	10/7/2013	1045	102	I	S	0.64	7.0	0.09	21.1	11109	6.8	2.00	15.00	15.00	0.50	0.80	0.80	0.05	1.60	1.60	0.01	0.20	0.20	3.0	40.0	40.0	0.002	0.009	0.009	0.002	0.000	0.002	0.02	0.053	0.053	5.0	0.0	5.0	10.0	2909.0	2909.00	1.0	110.0	110.0
Versar	2	AC	10/7/2013	1345	102	I	S				21.2	186236	7.0	2.00	6.00	6.00	0.50	1.20	1.20	0.05	0.43	0.43	0.01	0.29	0.29	3.0	90.0	90.0	0.002	0.048	0.048	0.002	0.008	0.008	0.02	0.098	0.098	5.0	0.0	5.0	10.0	14136.0	14136.00	1.0	26.0	26.0
Versar	3	AC	10/7/2013	1625	102	I	S				21.1	532079	7.0	2.00	3.00	3.00	0.50	0.00	0.50	0.05	0.26	0.26	0.01	0.09	0.09	3.0	17.0	17.0	0.002	0.007	0.007	0.002	0.000	0.002	0.02	0.044	0.044	5.0	0.0	5.0	10.0	9208.0	9208.00	1.0	32.0	32.0
COMBINED 10/7/2013										**Event Mean Concentration:**	**21.13**		**7.0**	**2.00**	**3.95**	**3.95**	**0.50**	**0.32**	**0.68**	**0.05**	**0.324**	**0.324**	**0.01**	**0.143**	**0.143**	**3.0**	**36.0**	**36.0**	**0.002**	**0.017**	**0.017**	**0.002**	**0.002**	**0.004**	**0.02**	**0.058**	**0.058**	**5.0**	**0.0**	**5.0**	**10.0**	**10370.28**	**10370.28**	**1.0**	**31.66**	**31.66**
Versar	1	AC	12/6/2013	2250	102	I	S	0.61	10.0	0.06	9.6	378212	7.1	2.00	3.00	3.00	0.50	0.90	0.90	0.05	0.75	0.75	0.01	0.14	0.14	3.0	28.0	28.0	0.002	0.013	0.013	0.002	0.003	0.003	0.02	0.089	0.089	5.0	0.0	5.0	10.0	3076.0	3076.00	1.0	48.0	48.0
Versar	2	AC	12/7/2013	210	102	I	S				7.4	261637	7.1	2.00	0.00	2.00	0.50	0.60	0.60	0.05	0.29	0.29	0.01	0.13	0.13	3.0	35.0	35.0	0.002	0.008	0.008	0.002	0.004	0.004	0.02	0.070	0.070	5.0	0.0	5.0	10.0	3654.0	3654.00	1.0	31.0	31.0
Versar	3	AC	12/7/2013	330	102	I	S				7.4	121401	7.1	2.00	0.00	2.00	0.50	0.00	0.50	0.05	0.23	0.23	0.01	0.06	0.06	17.0	0.0	17.0	0.002	0.004	0.004	0.002	0.000	0.002	0.02	0.056	0.056	5.0	0.0	5.0	10.0	1670.0	1670.00	1.0	31.0	31.0
COMBINED 12/6/2013										**Event Mean Concentration:**	**8.49**		**7.1**	**2.00**	**1.49**	**2.50**	**0.50**	**0.65**	**0.73**	**0.05**	**0.509**	**0.509**	**0.01**	**0.124**	**0.124**	**5.2**	**25.9**	**28.7**	**0.002**	**0.010**	**0.010**	**0.002**	**0.003**	**0.003**	**0.02**	**0.077**	**0.077**	**5.0**	**0.0**	**5.0**	**10.0**	**3050.43**	**3050.43**	**1.0**	**39.4**	**39.4**
Versar	1	AC	12/23/2013	240	102	I	S	0.43	12.0	0.04	13.2	15621	7.0	2.00	0.00	2.00	0.50	0.90	0.90	0.05	0.54	0.54	0.01	0.08	0.08	3.0	9.0	9.0	0.002	0.004	0.004	0.002	0.000	0.002	0.02	0.056	0.056	5.0	0.0	5.0	10.0	2909.0	2909.00	1.0	85.0	85.0
Versar	2	AC	12/23/2013	1145	102	I	S				13.9	459957	7.2	2.00	0.00	2.00	0.50	0.80	0.80	0.05	0.24	0.24	0.01	0.14	0.14	3.0	50.0	50.0	0.002	0.000	0.002	0.002	0.004	0.004	0.02	0.052	0.052	5.0	0.0	5.0	10.0	4352.0	4352.00	1.0	44.0	44.0
Versar	3	AC	12/23/2013	1300	102	I	S				13.9	168909	7.2	2.00	2.00	2.00	0.50	0.00	0.50	0.05	0.00	0.05	0.01	0.00	0.01	3.0	0.0	3.0	0.002	0.000	0.002	0.002	0.000	0.002	0.02	0.000	0.020	5.0	0.0	5.0	1.0	1553.0	1553.00	1.0	0.0	1.0
COMBINED 12/23/2013										**Event Mean Concentration:**	**13.88**		**7.2**	**2.00**	**0.52**	**2.00**	**0.50**	**0.59**	**0.72**	**0.05**	**0.184**	**0.197**	**0.01**	**0.102**	**0.104**	**3.0**	**35.9**	**36.7**	**0.002**	**0.000**	**0.002**	**0.002**	**0.003**	**0.003**	**0.02**	**0.038**	**0.044**	**5.0**	**0.0**	**5.0**	**7.6**	**3583.5**	**3583.5**	**1.0**	**33.5**	**33.7**
Versar	1	AC	3/6/2014	1350	102	I	B				3.8	646	6.4	2.00	0.00	2.00	0.50	4.40	4.40	0.05	1.60	1.60	0.01	0.07	0.070	1.0	14.00	14.0	0.002	0.003	0.003	0.002	0.000	0.002	0.02	0.052	0.052	5.0	0.0	5.0	10.0	213.0	213.0	1.0	200.0	200.0
										Event Mean Concentration:	**3.80**		**6.4**	**2.00**	**0.00**	**2.00**	**0.50**	**4.40**	**4.40**	**0.05**	**1.60**	**1.60**	**0.01**	**0.07**	**0.070**	**1.0**	**14.00**	**14.0**	**0.002**	**0.003**	**0.003**	**0.00**	**0.000**	**0.002**	**0.02**	**0.052**	**0.052**	**5.0**	**0.0**	**5.0**	**10.0**	**213.0**	**213.0**	**1.0**	**200.0**	**200.0**
Versar	1	AC	3/18/2014	1345	102	I	B				5.6	835	7.1	2.00	4.00	4.00	0.50	5.60	5.60	0.05	1.60	1.60	0.01	0.07	0.070	1.0	21.00	21.0	0.002	0.004	0.004	0.002	0.000	0.002	0.02	0.056	0.056	5.0	0.0	5.0	10.0	644.0	644.0	1.0	220.0	220.0
										Event Mean Concentration:	**5.60**		**7.1**	**2.00**	**4.00**	**4.00**	**0.50**	**5.60**	**5.60**	**0.05**	**1.60**	**1.60**	**0.01**	**0.07**	**0.070**	**1.0**	**21.00**	**21.0**	**0.002**	**0.004**	**0.004**	**0.002**	**0.000**	**0.002**	**0.02**	**0.056**	**0.056**	**5.0**	**0.0**	**5.0**	**10.0**	**644.0**	**644.0**	**1.0**	**220.0**	**220.0**
Versar	1	AC	3/28/2014	1350	102	I	B				8.0	701	6.9	4.00	0.00	4.00	0.50	1.10	1.10	0.05	1.90	1.90	0.01	0.12	0.120	1.0	27.00	27.0	0.002	0.008	0.008	0.002	0.000	0.002	0.02	0.091	0.091	5.0	0.0	5.0	10.0	292.0	292.0	1.0	150.0	150.0
										Event Mean Concentration:	**8.00**		**6.9**	**4.00**	**0.00**	**4.00**	**0.50**	**1.10**	**1.10**	**0.05**	**1.90**	**1.90**	**0.01**	**0.12**	**0.120**	**1.0**	**27.00**	**27.0**	**0.002**	**0.008**	**0.008**	**0.002**	**0.000**	**0.002**	**0.02**	**0.091**	**0.091**	**5.0**	**0.0**	**5.0**	**10.0**	**292.0**	**292.0**	**1.0**	**150.0**	**150.0**
Versar	1	AC	4/7/2014	1145	102	I	S	0.29	12.0	0.02	9.1	24098	7.1	2.00	0.00	2.00	0.50	0.90	0.90	0.05	1.80	1.80	0.01	0.12	0.12	1.0	20.0	20.0	0.002	0.005	0.005	0.002	0.000	0.002	0.02	0.065	0.065	5.0	0.0	5.0	10.0	145.0	145.00	1.0	120.0	120.0
Versar	2	AC	4/7/2014	1715	102	I	S				11.2	175533	7.4	2.00	6.00	6.00	0.50	1.30	1.30	0.05	1.00	1.00	0.01	0.26	0.26	1.0	45.0	45.0	0.002	0.016	0.016	0.002	0.005	0.005	0.02	0.100	0.100	5.0	0.0	5.0	10.0	4611.0	4611.00	1.0	68.0	68.0
Versar	3	AC	4/7/2014	1925	102	I	S				11.5	125302	7.4	2.00	4.00	4.00	0.50	0.90	0.90	0.05	0.59	0.59	0.01	0.07	0.07	1.0	14.0	14.0	0.002	0.008	0.008	0.002	0.000	0.002	0.02	0.043	0.043	5.0	0.0	5.0	10.0	813.0	813.00	1.0	57.0	57.0
COMBINED 4/7/2014										**Event Mean Concentration:**	**11.16**		**7.4**	**2.00**	**4.78**	**4.93**	**0.50**	**1.12**	**1.12**	**0.05**	**0.901**	**0.901**	**0.01**	**0.176**	**0.176**	**1.0**	**31.2**	**31.2**	**0.002**	**0.012**	**0.012**	**0.002**	**0.002**	**0.003**	**0.02**	**0.075**	**0.075**	**5.0**	**0.0**	**5.0**	**10.0**	**2815.18**	**2815.18**	**1.0**	**67.61**	**67.61**
Versar	1	AC	5/27/2014	1935	102	I	S	0.58	3.0	0.19		1898	7.3	2.00	10.00	10.00	0.50	1.70	1.70	0.05	0.82	0.82	0.01	0.27	0.27	1.0	20.0	20.0	0.002	0.092	0.092	0.002	0.000	0.002	0.02	0.081	0.081	5.0	0.0	5.0	10.0	557.0	557.00	1.0	60.0	60.0
Versar	2	AC	5/27/2014	1955	102	I	S					36217	7.3	2.00	36.00	36.00	0.50	3.50	3.50	0.05	1.10	1.10	0.01	0.46	0.46	1.0	190.0	190.0	0.002	0.028	0.028	0.002	0.017	0.017	0.02	0.170	0.170	5.0	0.0	5.0	10.0	11199.0	11199.00	1.0	67.0	67.0
Versar	3	AC	5/27/2014	2210	102	I	S					117729	7.5	2.00	4.00	4.00	0.50	1.10	1.10	0.05	0.34	0.34	0.01	0.11	0.11	1.0	25.0	25.0	0.002	0.004	0.007	0.002	0.000	0.002	0.02	0.035	0.035	5.0	0.0	5.0	10.0	3255.0	3255.00	1.0	40.0	40.0
COMBINED 5/27/2014										**Event Mean Concentration:**			**7.4**	**2.00**	**11.51**	**11.51**	**0.50**	**1.67**	**1.67**	**0.05**	**0.522**	**0.522**	**0.01**	**0.193**	**0.193**	**1.0**	**63.3**	**63.3**	**0.002**	**0.011**	**0.013**	**0.002**	**0.004**	**0.005**	**0.02**	**0.067**	**0.067**	**5.0**	**0.0**	**5.0**	**10.0**	**5068.27**	**5068.27**	**1.0**	**46.5**	**46.5**
Versar	1	AC	6/19/2014	1740	102	I	S	0.23	3.0	0.08	24.2	7654	6.8	2.00	9.00	9.00	0.50	1.30	1.30	0.05	0.81	0.81	0.01	0.14	0.14	1.0	36.0	36.0	0.002	0.016	0.016	0.002	0.002	0.002	0.02	0.077	0.077	5.0	0.0	5.0	100.0	2310.0	2310.00	1.0	74.0	74.0
Versar	2	AC	6/19/2014	1830	102	I	S				25.5	118856	7.0	2.00	11.00	11.00	0.50	1.10	1.10	0.05	0.64	0.64	0.01	0.24	0.24	1.0	110.0	110.0	0.002	0.020	0.020	0.002	0.014	0.014	0.02	0.130	0.130	5.0	0.0	5.0	100.0	24890.0	24890.00	1.0	46.0	46.0
Versar	3	AC	6/19/2014	1855	102	I	S				25.8	67960	7.0	2.00	6.00	6.00	0.50	0.60	0.60	0.05	0.47	0.47	0.01	0.13	0.13	1.0	50.0	50.0	0.002	0.011	0.011	0.002	0.004	0.004	0.02	0.064	0.064	5.0	0.0	5.0	100.0	29090.0	29090.00	1.0	36.0	36.0
COMBINED 6/19/2014										**Event Mean Concentration:**	**25.55**		**7.0**	**2.00**	**9.17**	**9.17**	**0.50**	**0.93**	**0.93**	**0.05**	**0.587**	**0.587**	**0.01**	**0.198**	**0.198**	**1.0**	**86.1**	**86.1**	**0.002**	**0.017**	**0.017**	**0.002**	**0.010**	**0.010**	**0.02**	**0.105**	**0.105**	**5.0**	**0.0**	**5.0**	**100.0**	**25469.0**	**25469.0**	**1.0**	**43.6**	**43.6**

Anne Arundel County NPDES
Sampling and EMC Data – 2014 Reporting Year
Church Creek Station

	Sampler	ID	Jurisdiction	Date	Time	Site	Outfall or Instream	Storm or Baseflow	Depth	Duration	Intensity	Temperature - field	Flow	pH - field	dt for BOD	BOD	BOD	dt for Total Kjeldahl Nitrogen	Total Kjeldahl Nitrogen	Total Kjeldahl Nitrogen	dt for Nitrate+ Nitrite - N	Nitrate+ Nitrite - N	Nitrate+ Nitrite - N	dt for Total Phosphorus	Total Phosphorus	Total Phosphorus	dt for TSS	TSS	TSS	dt for Copper	Copper	Copper	dt for Lead	Lead	Lead	dt for Zinc	Zinc	Zinc	dt for TPH	TPH	TPH	dt for E-COLI	E-COLI	E-COLI	dt for HARDNESS	HARDNESS	HARDNESS
									Inches	Hours	In/Hr	oC	cf	pH	mg/L	(0) mg/L	(dt) mg/L	mg/L	(0) mg/L	(dt) mg/L	mg/L	(0) mg/L	(dt) mg/L	mg/L	(0) mg/L	(dt) mg/L	mg/L	(0) mg/L	(dt) mg/L	mg/L	(0) mg/L	(dt) mg/L	mg/L	(0) mg/L	(dt) mg/L	mg/L	(0) mg/L	(dt) mg/L	mg/L	(0) mg/L	(dt) mg/L	MPN	(0) MPN	(dt) MPN	(dt) mg/L	mg/L	(0) mg/L
SUMMER QUARTER (JULY, AUGUST, SEPTEMBER)																																														
Summer Quarter Flow-Weighted EMC (9/12/13):												24.15		7.02		2.05	4.41		0.00	0.50		0.11	0.11		0.14	0.14		42.96	42.97		0.01	0.01		0.00	0.00		0.07	0.07		0.00	5.00		12577.00	12577.00		34.63	34.63
Average:																3.23	mg/l		0.25	mg/l		0.11	mg/l		0.14	mg/l		42.96	mg/l		0.012	mg/l		0.004	mg/l		0.069	mg/l		2.50	mg/l		12577.00	MPN/100mL		34.63	mg/l
																0.0002014	lb/cf		0.0000156	lb/cf		0.0000069	lb/cf		0.0000085	lb/cf		0.0026817	lb/cf		0.0000007	lb/cf		0.0000003	lb/cf		0.0000043	lb/cf		0.0001560	lb/cf					0.0021614	lb/cf
Total Volume (Quarter Events):																1,381,325	cf																														
Pollutant Load (Quarter Events):																278.21	lbs		21.55	lbs		9.47	lbs		11.74	lbs		3,704.25	lbs		1.01	lbs		0.35	lbs		5.92	lbs		215.54	lbs					2,985.63	
Total Volume (Quarter):																24,137,498	cf																														
Pollutant Load (Quarter):																4,862	lbs		377	lbs		165	lbs		205	lbs		64,729	lbs		17.6	lbs		6.1	lbs		103	lbs		3,766	lbs					52,171	
FALL QUARTER (OCTOBER, NOVEMBER, DECEMBER)																																														
Fall Quarter Flow-Weighted EMC (10/7/13), (12/6/13), (12/23/13):												14.44		7.09		2.04	2.84		0.52	0.71		0.348	0.352		0.124	0.124		32.38	33.58		0.010	0.010		0.003	0.003		0.059	0.061		0.0	5.0		5711.96	5711.96		34.98	35.06
Average:																2.44	mg/l		0.62	mg/l		0.35	mg/l		0.12	mg/l		32.98	mg/l		0.010	mg/l		0.003	mg/l		0.060	mg/l		2.50	mg/l		5711.96	MPN/100mL		35.02	mg/l
																0.0001523	lb/cf		0.0000385	lb/cf		0.0000218	lb/cf		0.0000077	lb/cf		0.0020586	lb/cf		0.0000006	lb/cf		0.0000002	lb/cf		0.0000037	lb/cf		0.0001560	lb/cf					0.0021857	lb/cf
Total Volume (Quarter Events):																2,135,160	cf																														
Pollutant Load (Quarter Events):																325.27	lbs		82.22	lbs		46.61	lbs		16.53	lbs		4,395.44	lbs		1.31	lbs		0.39	lbs		7.96	lbs		333.17	lbs					4,666.79	
Total Volume (Quarter):																35,614,106	cf																														
Pollutant Load (Quarter):																5,425	lbs		1,371	lbs		777	lbs		276	lbs		73,315	lbs		21.8	lbs		6.5	lbs		133	lbs		5,557	lbs					77,841	
WINTER QUARTER (JANUARY, FEBRUARY, MARCH)																																														
Fall Quarter Flow-Weighted EMC:												5.84		6.83		1.53	3.41		3.80	3.80		1.70	1.70		0.09	0.09		20.86	20.86		0.00	0.00		0.00	0.00		0.07	0.07		0.00	5.00		403.31	403.31		191.59	191.59
Average:																2.47	mg/l		3.80	mg/l		1.70	mg/l		0.09	mg/l		20.86	mg/l		0.005	mg/l		0.001	mg/l		0.066	mg/l		2.50	mg/l		403.31	MPN/100mL		191.59	mg/l
																0.0001541	lb/cf		0.0002371	lb/cf		0.0001059	lb/cf		0.0000054	lb/cf		0.0013017	lb/cf		0.0000003	lb/cf		0.0000001	lb/cf		0.0000041	lb/cf		0.0001560	lb/cf					0.0119583	lb/cf
Total Volume (Quarter Events):																2,182	cf																														
Pollutant Load (Quarter Events):																0.34	lbs		0.52	lbs		0.23	lbs		0.01	lbs		2.84	lbs		0.00	lbs		0.00	lbs		0.01	lbs		0.34	lbs					26.09	
Total Volume (Quarter):																33,023,295	cf																														
Pollutant Load (Quarter):																5,090	lbs		7,830	lbs		3,497	lbs		177	lbs		42,986	lbs		9.8	lbs		2.1	lbs		136	lbs		5,153	lbs					394,902	
SPRING QUARTER (APRIL, MAY, JUNE)																																														
Fall Quarter Flow-Weighted EMC (4/7/14, 5/27/14, 6/19/14):												12.73		7.28		7.60	7.60		1.19	1.19		0.72	0.72		0.19	0.19		54.42	54.42		0.01	0.01		0.01	0.01		0.08	0.08		0.00	5.00		9859.47	9859.47		55.83	55.83
Average:																7.60	mg/l		1.19	mg/l		0.72	mg/l		0.19	mg/l		54.42	mg/l		0.013	mg/l		0.005	mg/l		0.082	mg/l		2.50	mg/l		9859.47	MPN/100mL		55.83	mg/l
																0.0004744	lb/cf		0.0000743	lb/cf		0.0000452	lb/cf		0.0000116	lb/cf		0.0033965	lb/cf		0.0000008	lb/cf		0.0000003	lb/cf		0.0000051	lb/cf		0.0001560	lb/cf					0.0034848	lb/cf
Total Volume (Quarter Events):																675,248	cf																														
Pollutant Load (Quarter Events):																320.33	lbs		50.16	lbs		30.49	lbs		7.86	lbs		2,293.49	lbs		0.56	lbs		0.23	lbs		3.45	lbs		105.37	lbs					2,353.09	
Total Volume (Quarter):																29,019,342	cf																														
Extrapolated Volume (Quarter):																34,976,955																															
Pollutant Load (Quarter):																16,593	lbs		2,598	lbs		1,579	lbs		407	lbs		118,800	lbs		29.0	lbs		11.8	lbs		179	lbs		5,458	lbs					121,887	
AVERAGE ANNUAL EMCs:												17.36		7.10		3.53	mg/l		0.590	mg/l		0.332	mg/l		0.138	mg/l		39.71	mg/l		0.011	mg/l		0.004	mg/l		0.066	mg/l		2.500	mg/l		8638.074	mg/l		38.323	mg/l
TOTAL ANNUAL POLLUTANT LOAD (EVENTS):																924.15	lbs		154.45	lbs		86.79	lbs		36.14	lbs		10,396.02	lbs		2.87	lbs		0.970	lbs		17.338	lbs		654.417	lbs					10031.606	lbs
Per Acre:																3.31			0.55			0.31			0.13			37.25			0.01			0.00			0.06			2.34						35.94	
TOTAL 2014 POLLUTANT LOAD:																31,969.26	lbs		12,176.74	lbs		6,018.58	lbs		1,065.16	lbs		299,829.88	lbs		78.14	lbs		26.52	lbs		551.18	lbs		19,934.36	lbs					646,801.45	lbs

APPENDIX H

BMP ACRONYMS

LIST OF ACRONYMS

BMP –	best management practice
BR –	bioretention
BS –	baysaver (hydrodynamic structure)
DP –	dry pond
DPW –	department of public works
DW –	dry well
EDSD –	extended detention structure, dry
EDSW –	extended detention structure, wet
ESD MB –	environmental site design, micro bioretention
ESD PERMP –	environmental site design, permeable pavers
ESD –	extended structure dry
ESD SGW –	environmental site design, subsurface gravel wetland
IB –	infiltration basin
IT –	infiltration trench
ITPE –	infiltration trench, partial exfiltration
SW –	swale
USG –	underground storage
WP –	wet pond

BIOLOGICAL AND GEOMORPHOLOGICAL CONDITION IN THE PICTURE SPRING BRANCH SUBWATERSHED, SEVERN RIVER WATERSHED, ANNE ARUNDEL COUNTY, MARYLAND: 2013 - 2014

Prepared for

Anne Arundel County, Maryland
Department of Public Works
Watershed Protection and Restoration Program
2662 Riva Road
Annapolis, MD 21401

Prepared by

Versar, Inc.
9200 Rumsey Road
Columbia, MD 21045

September 2014

TABLE OF CONTENTS

1.0 INTRODUCTION 1-1

2.0 METHODS 2-1
2.1 SAMPLING LOCATIONS 2-1
2.2 FIELD METHODS 2-2
2.2.1 Stream Habitat 2-3
2.2.2 Benthic Macroinvertebrates 2-3
2.2.3 Water Quality 2-3
2.2.4 Geomorphic Assessment 2-4
2.3 DATA ANALYSIS 2-5
2.3.1 Aquatic Habitat 2-5
2.3.2 Benthic Macroinvertebrates 2-6
2.3.3 Water Quality 2-9
2.3.4 Geomorphic Assessment 2-9
2.4 LAND USE and STORMWATER MANaGEMENT ASSESSMENT 2-10
2.4.1 Picture Spring Branch Watershed BMP Inspection 2-10

3.0 RESULTS 3-1
3.1 AQUATIC HABITAT 3-1
3.2 BENTHIC MACROINVERTEBRATES 3-1
3.3 WATER QUALITY 3-2
3.4 GEOMORPHIC ASSESSMENT 3-3

4.0 SUMMARY AND CONCLUSIONS 4-1
4.1 BIOLOGICAL ASSESSMENT SUMMARY 4-1
4.2 GEOMORPHIC ASSESSMENT SURVEY 4-4
4.3 GENERAL CONCLUSIONS 4-5

5.0 REFERENCES 5-1

APPENDICES

A QUALITY ASSURANCE / QUALITY CONTROL A-1
B BIOLOGICAL ASSESSMENT RESULTS B-1
C MASTER BENTHIC MACROINVERTEBRATE TAXA LIST C-1
D ROSGEN STREAM CLASSIFICATION D-1
E GEOMORPHIC ASSESSMENT RESULTS E-1
F BMP ACRONYMS F-1

I:\WPShared\DEPT.74\Anne Arundel\Picture Spring\2014 Rpt\15455-R.doc

LIST OF TABLES

Table No. **Page**

2-1. Summary of land use in the Picture Spring Branch Subwatershed, Anne Arundel County 2-1
2-2. Maryland Biological Stream Survey PHI scoring 2-6
2-3. EPA Rapid Bioassessment Protocol scoring 2-6
2-4. Biological condition scoring for the coastal plains metrics 2-8
2-5. Maryland Biological Stream Survey BIBI scoring 2-8
2-6. Maryland COMAR water quality standards for Use I streams 2-9
2-7. Rosgen Stream Classification types 2-10
2-8. Picture Spring Branch BMP overview 2-12
3-1. PHI and RBP physical habitat assessment results - 2014 3-1
3-2. Benthic macroinvertebrate assessment results - 2014 3-2
3-3. Water Quality Measurement Results - 2014 3-3
3-4. Rosgen Classification Results - 2014 3-4
4-1. PHI scores from 2006 to 2014 4-2
4-2. BIBI scores from 2006 to 2014 4-3
4-3. Summary of cross sectional area at the five cross-sections and changes over time 4-5

LIST OF FIGURES

Figure No. **Page**

2-1. Picture Spring Branch study area stream monitoring locations 2-2
2-2. Picture Spring Branch BMPs 2-11
3-1. Comparison of the bankfull width drainage area relationship between Picture Spring Branch (PSB) 2014 field data and regional relationship curve data 3-4
3-2. Comparison of the bankfull cross-sectional area drainage area relationship between Picture Spring Branch 2014 field data and regional relationship curve data 3-5
3-3. Comparison of the mean bankfull depth drainage area relationship between Picture Spring Branch 2014 field data and regional relationship curve data 3-6
4-1. Comparison of PHI Habitat Scores from 2006 through 2014 4-2
4-2. Comparison of BIBI Scores from 2006 through 2014 4-3

1.0 INTRODUCTION

Anne Arundel County is required to perform physical stream monitoring in the Picture Spring Branch Subwatershed in accordance with their National Pollutant Discharge Elimination System (NPDES) Municipal Separate Storm Sewer System Discharge Permit (NPDES permit number MD0068306). The goal of this monitoring effort is to assess the implementation of best management practice (BMP) design criteria from the *2000 Maryland Stormwater Design Manual* approved by Maryland Department of the Environment (MDE). The BMP design criteria were applied to the stormwater management system constructed at the West County Library site, located in Odenton, Maryland, just west of the intersection of State Highways 170 and 175. Specifically, bioretention areas and dry swale structural BMPs, and the nonstructural credit "sheetflow to buffer" were incorporated into the library site development in order to mitigate the effects of stormwater runoff on Picture Spring Branch.

In addition, there are four other BMPs within the watershed that are providing detention for stormwater that are impacting the flows through the study reach. These include a dry detention pond, a retention pond, and two other detention ponds with shallow wetlands. Baseline conditions within the watershed, for both land use and BMP functionality, were developed as part of this long-term study. These conditions are monitored periodically to determine if changes within the watershed affect the conditions found in the stream channel. Stormwater facilities were not required to be mapped or inspected in 2014.

To monitor the effectiveness of these BMPs on stream channel protection, the County has implemented a NPDES Monitoring Program to characterize the biological and geomorphological conditions of the Picture Spring Branch Subwatershed, located within the Severn River Watershed, in the vicinity of the West County Library. Physical condition and habitat monitoring for Picture Spring Branch began in 2003 and is conducted on an annual basis. Biological monitoring to measure overall stream health is also performed.

This report summarizes the results of biological, geomorphological, and physical habitat assessments performed in 2014 with comparisons to previous years' conditions, and discusses the current watershed conditions.

2.0 METHODS

2.1 SAMPLING LOCATIONS

The study area is located in the southwestern portion of the Picture Spring Branch Subwatershed, within the Severn River Watershed in Anne Arundel County, Maryland (Figure 2-1). The study area consists of the North Tributary and South Tributary and encompasses approximately 155 acres of drainage. The land use within the Picture Spring Branch study area is dominated by developed land, with over 56% residential, commercial, and industrial uses (Table 2-1). Less than one-third of the subwatershed (31.6%) is open space or wooded land cover, most of which surrounds the stream valley.

Three biological monitoring locations are located within the study area, which were selected by County staff in 2006 (see Figure 2-1). Two sites were placed on the North Tributary and one site was placed downstream of the confluence with the South Tributary and below Piney Orchard Parkway (MD State Highway 170). Sites were marked in the field using silver tree tags labeled with the site name located at the upstream and downstream ends of each 75-meter sampling segment.

Table 2-1. Summary of land use in the Picture Spring Branch Subwatershed, Anne Arundel County

Land Use	Acres	% of Watershed Area
Commercial	15.6	10.0%
Industrial	16.3	10.5%
Open Space	6.0	3.9%
Residential	56.0	36.1%
Transportation	16.8	10.8%
Utility	1.6	1.1%
Forest	43.0	27.7%
Total	**155.3**	

Source: Anne Arundel County Department of Public Works

Five permanent cross sections were previously established for the County's NPDES Program and were measured again in 2014 as part of the geomorphological assessment. Three cross sections are located along the North Tributary, one is located on the South Tributary, and another is located downstream of Piney Orchard Parkway (see Figure 2-1). Permanent cross section monuments were placed on each bank and consist of iron bolts set in concrete flush to the ground surface.

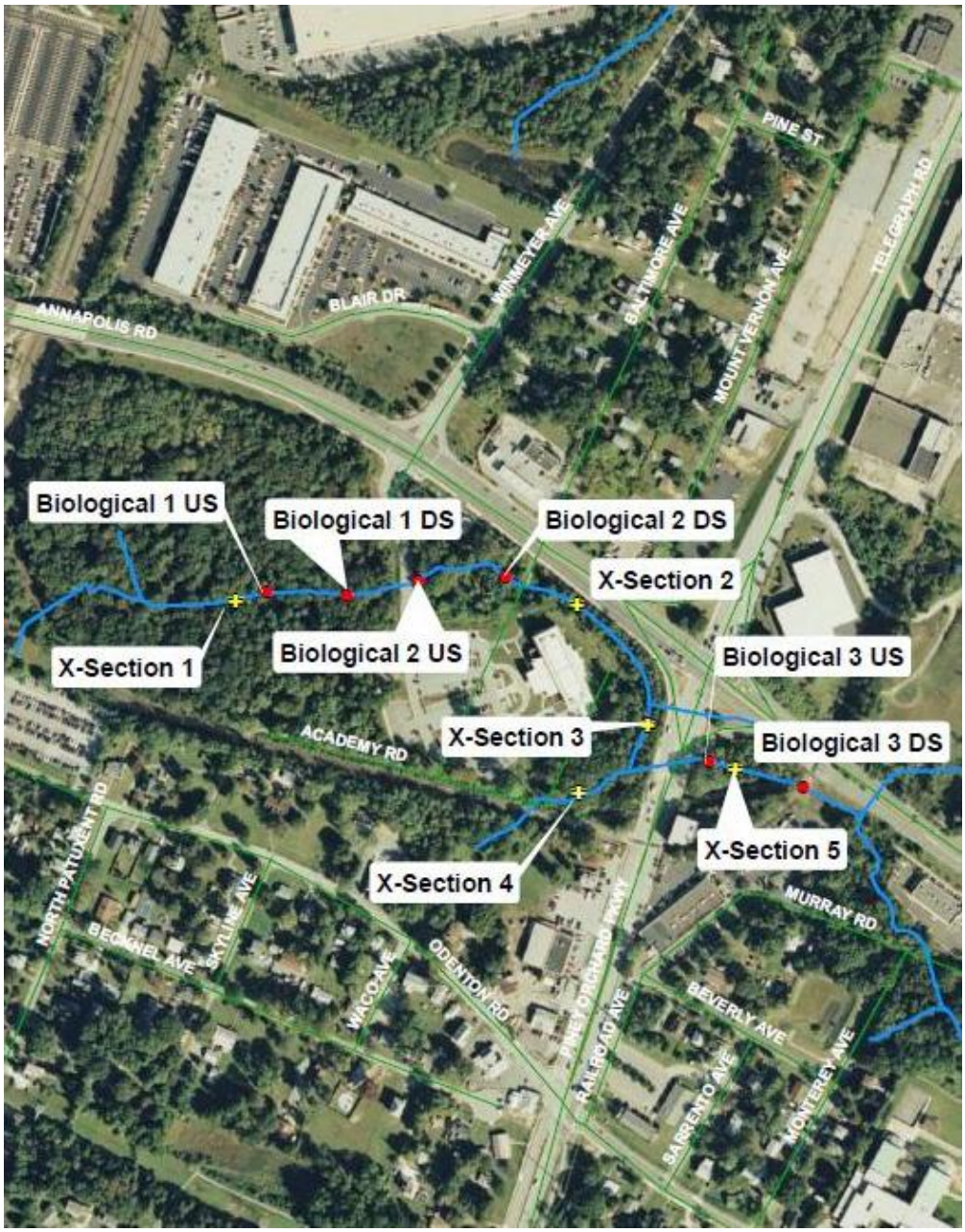


Figure 2-1. Picture Spring Branch study area stream monitoring locations

2.2 FIELD METHODS

All biological assessment data were collected in accordance with the *Anne Arundel County Biological Monitoring and Assessment Program: Quality Assurance Project Plan* (Anne Arundel County 2010), which incorporates many elements of Maryland Department of Natural Resources' Maryland Biological Stream Survey (MBSS). Geomorphic assessment data were

collected in accordance with the standard operating procedures (SOPs) approved for the County's NPDES Program. All methods are consistent with previous years' methods (with applicable updates) to ensure data comparability between years. Collection methods are summarized below. Field data were collected in 2014 by Versar, Inc., a consultant to Anne Arundel County.

2.2.1 Stream Habitat

To support the biological monitoring, a visual assessment of physical habitat was completed at each monitoring site to evaluate the reach's ability to support aquatic life. Both the MBSS's Physical Habitat Index (PHI; Paul et al. 2003) and the EPA's Rapid Bioassessment Protocol (RBP) habitat assessment for high gradient streams (Barbour et al. 1999) were used to visually assess the physical habitat at each site in conjunction with the spring benthic monitoring. Both habitat assessments consist of a review of biologically significant habitat parameters that assess a stream's ability to support an acceptable level of biological health.

2.2.2 Benthic Macroinvertebrates

Benthic macroinvertebrate samples were collected in March 2014 following the MBSS Spring index period protocols (MD DNR 2010) and consistent with the methods specified in *Anne Arundel County Biological Monitoring and Assessment Program: Quality Assurance Project Plan* (QAPP; Anne Arundel County 2010). This methodology emphasizes the community composition and relative abundance of benthic macroinvertebrates inhabiting the most taxonomically diverse, or productive, instream habitats. In this sampling approach, a total of twenty jabs are distributed among the most productive habitats present within the 75-meter reach and sampled in proportion to their dominance within the segment. The most productive stream habitats are riffles followed by rootwads, rootmats and woody debris and associated snag habitat; leaf packs; submerged macrophytes and associated substrate; and undercut banks. Other less preferred habitats include gravel, broken peat, clay lumps and detrital or sand areas in runs; however, of the aforementioned habitat types, those that are located within moving water are preferred over those in still water.

2.2.3 Water Quality

To supplement the biological and physical sampling, *in situ* water quality was measured at each site. Field tested parameters include pH, specific conductivity, dissolved oxygen, temperature, and turbidity. With the exception of turbidity, which was measured once at the upstream end of the site, all measurements were collected from three locations within each sampling reach (upstream end, midpoint, and downstream end) and results were averaged to minimize variability and better represent water quality conditions throughout the entire sampling reach. All *in situ* parameters were measured with a YSI 6820 multiparameter water quality sonde.

2.2.4 Geomorphic Assessment

Geomorphic assessments included a survey of the longitudinal profile, measurement of permanent cross sections, and representative pebble counts. Data from these measurements were used to determine the stream type of each reach as categorized by the Rosgen Stream Classification (Rosgen 1996), which can be found in Appendix D.

The longitudinal profile was performed throughout the entire study area, totaling 1967 linear feet along the North Tributary and continuing below Telegraph Road, and 353 linear feet along the South Tributary. The goal of the longitudinal profile was to identify indicators and elevations of the bankfull discharge (i.e., bankfull indicators) and to determine the bankfull water surface slope throughout the study reach. Once the bankfull indicators were identified, elevation data on the channel thalweg, water surface, and bankfull indicators were also collected.

The cross section surveys were performed at the five permanent cross section locations (Figure 2-1). Photos were taken of upstream, downstream, left bank, and right bank views at each cross section location. Photographs are included in Appendix E. Cross section surveys consisted of measuring the topographic variability of the associated stream bed, floodplains, and terraces, including:

- Monument elevations
- Changes in topography
- Top of each channel bank
- Elevations of bankfull indicators
- Edge of water during the time of survey
- Thalweg or deepest elevation along active channel
- Depositional and erosional features within the channel

During the cross sectional survey, the following measurements and calculations of the bankfull channel, which are critical for determining the Rosgen stream type of each reach, were also collected:

- Bankfull Width (Wbkf): the width of the channel at the elevation of bankfull discharge or at the stage that defines the bankfull channel.
- Mean Depth (dbkf): the mean depth of the bankfull channel.
- Bankfull Cross Sectional Area (Abkf): the area of the bankfull channel, estimated as the product of bankfull width and mean depth.
- Width Depth Ratio (Wbkf/dbkf): the ratio of the bankfull width to mean depth.
- Maximum Depth (dmbkf): the maximum depth of the bankfull channel, or the difference between the thalweg elevation and the bankfull discharge elevation.
- Width of Floodprone Area (Wfpa): the width of the channel at a stage of twice the maximum depth. If the width of the floodprone area was far outside of the channel, its value was visually estimated or paced off.

- Entrenchment Ratio (ER): the ratio of the width of the floodprone area versus bankfull width.
- Sinuosity (K): ratio of the stream length versus the valley length or the valley slope divided by the channel slope. Sinuosity was visually estimated or the valley length was paced off so that an estimate could be calculated.

To quantify the distribution of channel substrate particle sizes within the study area, a modified Wolman pebble count (Rosgen 1996) was performed at each cross section location. Reach-wide proportional counts were used. Each pebble count consists of stratifying the reach based on the frequency of channel features in that reach (e.g., riffle, run, pool, glide) and measuring 100 particles across ten transects (i.e., 10 particles in each of 10 transects). The transects are allocated across all feature types in the proportion at which they occur within the reach. The intermediate axis of each measured pebble is recorded. The goal of the pebble count is to measure 100 particles across the bankfull width of the channel and calculate the median substrate particle size (i.e., D50) of the reach. This value is used for categorizing the sites into the Rosgen Stream Classification (Rosgen 1996). If a channel was clearly a sand or silt bed channel with no distinct variation in material size, the pebble count was not performed, and the D50 was visually estimated. However, if the channel did have variation in bed material size from feature to feature, a full pebble count was performed.

2.3 DATA ANALYSIS

2.3.1 Aquatic Habitat

At each monitoring site, stream physical habitat was visually assessed utilizing the Maryland Biological Stream Survey (MBSS) Physical Habitat Index (PHI; Paul et al. 2003). The PHI was developed in part based on the Environmental Protection Agency's Rapid Bioassessment Protocol (RBP; Barbour et al. 1999), and has been specifically calibrated to each of Maryland's physiographic regions. The habitat metrics for coastal plain streams include epifaunal substrate, percent shading, remoteness (i.e., distance to the nearest road), instream habitat, bank stability, and instream woody debris and rootwads. The metrics selected represent a mixture of physical habitat characteristics including geomorphology, habitat complexity for aquatic biota, riparian condition, and surrounding land use.

To calculate PHI at each site, six parameters were given a numerical score and a categorical rating. The raw scores are then transformed into a scaled score (0-100 scale) as described in Paul et al. (2003), and the six scaled scores are averaged into an aggregate final PHI score. Narrative condition descriptions and scoring ranges for the PHI are displayed in Table 2-2.

The Rapid Bioassessment Protocol (RBP) habitat assessment consists of a review of ten biologically significant habitat parameters that assess a stream's ability to support an acceptable level of biological health: Epifaunal substrate/available cover, Embeddedness, Velocity/depth regime, Sediment deposition, Channel flow status, Channel alteration, Frequency of riffles/bends,

Bank stability, Vegetative protection, and Riparian vegetative zone width (Barbour et al. 1999). In the field, each parameter was given a numerical score from 0-20 (20=best, 0=worst), or 0-10 (10=best, 0=worst) for individual bank parameters, and a categorical rating of optimal, suboptimal, marginal or poor. Overall habitat quality typically increases as the total score for each site increases. The individual RBP habitat parameters for each reach were summed to obtain an overall RBP assessment score. Because adequate reference conditions currently do not exist for Anne Arundel County, the percent comparability was calculated based on western coastal plain reference site conditions obtained from work done in Prince George's County streams (Stribling et al. 1999). The percent of reference score, or percent comparability score, was then used to place each site into corresponding narrative rating categories. The ranges are shown in Table 2-3.

Table 2-2. Maryland Biological Stream Survey PHI scoring

Score	Narrative
81-100	Minimally Degraded
66-80.9	Partially Degraded
51-65.9	Degraded
0-50.9	Severely Degraded

Table 2-3. EPA Rapid Bioassessment Protocol (RBP) scoring

Percent of Reference Score	Narrative
90-100	Comparable to Reference
75.1-89.9	Supporting
60.1-75	Partially Supporting
0-60	Non-Supporting

2.3.2 Benthic Macroinvertebrates

Benthic macroinvertebrate samples were processed and subsampled according to MBSS methods described in the MBSS laboratory methods manual (Boward and Freidman, 2000) and as briefly summarized in the *Anne Arundel County Biological Monitoring and Assessment Program: Quality Assurance Project Plan* (Anne Arundel County 2010). Subsampling is conducted to standardize the sample size and reduce variation caused by field collection methods. In brief, the sample was washed of preservative in a 0.595mm screen and spread evenly across a tray comprised of 100 numbered 5cm x 5cm grids. A random number between one and 100 was selected and the selected gird was picked entirely of macroinvertebrates under a bright light source. This process was repeated until a count of 120 was reached. The 120 organism target was used following MBSS methods to allow for specimens that are missing parts or are early instars, which cannot be properly identified.

The samples were taxonomically identified by Versar taxonomists certified by the Society for Freshwater Science (SFS) (formerly known as the North American Benthological

Society, NABS). The taxonomic level for most organisms was genus level when possible, with the exception of Oligochaeta which were identified to the family level. Early instars or damaged specimens were identified to the lowest possible level. Oligochaeta and Chironomidae specimens were permanently slide mounted for identification. Counts and identifications were recorded on a laboratory bench sheet and entered into a master database for analysis. A list of all taxa identified is provided in Appendix C: Master Taxa List.

Benthic macroinvertebrate data were analyzed using methods developed by MBSS as outlined in the *New Biological Indicators to Better Assess the Condition of Maryland Streams* (Southerland et al. 2005). The Benthic Index of Biotic Integrity (BIBI) approach involves statistical analysis using metrics that have a predictable response to water quality and/or habitat impairment. The metrics selected fall into five major groups including taxa richness, composition measures, tolerance to perturbation, trophic classification, and habit measures. Tolerance values were obtained from Bressler et al. (2005).

Raw values from each metric are given a score of 1, 3, or 5 based on ranges of values developed for each metric. The results are combined into a scaled BIBI score ranging from 1.0 to 5.0 and a corresponding narrative rating is assigned. Three sets of metric calculations have been developed for Maryland streams based on broad physiographic regions: Coastal Plain, Piedmont and Combined Highlands. The Coastal Plain, and Piedmont regions are divided by the Fall Line. The current study area is located within the Coastal Plain region. Table 2-4 shows the thresholds for the determination of the metric scoring. The metrics calculated for Coastal Plain streams are as follows:

Total Number of Taxa – Equals the richness of the community in terms of the total number of genera at the genus level or higher. A large variety of genera typically indicate better overall water quality, habitat diversity and/or suitability, and community health.

Number of EPT Taxa – Equals the richness of genera within the Ephemeroptera (mayflies), Plecoptera (stoneflies), and Trichoptera (caddisflies). EPT taxa are generally considered pollution sensitive, thus higher levels of EPT taxa would be indicative of higher water quality.

Number of Ephemeroptera Taxa – Equals the total number of Ephemeroptera Taxa in the sample. Ephemeroptera are generally considered pollution sensitive, thus communities dominated by Ephemeroptera usually indicate lower disturbances in water quality.

Percent Intolerant Urban – Percentage of sample considered intolerant to urbanization. Equals the percentage of individuals in the sample with a tolerance value of 0-3 out of 10. As impairment increases the percent of intolerant taxa decreases.

Percent Ephemeroptera – Equals the percent of Ephemeroptera individuals in the sample. Ephemeroptera are generally considered pollution sensitive, thus communities dominated by Ephemeroptera usually indicate lower disturbances in water quality.

Number Scraper Taxa – Equals the number of taxa in the sample that have evolved to scrape their food from the substrate in their environment. As the levels of stressors or pollution rise, there is an expected decrease in the numbers of Scraper taxa.

Percent Climbers – Equals the percentage of the total number of individuals who are adapted to living on stem type surfaces. Higher percentages of climbers typically represent a decrease in stressors and overall better water quality.

Table 2-4. Biological condition scoring for the coastal plains metrics

Metric	Score		
	5	**3**	**1**
Total Number of Taxa	≥ 22	14-21	< 14
Number of EPT Taxa	≥ 5	2-4	< 2
Number of Ephemeroptera Taxa	≥ 2	1.9-1.0	< 1.0
Percent Intolerant Urban	≥ 28	10-27	< 10
Percent Ephemeroptera	≥ 11	0.8-10.9	< 0.8
Number Scraper Taxa	≥ 2	1.9-1.0	< 1.0
Percent Climbers	≥ 8.0	0.9-7.9	< 0.9

All of the metric scores are summed and then averaged to obtain the final BIBI score. Table 2-5 shows the scores and narrative rankings of the MBSS BIBI.

Table 2-5. Maryland Biological Stream Survey BIBI scoring

BIBI Score	Narrative Ranking	Characteristics
4.0-5.0	Good	Comparable to reference conditions, stream considered to be minimally impacted, biological metrics fall within upper 50th percentile of reference site conditions.
3.0-3.9	Fair	Comparable to reference conditions, but some aspects of biological integrity may not resemble the qualities of minimally impacted streams.
2.0-2.9	Poor	Significant deviation from reference conditions, indicating some degradation. On average, biological metrics fall below the 10th percentile of reference site values.
1.0-1.9	Very Poor	Strong deviation from reference conditions, with most aspects of biological integrity not resembling the qualities of minimally impacted streams, indicating severe degradation. On average, most or all metrics fall below the 10th percentile of reference site values.

2.3.3 Water Quality

Data were compared to the standards for Use I streams listed in the *Code of Maryland Regulations (COMAR) 26.08.02.03-3 Water Quality* and shown in Table 2-6.

Table 2-6. Maryland COMAR water quality standards for Use I streams

Parameter	Standard
pH	6.5 to 8.5
Dissolved Oxygen (mg/L)	Minimum of 5 mg/L
Conductivity (µS/cm)	No existing standard
Turbidity (NTU)	Maximum of 150 NTU and maximum monthly average of 50 NTU
Total Dissolved Solids (mg/L)	No existing standard
Temperature (C)	Maximum of 32 °C (90 °F) or ambient temperature, whichever is greater

Source: Code of Maryland Regulations (COMAR) 26.08.02.03-3 Water Quality

2.3.4 Geomorphic Assessment

Geomorphic field data were compared to regional relationships of bankfull channel geometry developed by the USFWS for streams in the Maryland Coastal Plain (McCandless 2003) and by Anne Arundel County Department of Public Works (AADPW 2002) for urban streams within the County. Estimates of the bankfull channel parameters, the longitudinal profile survey, the cross section survey, and the pebble count data were entered into *The Reference Reach Spreadsheet* (Mecklenburg 2004) and analyzed for each assessment site. These data were used to identify each stream reach as one of the stream types categorized by the Rosgen Stream Classification (Rosgen 1996). In the Rosgen Classification methodology, streams are categorized based on their measured field values of entrenchment ratio, width/depth ratio, sinuosity, water surface slope, and channel materials according to the table in Appendix D: Rosgen Stream Classification. As illustrated in Appendix D, the Rosgen Stream Classification categorizes streams into broad stream types, which are identified by the letters Aa, A, B, C, D, DA, E, F, and G. Table 2-7 includes general descriptions of each Rosgen stream type. A summary of the stream types identified for the streams in this study is included in Appendix E: Geomorphic Assessment Results.

Table 2-7. Rosgen Stream Classification types

Channel Type	General Description
Aa+	Very steep, deeply entrenched, debris transport, torrent streams.
A	Steep, entrenched, confined, cascading, step/pool streams. High energy/debris transport associated with depositional soils. Very stable if bedrock or boulder dominated channel.
B	Moderately entrenched, moderate gradient, riffle dominated channel with infrequently spaced pools. Moderate width/depth ratio. Narrow, gently sloping valleys. Very stable plan and profile. Stable banks.
C	Low gradient, meandering, slightly entrenched, point-bar, riffle/pool, alluvial channels with broad, well-defined floodplains.
D	Braided channel with longitudinal and transverse bars. Very wide channel with eroding banks. Active lateral adjustment, high bedload and bank erosion.
DA	Anastomosing (multiple channels) narrow and deep with extensive, well-vegetated floodplains and associated wetlands. Very gentle relief with highly variable sinuosities and width/depth ratios. Very stable streambanks.
E	Low gradient, Highly sinuous, riffle/pool stream with low width/depth ratio and little deposition. Very efficient and stable. High meander/width ratio.
F	Entrenched, meandering riffle/pool channel on low gradients with high width/depth ratio and high bank erosion rates.
G	Entrenched "gully" step/pool and low width/depth ratio on moderate gradients. Narrow valleys. Unstable, with grade control problems and high bank erosion rates.

Source: Rosgen (1996).

2.4 LAND USE AND STORMWATER MANAGEMENT ASSESSMENT

2.4.1 Picture Spring Branch Watershed BMP Inspection

The Picture Spring Branch watershed contains 14 BMPs, as shown in Figure 2-2. An overview of the BMPs compiled in 2013 is presented in Table 2-8. No land use assessment or BMP inspections were conducted in 2014.

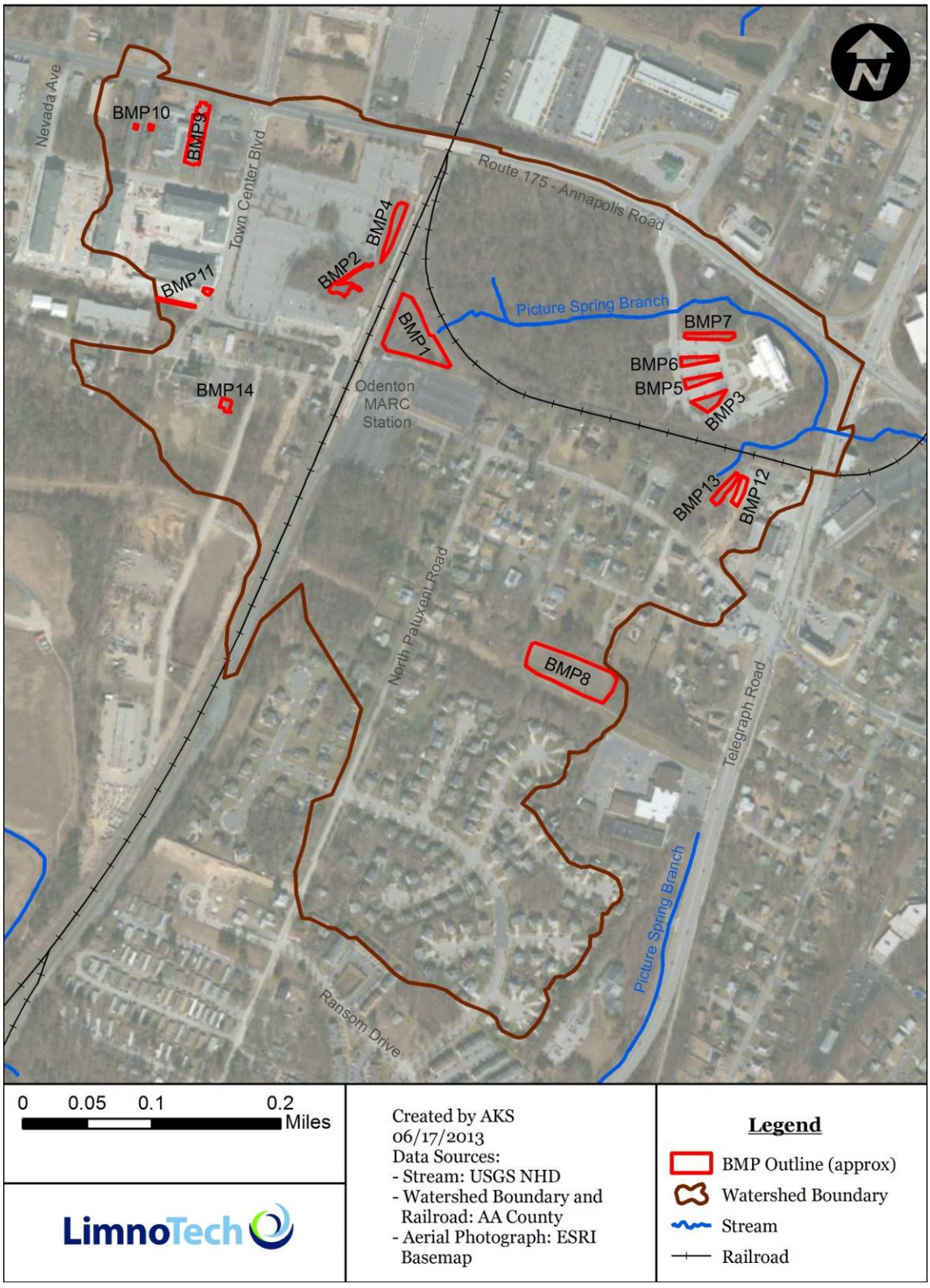


Figure 2-2. Picture Spring Branch BMPs (Figure from Versar, Inc. 2013)

Table 2-8. Picture Spring Branch BMP overview (Table from Versar, Inc. 2013)

Picture Spring Branch BMP[a]	AA County Urban BMP Database ID	BMP Type[b]	Drainage Area (acres)[c]	Location	Address	Presumed Owner
1	AA004443	DP	2.1	Odenton MARC Station Parking Lot	Odenton MARC Station	MTA
2	not found in 2012 database	WP	-	Odenton MARC Station Parking Lot	Odenton MARC Station	MTA
3	AA012418	BR	3	West County Library Parking Lot	1325 Annapolis Road	County
4	not found in 2012 database	WP	-	Odenton MARC Station Parking Lot	Odenton MARC Station	MTA
5	AA012419	BR	3	West County Library Parking Lot	1325 Annapolis Road	County
6	AA012420	BR	3	West County Library Parking Lot	1325 Annapolis Road	County
7	AA012421	SW	3	West County Library Parking Lot	1325 Annapolis Road	County
8	AA002445	EDSD	36.86	Peach Tree East Neighborhood	Peach Leaf Court	County
9	AA004558	UGS	2	Donaldson Funeral Home Parking Lot	1411 Annapolis Road	County
10	AA000692	ITCE	-	Odenton Commerce Center Parking Lot	1413A Annapolis Road	County
11	AA009976 AA009977 AA009978 AA009980	IT	3	The Village at Odenton Parking Lot	Town Center Boulevard	County
12	AA012190	UGS	1.9	Walgreens Parking Lot	8374 Piney Orchard Parkway	County
13	AA012189	SF	1.9	Walgreens Parking Lot	8374 Piney Orchard Parkway	County
14	AA004926	ITCE	2.97	Epiphany Episcopal Church Playground	1419 Odenton Road	Private

[a] Numbering system carried over from the 2012 BMP inspection report.
[b] BMP type carried over from the 2012 BMP inspection report or copied from the 2012 AA County Urban BMP database. See List of Acronyms in Appendix F.
[c] Drainage areas copied from the 2012 AA County Urban BMP database. Some drainage areas are missing in the Urban BMP database.

3.0 RESULTS

3.1 AQUATIC HABITAT

Physical habitat quality within the Picture Spring Branch study area was primarily rated as "Degraded" by the Maryland PHI. However, the most upstream reach, PSB-01, received the highest score (77.7), and was rated as "Partially Degraded." Remoteness was rated very low at PSB-01; however, there was substantial riparian buffer throughout this reach providing adequate shading, banks exhibited only minor erosion and were well-vegetated, and woody debris and rootwads were present in sufficient amounts for colonization of benthic macroinvertebrates. Site PSB-02, located between the Winmeyer Avenue and Baltimore Avenue culverts, received a score of 64.7 and a narrative rating of "Degraded." Remoteness was rated very low due to the immediate proximity to the parking lot and roads surrounding the stream reach. This reach also received a low score for epifaunal substrate and marginal scores for instream habitat and percent shading. The site downstream of Maryland Route 170 (PSB-03) also received a "Degraded" habitat rating (PHI score of 65.7), primarily due to a very low remoteness score, a low score for shading and epifaunal substrate, and a marginal score for instream habitat. Table 3-1 shows the PHI scores for the sampling sites within the Picture Spring Branch study area. Data for individual parameters are listed in Appendix B.

Physical habitat quality was also evaluated with the RBP and rated "Partially Supporting" for two sites and "Supporting" for one site (Table 3-1). Index scores varied somewhat and ranged from a low of 71 at PSB-03 to a high of 78 at PSB-01. All sites scored low for velocity/depth regime metric. PSB-02 also scored low in sediment composition and epifaunal substrate/cover while PSB-03 also rated low in epifaunal substrate/cover and embeddedness.

Table 3-1. PHI and RBP physical habitat assessment results - 2014

Site	PHI Score	PHI Narrative Rating	RBP Score	RBP Narrative Rating
PSB-01	77.7	Partially Degraded	78	Supporting
PSB-02	64.7	Degraded	75	Partially Supporting
PSB-03	65.7	Degraded	71	Partially Supporting

3.2 BENTHIC MACROINVERTEBRATES

The biological condition rated "Poor" at all sites. Table 3-2 contains the BIBI scores and corresponding narrative condition ratings for each sampling location. Detailed data on each site can be found in Appendix B: Biological Assessment Results.

The most upstream site within the North Tributary (PSB-01) had a BIBI score of 2.43, which is slightly lower than its 2013 BIBI score. This site is well-buffered by a young deciduous

forest. The macroinvertebrate community was represented by 18 taxa, three of which were sensitive EPT taxa. The sample had a very low abundance of 61 individual organisms. This could be due to the colder than average temperatures during the March 2014. The sample was dominated by individuals of the family Pisidiidae, a small to minute freshwater bivalve mollusc (Tolerance Value (TV)=6.5), followed by the taxa Prodiamesa (TV=6.6). Overall, 0% of the individuals present were intolerant to urban stressors. However, the complete lack of Ephemeroptera taxa in the subsample indicates that stressors such as sedimentation may be affecting the biological community. Climbers made up 7% of the sample.

Table 3-2. Benthic macroinvertebrate assessment results - 2014

Site	BIBI Score	Narrative Rating
PSB-01	2.43	Poor
PSB-02	2.71	Poor
PSB-03	2.43	Poor

Site PSB-02, also located on the North Tributary, received a BIBI score of 2.71 in 2014, a decrease from its 3.29 score in 2013. Of the 17 taxa present in the subsample, 14% were intolerant to urban stressors, and one taxa was the sensitive EPT taxa. The dominant taxa at this site was Zavrelimyia in the family Chironomidae (TV=5.3) and the taxa Physa (TV=7). This site also had a lack of Ephemeroptera taxa and a low percentage of climbers, possibly due to heavy sedimentation and a general lack of riffle habitat.

Downstream of State Highway 170, site PSB-03 received a BIBI score of 2.43, a decrease from its 3.00 score in 2013. Overall, this site had a total of 16 taxa identified, including three sensitive EPT taxa. However, only 2.3% of the individuals present in the subsample were intolerant to urban stressors, suggesting an increase in urban stressors at this sampling location. Ephemeroptera taxa were absent from the subsample. The benthic community was dominated by the taxa Parametriocnemus, generally tolerant midges of the Chironomidae family.

3.3 WATER QUALITY

All water quality measurements were within Maryland's Use I stream standards (Table 3-3). Conductivity values were relatively high compared to most coastal plain streams, but are within the range of those found in other urban, or highly impervious, drainage areas in Maryland (DNR, 2001, 2003, 2005; KCI, 2009a; Hill and Crunkleton, 2009). Stream conductivity is affected by inorganic dissolved solids such as chloride, nitrate, sulfate, and phosphate anions or sodium, magnesium, calcium, iron, and aluminum cations, many of which are generally found at elevated concentrations in urban streams (Paul and Meyer 2001). Increased stream ion concentrations (measured as conductivity) in urban systems typically result from runoff over impervious surfaces, passage through pipes, and exposure to other infrastructure (Cushman 2006).

Table 3-3. Water Quality Measurement Results - 2014					
Site	pH unit	Temperature °C	Dissolved Oxygen mg/L	Conductivity µS/cm	Turbidity NTU
PSB-01	6.44	12.47	9.06	1544	2.4
PSB-02	6.85	11.18	9.22	1446	2.7
PSB-03	6.83	10.63	10.82	1495	4.2

3.4 GEOMORPHIC ASSESSMENT

The geomorphic assessment field data were compared to both the Maryland Coastal Plain (MCP) regional relationships of bankfull channel geometry (McCandless 2003) and relationships for gaged urban Coastal Plain streams developed specifically for Anne Arundel County (AADPW 2002) to determine how bankfull characteristics observed in the field compared to those predicted by the MCP and urban relationships. Comparisons of bankfull width, bankfull cross-sectional area, and mean bankfull depth are shown in Figures 3-1, 3-2, and 3-3, respectively. Bankfull width values tended to loosely fit the predictions of the urban curve, with most points wider than predicted due to the engineered channel design. All bankfull cross-section area field data values fell between the MCP curve and urban curve predictions. Field data for mean bankfull depth mainly fell between the MCP curve and urban curve predictions, with one site falling just below the MCP curve. Overall, it appears that some of the field data were not consistent with the MCP relationships, however, it should be noted that the regional curves were developed using streams with drainage areas ranging from 0.3 to 89.7 square miles, with the majority of the data collected in watersheds greater than one square-mile with low (zero to three percent) imperviousness. Thus, it is possible that stream channels with smaller drainage areas, such as those studied in this assessment (ranging from 0.07 to 0.23 square miles), exhibit greater variability in channel dimensions when compared to the MCP relationships. Additionally, the Rosgen method is best used on streams that are free to adjust their lateral boundaries under the current discharge regime experienced by the system (Rosgen 1996), conditions which do not necessarily exist in the study area. For example, cross sections 2, 3, and 5 are underlain by concrete trapezoidal channels, possibly making the accurate determination of the bankfull indicators in the field at these locations problematic. Regardless, given the high imperviousness of the study drainage area and the modified nature of the channel, it is not surprising that the field data deviated in many cases from the MCP curve and were more closely matched to urban curve predictions for bankfull width.

Based on the Rosgen Classification scheme, one site was classified as a C channel, one as an E channel, and three sites were classified as F channels (Table 3-4). Water surface slopes along the study area ranged from 0.001 ft/ft to 0.02 ft/ft. All sites had channel substrates dominated by sand. Detailed summaries of the geomorphic data and stream types are included in Appendix E: Geomorphic Assessment Results.

Table 3-4. Rosgen Classification Results - 2014			
Cross Section	**Classification**	**D50 (mm)**	**Water Surface Slope (ft/ft)**
XS-1	C5	0.19	0.007
XS-2	F5	0.18	0.003
XS-3	F5	0.23	0.005
XS-4	E5	0.56	0.020
XS-5	F5	0.52	0.003

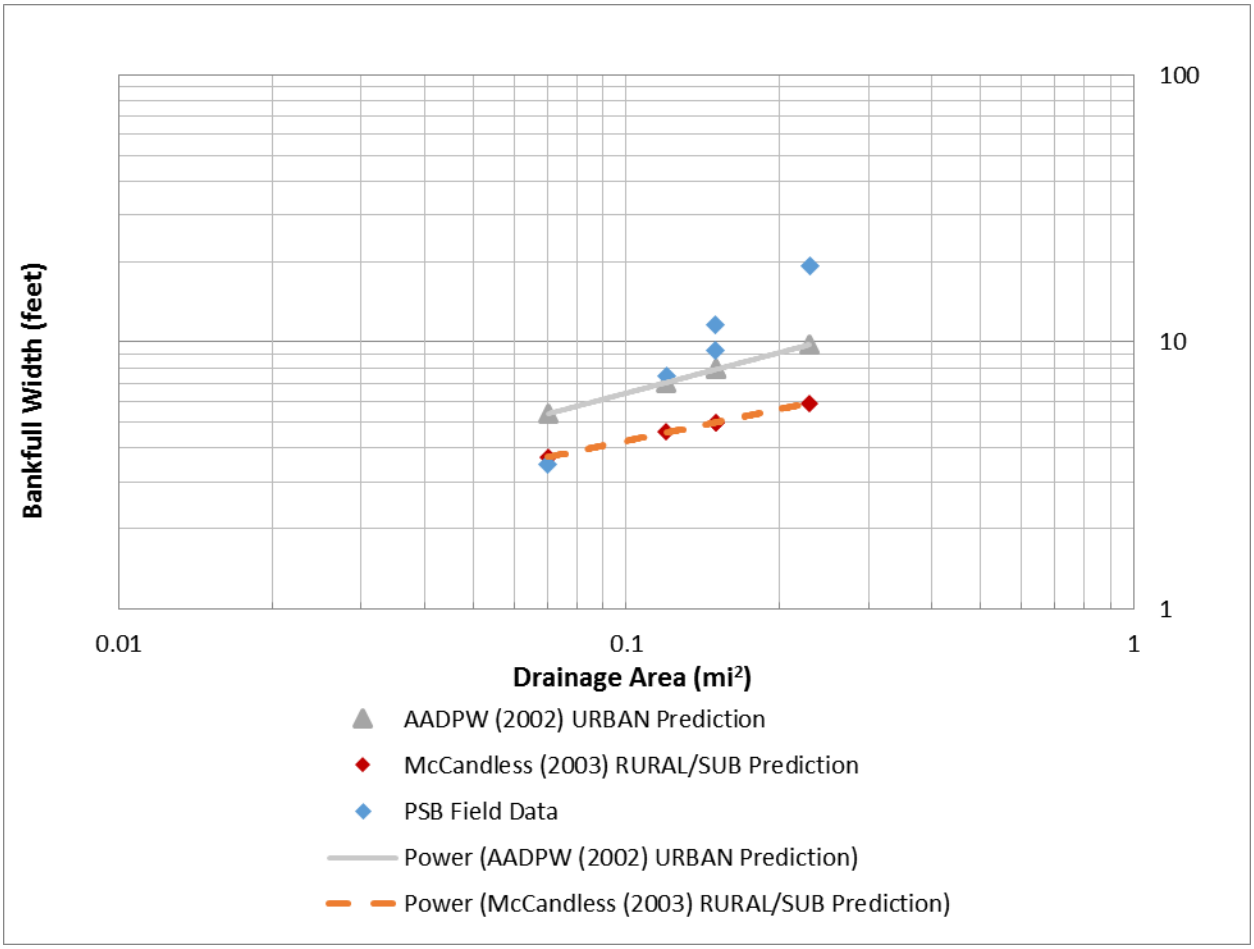


Figure 3-1. Comparison of the bankfull width drainage area relationship between Picture Spring Branch (PSB) 2014 field data and regional relationship curve data

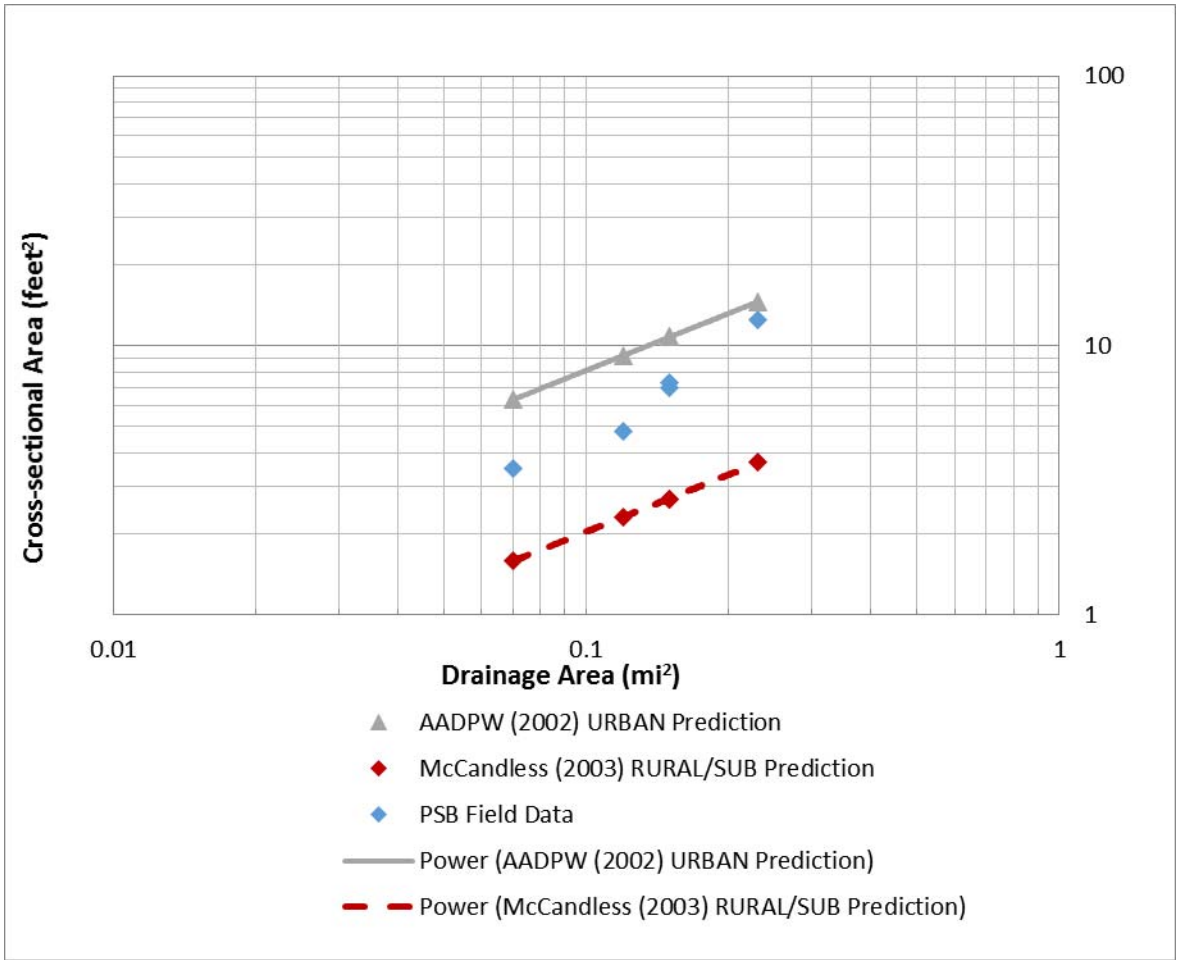


Figure 3-2. Comparison of the bankfull cross-sectional area drainage area relationship between Picture Spring Branch 2014 field data and regional relationship curve data

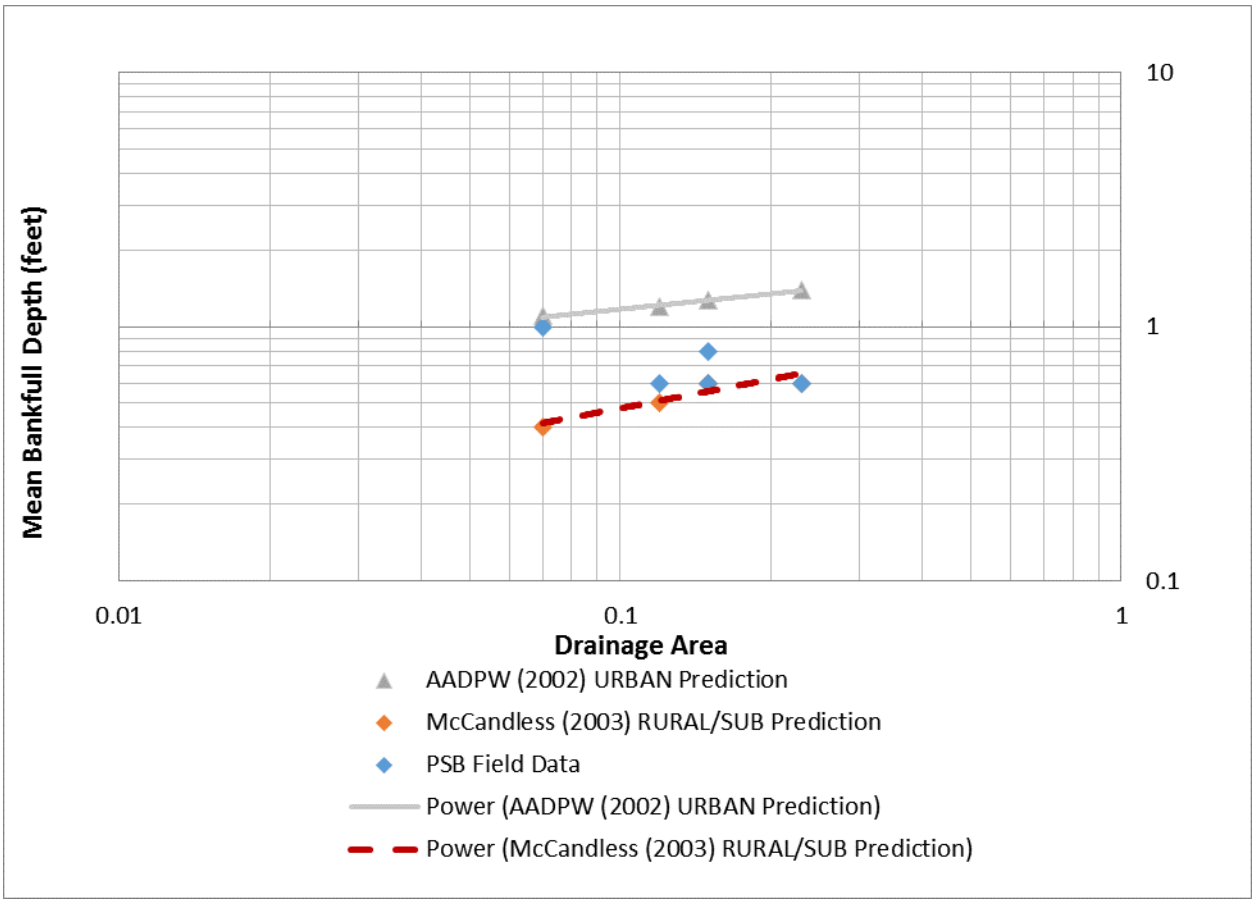


Figure 3-3. Comparison of the mean bankfull depth drainage area relationship between Picture Spring Branch 2014 field data and regional relationship curve data

The channel located in the well-forested, upper portion of the North Tributary at cross section 1 exhibited characteristics typical of both C and E type channels, as well as some characteristics that fit neither. For example, E channels are typically very sinuous, however, this reach had very little sinuosity. Likewise, C channels often have numerous point bars, which were not common along this reach. As a result, best professional judgment was applied and the final decision was to assign a C5 classification in order to be consistent with the prior classifications, since there is little evidence to indicate that the channel has evolved from a C to E type channel. F channels were identified at cross sections 2, 3, and 5, which had been altered in the past with concrete trapezoidal channels. The channel along this segment of the North Tributary and down-stream of Maryland State Highway 170 was overwidened as a result of the channelization, however, it continues to adjust by filling with sediment and woody debris, thus establishing a more "natural" stream channel within the man-made, engineered channel.

An E channel was identified at cross section 4 on the South Tributary, which appeared to have been channelized in the past and is piped underground for a significant distance upstream, further modifying its hydrology. However, the South Tributary is not overwidened and is

significantly steeper than the North Tributary. Indicators were observed that show some limited floodplain connectivity along the upstream portion of the tributary where the cross section is located. However, just downstream of the cross section location, the channel became noticeably entrenched and showed signs of active downcutting. While it is possible that this reach may exhibit both B and E characteristics along different portions of the reach, it was assigned an E5 classification primarily based on the entrenchment and width/depth ratios measured at the cross section location. Evidence of recent downcutting (e.g., nick points) suggests that the reach is unstable and is likely shifting from an E channel to a B channel. Significant changes in the shape of this cross section were observed during the 2013 survey, as the channel had noticeably deepened and widened since the 2012 survey (Appendix E). Over the next year, as seen in the 2014 survey, aggradation occurred affecting the bed level by raising it approximately 0.5 feet. Analysis of the longitudinal profile overlay from 2007 through 2014 shows considerable downcutting between stations 1+00 and 2+20 since 2007 (Appendix E). However, during 2014 the pool near station 2+00 has mostly filled in. The headcut and large scour pool between stations 2+68 and 2+90 just downstream from this eroded section have not worsened. It is recommended that this area continue to be monitored, since further erosion could eventually lead to undermining of the concrete-lined channel just downstream.

An overlay of North Tributary longitudinal profiles shows little change occurring to this reach from 2007 through 2014 (Appendix E). Numerous man-made structures (i.e., culverts, concrete-lined channel) throughout this reach are providing adequate grade control, preventing substantial channel degradation.

4.0 SUMMARY AND CONCLUSIONS

4.1 BIOLOGICAL ASSESSMENT SUMMARY

Water quality measurements showed all parameters within COMAR standards. Conductivity levels at all of the sampling sites continue to be elevated, which is likely due to the high percent of impervious surfaces within the drainage area and the resulting stormwater runoff. In urban systems, high conductivity may be an indicator of road salt usage (Morgan et al. 2012, Southerland et al. 2007, Kaushal et al. 2005); however, chloride concentrations are often necessary to confirm whether road salts are a primary source. Given the presence in the watershed of the large MARC train station Park & Ride lots, which likely receive large quantities of de-icing salts, and two adjacent detention/shallow wetland ponds, which may accumulate the salts and slowly release them through the groundwater, it is plausible that road salt application is responsible, at least in part, for the observed elevated conductivity.

Physical habitat was rated "Partially Degraded" to "Degraded" throughout the study area, which is exactly the same as the ratings from 2013 (Table 4-1). The "Partially Degraded" site was located along the wooded upper reach of the North Tributary, which had a substantial riparian buffer, adequate shading, minor bank erosion, and sufficient instream woody debris and rootwads. These factors increase the potential of the stream to support a diverse macroinvertebrate community. Sites PSB-02 and PSB-03 had marginal riparian buffers and scored very low for remoteness due to their proximities to Routes 170 and 175. The scores for instream habitat and epifaunal substrate were also lower than upstream, but the reduced PHI scores were primarily due to the remoteness measure, which cannot improve over time.

During the past five years of monitoring, PHI scores have fluctuated slightly from year to year (Figure 4-1). Fluctuations in annual physical habitat scores can be attributed to two primary factors: 1) changes in the quantity of woody debris, which not only affects direct scoring of this parameter, but also indirectly influences scoring for epifaunal substrate and instream habitat; and 2) variability in qualitative visual assessment scoring between field crews.

In 2013 and 2014, the updated MBSS PHI methods (Paul et al. 2003) were used to calculate PHI instead of the original MBSS methods (Hall et al. 2002) which had been used in the Picture Spring Branch watershed reports from prior years. Scores for 2006-2012 shown in Table 4-1 and Figure 4-1 were calculated using the original method, while scores for 2013 and 2014 were calculated using the updated method.

In 2014, the benthic macroinvertebrate community at all three sites within the Picture Spring Branch study area was rated as "Poor", which is considered to be a minimally degraded biological condition. One site in 2013 was rated "Poor." Overall, taxa diversity and the number of Ephemeroptera was decreased in 2014 in all three sites as compared to previous years. Intolerant individuals at sites ranged from 0% (PSB-01) to 14% (PSB-02) of the total specimens. The numbers of sensitive EPT taxa were lower at PSB-02 (1 taxa) than at the other two sites

(3 taxa, each). However, no Ephemeroptera taxa were found at any of the sites during this sampling period.

Table 4-1. PHI scores from 2006 to 2014

Site		PSB-01	PSB-02	PSB-03
2006	PHI Score	66.0	60.1	50.9
	Rating	Degraded	Degraded	Severely Degraded
2007	PHI Score	79.6	69.5	69.5
	Rating	Partially Degraded	Partially Degraded	Partially Degraded
2008	PHI Score	84.5	73.0	73.3
	Rating	Minimally Degraded	Partially Degraded	Partially Degraded
2009	PHI Score	76.4	65.9	58.6
	Rating	Partially Degraded	Degraded	Degraded
2010	PHI Score	84.3	72.4	73.8
	Rating	Minimally Degraded	Partially Degraded	Partially Degraded
2011	PHI Score	83.3	73.4	71.9
	Rating	Minimally Degraded	Partially Degraded	Partially Degraded
2012	PHI Score	83.9	74.8	73.2
	Rating	Minimally Degraded	Partially Degraded	Partially Degraded
2013	PHI Score	77.2	62.6	57.2
	Rating	Partially Degraded	Degraded	Degraded
2014	PHI Score	77.7	64.7	65.7
	Rating	Partially Degraded	Degraded	Degraded

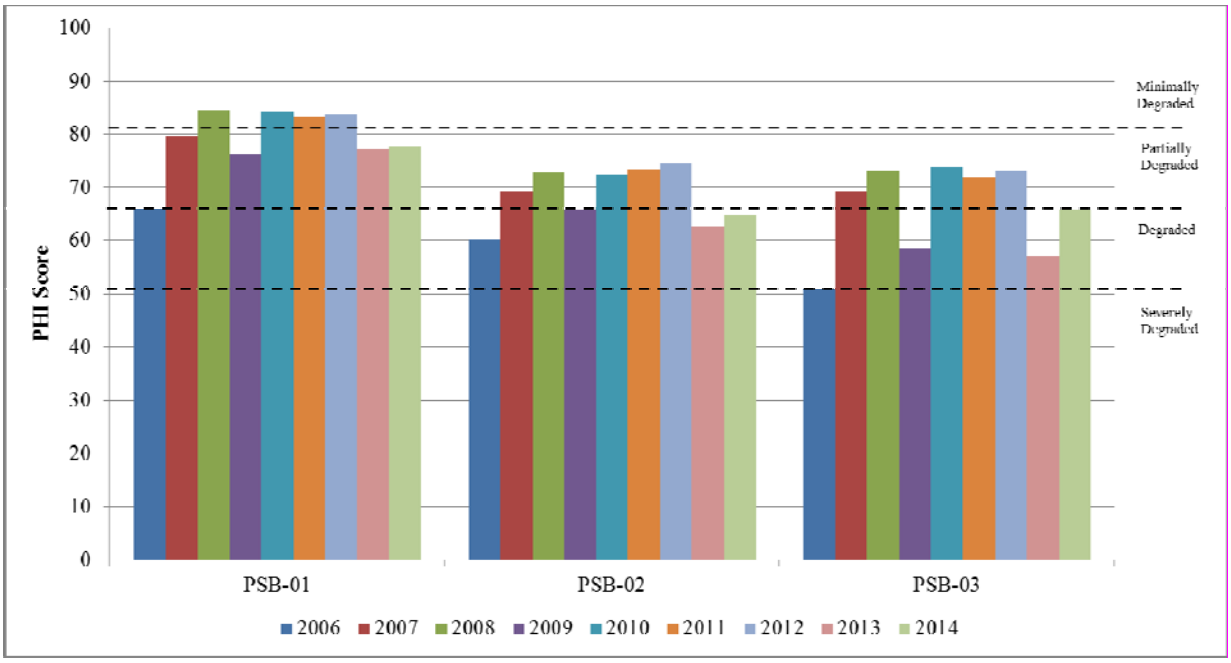


Figure 4-1. Comparison of PHI Habitat Scores from 2006 through 2014

BIBI scores decreased at all three sites between 2013 and 2014 (Table 4-2). The narrative ratings at one site stayed constant from 2013 to 2014, however, two sites decreased to "Fair" from "Poor". Figure 4-2 provides a visual comparison of BIBI scores over time, which shows scores fluctuating from year to year.

Table 4-2. BIBI scores from 2006 to 2014

Site		PSB-01	PSB-02	PSB-03
2006	BIBI Score	3.00	2.71	2.43
	Rating	Fair	Poor	Poor
2007	BIBI Score	3.29	3.00	3.57
	Rating	Fair	Fair	Fair
2008	BIBI Score	3.86	3.00	2.71
	Rating	Fair	Fair	Poor
2009	BIBI Score	2.43	2.71	1.86
	Rating	Poor	Poor	Very Poor
2010	BIBI Score	2.71	3.00	2.43
	Rating	Poor	Fair	Poor
2011	BIBI Score	3.29	3.29	2.71
	Rating	Fair	Fair	Poor
2012	BIBI Score	3.29	3.00	3.00
	Rating	Fair	Fair	Fair
2013	BIBI Score	2.71	3.29	3.00
	Rating	Poor	Fair	Fair
2014	BIBI Score	2.43	2.71	2.43
	Rating	Poor	Poor	Poor

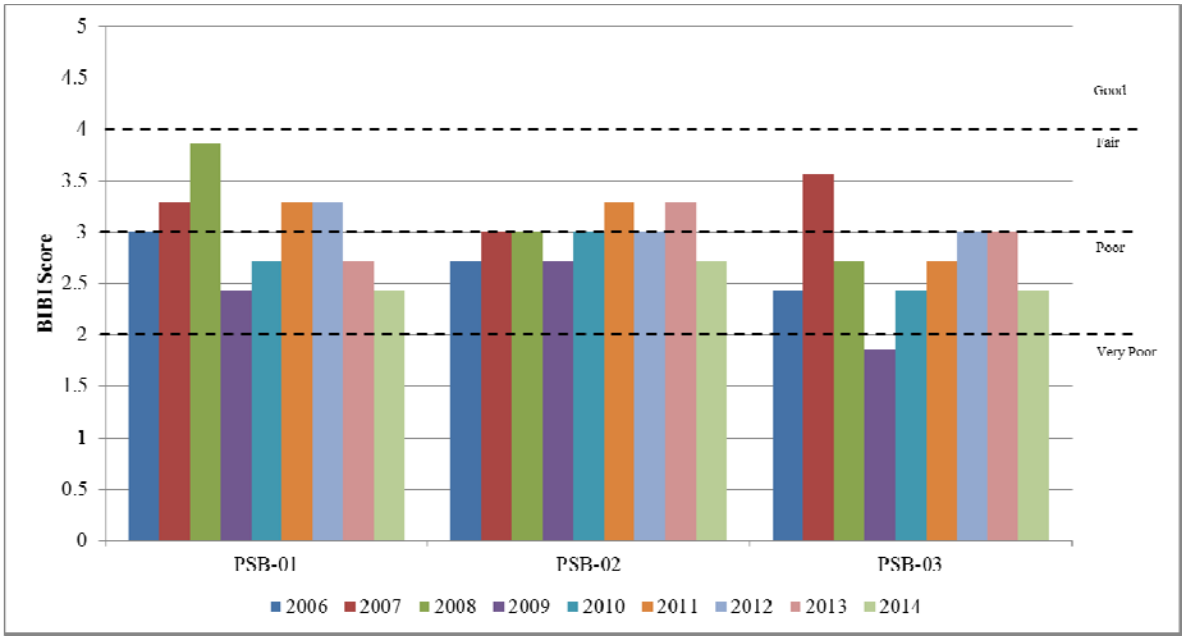


Figure 4-2. Comparison of BIBI Scores from 2006 through 2014

4.2 GEOMORPHIC ASSESSMENT SURVEY

The majority of the streams within the Picture Spring Branch study area have been altered by past channelization and the installation of concrete lined channels, resulting from modifications made to accommodate runoff from Maryland State Highways 170 and 175, running both parallel and adjacent to the stream channel. Consequently, stream reaches in the vicinity of cross sections XS-2, XS-3, and XS-5, on the North Tributary and mainstem have been overwidened resulting in F channels at these locations. A notable amount of sediment has deposited in these concrete channels in the past, and it appears as though these channels have become naturalized, especially below Route 170 where a more natural stream pattern is emerging. These cross sections also appeared quite stable during recent years, having shown very little change from previous surveys, with the exception of XS-5 which experienced notable aggradation across its total width between 2011 and 2012. However, between 2012 and 2013 the right side stream bed at XS-5 eroded slightly while the left side had no change. The 2014 survey continued to show left side erosion. Past channelization also appears to have occurred on the South Tributary in the vicinity of cross section XS-4. The slope of the South Tributary is much greater than that of the North Tributary, and the channel is showing signs of active downcutting. The least disturbed reach in the Picture Spring Branch study area is in the vicinity of cross section XS-1 in the well-forested upper portion of the North Tributary, which is classified as a C5 channel.

To compare changes in cross sectional area over time, cross sectional area from 2011 through 2014 was calculated using the top of bank elevation from the baseline survey in order to standardize comparisons and reduce variability among more subjective bankfull elevation reference points, or even changes that can occur to top of bank elevations from year to year. It is important to note that calculations prior to 2011 did not use the baseline reference elevation, instead they used the corresponding years top of bank elevation for calculating cross sectional area, and consequently these values are not directly comparable to the cross sectional areas reported in 2011 through 2014. Comparison of baseline cross sectional area is however comparable to 2011 through 2014 since all calculations are made using the same top of bank elevation. Channel dimensions appear moderately constant for three out of the five cross sections, compared to baseline conditions (Table 4-3). Only very minor changes were observed from baseline conditions in cross section XS-2, showing signs of minor aggradation in this overwidened reach. On the other hand, cross sections XS-1 and XS-4 have experienced a 37.5% and 31.6% increase over baseline conditions, respectively. Not surprisingly, these are the only two sections not located in an engineered or partially-armored channel. However, when comparing the most recent four years of data, only minor changes are shown where XS-1 has degraded by 9.3% while XS-4 has aggraded by 7.5%. Although cross section XS-4 has filled in slightly between 2013 and 2014, notable stream bed erosion is apparent. Between 2012 and 2013, the cross section area of XS-4 increased significantly by 62.8%. Cross sections XS-3 and XS-5 decreased in cross-section areas between the baseline assessment and the 2014 survey by 8.4% and 8.2%, respectively. These two station also show a similar change between 2011 and 2014 surveys by a decrease of 5.5% and 6.3%, respectively. During 2014 survey, slight deposition was seen along the right bank of cross section XS-3.

Table 4-3. Summary of cross sectional area (square feet) at the five cross-sections and changes over time.

Cross Section[a]	XS-1	XS-2	XS-3	XS-4	XS-5
July 2003	ND	146.0	84.5	7.6	35.5
Jan 2005	6.4	164.4	83.2	5.5	35.2
March 2006	7.6	143.9	81.0	7.6	34.0
March 2007	6.8	142.6	81.1	7.6	32.9
May 2008	6.3	141.5	81.5	7.4	34.9
July 2009	6.8	142.8	80.8	8.4	33.4
May 2010	6.0	145.2	80.5	9.7	34.5
July 2011[b]	9.7	143.0	81.9	9.3	34.8
April 2012[b]	8.0	143.1	81.8	9.2	28.4
July 2013[b]	8.6	142.8	80.4	10.5	30.9
June 2014 [b]	8.8	141.9	77.4	10.0	32.6
% Change 2003-2014	37.5[c]	-2.8	-8.4	31.6	-8.2
% Change 2011-2014	-9.3	-0.7	-5.5	7.5	-6.3

[a] All values listed here are for top of bank area
[b] Values obtained using reference elevations (top of bank) from baseline measurements
[c] % change from 2005
ND = No Data

4.3 GENERAL CONCLUSIONS

Based upon the data collected over the course of this study, it appears that the development of the West County Library site has not accelerated the degradation of this system. While physical habitat and biological conditions have fluctuated slightly from year to year, the overall conditions have changed minimally when compared to baseline data. It is likely that the best management practices installed within the watershed have reduced the impact of some stressors affecting the stream (i.e., hydrologic alteration) such that the system has begun to stabilize from past alteration and land use modifications (i.e., extensive channelization).

5.0 REFERENCES

Anne Arundel County. 2010. Anne Arundel County Biological Monitoring and Assessment Program: Quality Assurance Project Plan. Revised December 2010. Prepared by KCI Technologies, Inc. for Anne Arundel County Department of Public Works, Watershed Ecosystem and Restoration Services. Annapolis, MD. For additional information, contact Mr. Chris Victoria (410-222-4240, PWVICT16@aacounty.org).

Anne Arundel County Department of Public Works (AADPW). 2002. Cypress Creek Tributary Assessment and Findings Report. Prepared by Bayland Consultants and Designers, Inc., and Clear Creek Consulting. 32 pp., plus Appendices.

Barbour, M.T., J. Gerritsen, B.D. Snyder, J.B. Stribling. 1999. *Rapid bioassessment protocols for use in streams and wadeable rivers: Periphyton, benthic macroinvertebrates and fish, 2nd edition.* EPA841-B-99-002. U.S. Environmental Protection Agency; Office of Water; Washington, D.C.

Bressler, D., Paul, M. and J. Stribling. 2005. *DRAFT Development of tolerance values for benthic macroinvertebrates in Maryland*. Tetra Tech, Inc. Prepared for Maryland Department of Natural Resources.

Code of Maryland Regulations (COMAR), Title 26, Department of the Environment, Part 1, Vol. XXIII.

Cushman, S.F. 2006. Fish movement, habitat selection, and stream habitat complexity in small urban streams. Dissertation submitted to the Faculty of the Graduate School of the University of Maryland, College Park, in partial fulfillment of the requirements for the degree of Doctor of Philosophy.

Hall, Jr., L.W., R.P. Morgan II, E.S. Perry and A. Waltz. 2002. Development of a physical habitat index for Maryland freshwater streams. Environmental Monitoring and Assessment 77:265-291.

Hill C. R. and M. C. Crunkleton. 2009. *Howard County Biological Monitoring and Assessment, Dorsey Run, Hammond Branch, and Rocky Gorge Watersheds – 2009.* Prepared by KCI Technologies, Inc., Sparks, MD for Howard County, Department of Public Works. Stormwater Management Division. Columbia, MD. October 2009.

Kaushal, S.S., P.M. Groffman, G.E. Likens, K.T. Belt, W.P. Stack, V.R. Kelly, L.E. Band, and G.T. Fisher. 2005. Increased salinization of fresh water in the northeastern United States. Proceedings of the National Academy of Sciences of the United States of America 102: 13517-13520.

KCI Technologies. 2008. Patapsco River Nontidal Watershed Targeted Biological Monitoring and Assessment. Prepared by KCI Technologies, Inc., Sparks, MD for and in collaboration with Anne Arundel County, Department of Public Works, Watershed and Ecosystem Services and Restoration Division. Annapolis, MD. September 2008.

KCI Technologies. 2009. Stormwater Management Pond & Infiltration Trench Field Inspection Manual (Draft-Final). Prepared by KCI Technologies, Inc., Laurel, MD, for Anne Arundel County, Infrastructure Management Division, Annapolis, MD. March 4, 2009.

KCI Technologies. 2013. Land Use / Land Cover and Stormwater Management Assessment. Technical Memorandum Prepared by KCI Technologies, Inc., Sparks, MD for Janis Markusic, Anne Arundel County Department of Public Works. January 2013.

McCandless, T.L. 2003. *Maryland stream survey: Bankfull discharge and channel characteristics of streams in the Coastal Plain hydrologic region*. U.S. Fish and Wildlife Service, Annapolis, MD. CBFO-S03-02.

MD DNR. 2001. Maryland Biological Stream Survey 2000-2007 Volume 1: Ecological Assessment of Watersheds Sampled in 2000. CBWP-MANTA-EA-01-05. Maryland Department of Natural Resources, Annapolis, MD.

MD DNR. 2003. Maryland Biological Stream Survey 2000-2007 Volume 2: Ecological Assessment of Watersheds Sampled in 2001. CBWP-MANTA-EA-03-03. Maryland Department of Natural Resources, Annapolis, MD.

MD DNR. 2005. Maryland Biological Stream Survey 2000-2007 Volume 4: Ecological Assessment of Watersheds Sampled in 2003. CBWP-MANTA-EA-05-01. Department of Natural Resources, Annapolis, MD. Publication # DNR-12-0105-0038.

MD DNR. 2010. Maryland Biological Stream Survey Sampling Manual: Field Protocols. CBWPMANTA- EA-07-01. Revised January 2010. Maryland Department of Natural Resources, Annapolis, MD. Publication # 12-2162007-190.

Mecklenburg, Dan. 2004. *The Reference Reach Spreadsheet*. Version 4.1 L. Ohio Department of Natural Resources.

Morgan, R.P. II, K. M. Kline, M. J. Kline, S. F. Cushman, M. T. Sell, R.E. Weitzell Jr. and J.B. Churchill. 2012. *Stream Conductivity: Relationships to Land Use, Chloride, and Fishes in Maryland Streams*. North American Journal of Fisheries Management, 32:5, 941-952.

Paul, M.J. and J.L. Meyer. 2001. Streams in the urban landscape. Annual Review of Ecology and Systematics 32:333-365.

Paul, M.J., Stribling, J.B., Klauda, R.J., Kazyak, P.F., Southerland, M.T., and N.E. Roth. 2003. A Physical Habitat Index for Freshwater Wadeable Streams in Maryland. Maryland Department of Natural Resources, Monitoring and Non-Tidal Assessment Division. Annapolis, MD. CBWPMANTA-EA-03-4.

Rosgen, D.L. 1996. *Applied River Morphology*. Wildland Hydrology, Pagosa Springs, CO.

Southerland, M., G. Rogers, M. Kline, R. Morgan, D. Boward, P. Kazyak, and S. Stranko. 2005. *Development of New Fish and Benthic Macroinvertebrate Indices of Biotic Integrity for Maryland Streams*. Report to Monitoring and Non-Tidal Assessment Division, Maryland Department of Natural Resources, Annapolis, MD.

Southerland, M., J. Vølstad, E. Weber, R. Morgan, L. Currey, J. Holt, C. Poukish and M. Rowe. 2007. Using MBSS Data to Identify Stressors for Streams that Fail Biocriteria in Maryland. Prepared by Versar, Inc., Columbia, MD, University of Maryland, Frostburg, MD, and Maryland Department of the Environment, Baltimore, MD. June 15, 2007.

Stribling, J.B., E.W. Leppo, and C. Daley. 1999. Biological Assessment of the Streams and Watersheds of Prince George's County, Maryland. Spring Index Period 1999. PGDER Report No. 99-1. Prince George's County, Dept. of Env. Rsrs., Programs and Planning Division, Largo, MD.

Versar, Inc. 2013. Biological and Geomorphological Condition in the Picture Spring Branch Subwatershed, Severn River Watershed, Anne Arundel County, Maryland: 2013. Prepared for Anne Arundel County Department of Public Works. December 2013.

APPENDIX A

QUALITY ASSURANCE / QUALITY CONTROL

This section describes all Quality Assurance/Quality Control (QA/QC) procedures implemented for this project including field sampling, laboratory sorting and subsampling, data entry, metric calculation, final IBI calculation, geomorphic field sampling, and classification of stream types.

Field Sampling
Initial QA/QC procedures for benthic macroinvertebrate field sampling included formal training for field crew leaders in MBSS Sampling Protocols. All field crew members have attended at least one MBSS Spring Index Period Training. At least one crew member extensively trained and certified in MBSS sampling protocols was present for each field sampling day. Also during field sampling, each data sheet was double checked for completeness and sample bottle labels were double checked for accuracy. Geomorphic assessment field crews have more than one year of experience conducting similar assessment using the Rosgen Stream Classification Methodology.

Geomorphic assessment survey equipment is calibrated annually and regularly inspected to ensure proper functioning. Cross section and profile data were digitally plotted and analyzed in Ohio Department of Natural Resources (ODNR) Reference Reach Spreadsheet Version 4.3L for accuracy.

Water quality QA/QC procedures included calibration of the YSI multiprobe meter daily during the sampling season. Dissolved oxygen probe membranes were inspected regularly and replaced when dirty or damaged.

Laboratory Sorting and Subsampling
Sorting QA/QC was conducted on one sample since only seven samples were collected for this survey. This check consisted of entirely resorting one randomly selected sample to a sorting consistency above ninety percent efficiency. This QC resulted in a sorting efficiency above 95%, so no further action was required. As a taxonomic QC, one sample was re-identified completely by another Versar SFS-certified taxonomist following the same identification methods stated above. The Percent Difference in Enumeration (PDE) and the Percent Taxonomic Disagreement (PTD) were calculated and no further action was required since both the PDE and PTD met MBSS requirements.

Data Entry
All data entered were double checked by someone other than the person who performed the initial data entry. Any errors found during QA/QC were corrected to ensure 100% accuracy of the data.

Metric and IBI Calculations
Ten percent of metric and IBI calculations were checked by hand using a calculator to ensure correct calculation by the Access database. Any discrepancies were addressed at that time.

Identification of Stream Types
All stream types were determined by hand based on the methods of the Rosgen Stream Classification (Rosgen, 1996). Due to the natural variability, or continuum, of streams, adjustments in the values of Width Depth Ratio (+/- 2.0) and Entrenchment Ratio (+/- 0.2) are

allowed, which may result in assigning a different stream type. Therefore, all stream types assigned were checked by a second person and any necessary adjustments were made.

APPENDIX B

BIOLOGICAL ASSESSMENT RESULTS

Picture Spring Branch Site PSB-01

Sampled: 3/21/2014

Biological Condition

Benthic Macroinvertebrate IBI

Narrative Rating	Poor
BIBI Score	2.43

Metric	Value	Score
Total Taxa	18	3
EPT Taxa	3	3
Number Ephemeroptera	0	1
% Intolerant to Urban	0.00	1
% Ephemeroptera	0	1
Scraper Taxa	2	5
% Climbers	6.56	3

Benthic Macroinvertebrate Taxa List

Taxa	Count
Dytiscidae	2
Empididae	2
Helichus	2
Helius	1
Limnephilidae	4
Limnophila	1
Molanna	1
Parametriocnemus	4
Paraphaenocladius	1
Phaenopsectra	1
Pisidiidae	25
Prodiamesa	5
Psychomyiidae	1
Stratiomyidae	2
Tanypodinae	2
Thienemannimyia group	3
Tubificidae	3
Zavrelimyia	1

Physical Habitat

Maryland Biological Stream Survey PHI

Narrative Rating	Partially Degraded
PHI Score	77.69

Metric	Score
Drainage area (acres)	76.80
Remoteness	42.78
Percent Shading	73.32
Epifaunal Substrate	91.83
Instream Habitat	86.20
Instream Wood Debris	100.00
Bank Stability	71.98

Rapid Bioassessment Protocal

Narrative Rating	Supporting
RBP Score	78

Metric	Score
Epifaunal Substrate / Cover	10
Embeddedness	8
Velocity / Depth Regime	6
Sediment Deposition	9
Channel Flow Status	16
Channel Alteration	20
Frequency of Riffles	16
Bank Stability	8(Left)/8(Right)
Vegetative Protection	6(Left)/6(Right)
Riparian Veg Zone Width	9(Left)/9(Right)

Water Chemistry

Dissolved Oxygen (mg/L)	9.06
pH	6.44
Specific Conductance (µS/cm)	1544
Temperature (°C)	12.47
Turbidity (NTUs)	2.4

Picture Spring Branch Site PSB-02

Sampled: 3/21/2014

Biological Condition

Benthic Macroinvertebrate IBI

Narrative Rating	Poor
BIBI Score	2.71

Metric	Value	Score
Total Taxa	17	3
EPT Taxa	1	1
Number Ephemeroptera	0	1
% Intolerant to Urban	13.93	3
% Ephemeroptera	0	1
Scraper Taxa	4	5
% Climbers	17.21	5

Benthic Macroinvertebrate Taxa List

Taxa	Count
Calopteryx	2
Chaetocladius	5
Chironomini	1
Chironomus	3
Fossaria	2
Hemerodromia	1
Lymnaeidae	1
Orthocladius	5
Parametriocnemus	14
Phaenopsectra	2
Physa	16
Pisidium	10
Polycentropus	3
Procladius	14
Prodiamesa	5
Stenelmis	1
Tanypodinae	5
Zavrelimyia	32

Physical Habitat

Maryland Biological Stream Survey PHI

Narrative Rating	Degraded
PHI Score	64.69

Metric	Score
Drainage area (acres)	96.00
Remoteness	15.79
Percent Shading	68.32
Epifaunal Substrate	61.33
Instream Habitat	67.27
Instream Wood Debris	100.00
Bank Stability	75.45

Rapid Bioassessment Protocal

Narrative Rating	Partially Supporting
RBP Score	72

Metric	Score
Epifaunal Substrate / Cover	7
Embeddedness	9
Velocity / Depth Regime	4
Sediment Deposition	5
Channel Flow Status	19
Channel Alteration	17
Frequency of Riffles	17
Bank Stability	9(Left)/9(Right)
Vegetative Protection	6(Left)/6(Right)
Riparian Veg Zone Width	7(Left)/6(Right)

Water Chemistry

Dissolved Oxygen (mg/L)	9.22
pH	6.85
Specific Conductance (µS/cm)	1446
Temperature (°C)	11.18
Turbidity (NTUs)	2.7

Picture Spring Branch Site PSB-03

Sampled: 3/21/2014

Biological Condition

Benthic Macroinvertebrate IBI

Narrative Rating	Poor
BIBI Score	2.43

Metric	Value	Score
Total Taxa	16	3
EPT Taxa	3	3
Number Ephemeroptera	0	1
% Intolerant to Urban	2.33	1
% Ephemeroptera	0	1
Scraper Taxa	2	5
% Climbers	6.98	3

Benthic Macroinvertebrate Taxa List

Taxa	Count
Calopteryx	4
Cheumatopsyche	1
Chimarra	1
Conchapelopia	18
Crangonyx	1
Girardia	1
Gomphidae	1
Hydrobaenus	5
Micropsectra	1
Nigronia	1
Orthocladius	20
Parametriocnemus	69
Phaenopsectra	2
Physa	1
Pisidium	1
Pycnopsyche	2

Physical Habitat

Maryland Biological Stream Survey PHI

Narrative Rating	Degraded
PHI Score	65.70

Metric	Score
Drainage area (acres)	147.20
Remoteness	15.79
Percent Shading	58.94
Epifaunal Substrate	64.36
Instream Habitat	85.09
Instream Wood Debris	100.00
Bank Stability	70.02

Rapid Bioassessment Protocal

Narrative Rating	Partially Supporting
RBP Score	71

Metric	Score
Epifaunal Substrate / Cover	7
Embeddedness	7
Velocity / Depth Regime	8
Sediment Deposition	10
Channel Flow Status	16
Channel Alteration	15
Frequency of Riffles	10
Bank Stability	9(Left)/9(Right)
Vegetative Protection	7(Left)/7(Right)
Riparian Veg Zone Width	6(Left)/9(Right)

Water Chemistry

Dissolved Oxygen (mg/L)	10.82
pH	6.83
Specific Conductance (µS/cm)	1495
Temperature (°C)	10.63
Turbidity (NTUs)	4.2

APPENDIX C

MASTER BENTHIC MACROINVERTEBRATE TAXA LIST

Order	Family	Genus	Final ID	FFG[a]	Habit[b]	Tolerance Value[c]
Amphipoda	Crangonyctidae	Crangonyx	Crangonyx	Collector	sp	6.7
Basommatophora	Lymnaeidae		Lymnaeidae	Scraper	cb	6.9
Basommatophora	Lymnaeidae	Fossaria	Fossaria	Scraper	cb	6.9
Basommatophora	Physidae	Physa	Physa	Scraper	cb	7
Coleoptera	Dryopidae	Helichus	Helichus	Scraper	cn	6.4
Coleoptera	Dytiscidae		Dytiscidae	Predator	sw, dv	5.4
Coleoptera	Elmidae	Stenelmis	Stenelmis	Scraper	cn	7.1
Diptera	Chironomidae	Chaetocladius	Chaetocladius	Collector	sp	7
Diptera	Chironomidae	Chironomini	Chironomini			5.9
Diptera	Chironomidae	Chironomus	Chironomus	Collector	bu	4.6
Diptera	Chironomidae	Conchapelopia	Conchapelopia	Predator	sp	6.1
Diptera	Chironomidae	Hydrobaenus	Hydrobaenus	Scraper	sp	7.2
Diptera	Chironomidae	Micropsectra	Micropsectra	Collector	cb, sp	2.1
Diptera	Chironomidae	Orthocladius	Orthocladius	Collector	sp, bu	9.2
Diptera	Chironomidae	Parametriocnemus	Parametriocnemus	Collector	sp	4.6
Diptera	Chironomidae	Paraphaenocladius	Paraphaenocladius	Collector	sp	4
Diptera	Chironomidae	Phaenopsectra	Phaenopsectra	Collector	cn	8.7
Diptera	Chironomidae	Procladius	Procladius	Predator	sp	1.2
Diptera	Chironomidae	Prodiamesa	Prodiamesa	Collector	bu, sp	6.6
Diptera	Chironomidae	Tanypodinae	Tanypodinae	Predator		7.5
Diptera	Chironomidae	Thienemannimyia group	Thienemannimyia group	Predator	sp	8.2
Diptera	Chironomidae	Zavrelimyia	Zavrelimyia	Predator	sp	5.3
Diptera	Empididae		Empididae	Predator	sp, bu	7.5
Diptera	Empididae	Hemerodromia	Hemerodromia	Predator	sp, bu	7.9
Diptera	Stratiomyidae		Stratiomyidae	Collector		
Diptera	Tipulidae	Helius	Helius	Predator	sp, bu	3.6
Diptera	Tipulidae	Limnophila	Limnophila	Predator	bu	4.8
Megaloptera	Corydalidae	Nigronia	Nigronia	Predator	cn, cb	1.4
Odonata	Calopterygidae	Calopteryx	Calopteryx	Predator	cb	8.3
Odonata	Gomphidae		Gomphidae	Predator	bu	2.2
Trichoptera	Hydropsychidae	Cheumatopsyche	Cheumatopsyche	Filterer	cn	6.5
Trichoptera	Limnephilidae		Limnephilidae	Shredder	cb, sp, cn	3.4
Trichoptera	Limnephilidae	Pycnopsyche	Pycnopsyche	Shredder	sp, cb, cn	3.1
Trichoptera	Molannidae	Molanna	Molanna	Scraper	sp, cn	6
Trichoptera	Philopotamidae	Chimarra	Chimarra	Filterer	cn	4.4
Trichoptera	Polycentropodidae	Polycentropus	Polycentropus	Filterer	cn	1.1
Trichoptera	Psychomyiidae		Psychomyiidae			4.9
Tricladida	Dugesiidae	Girardia	Girardia	Predator	sp	9.3
Tubificida	Tubificidae		Tubificidae	Collector	cn	8.4
Veneroida	Pisidiidae		Pisidiidae	Filterer		6.5
Veneroida	Pisidiidae	Pisidium	Pisidium	Filterer	bu	5.7

[a] Functional Feeding Group

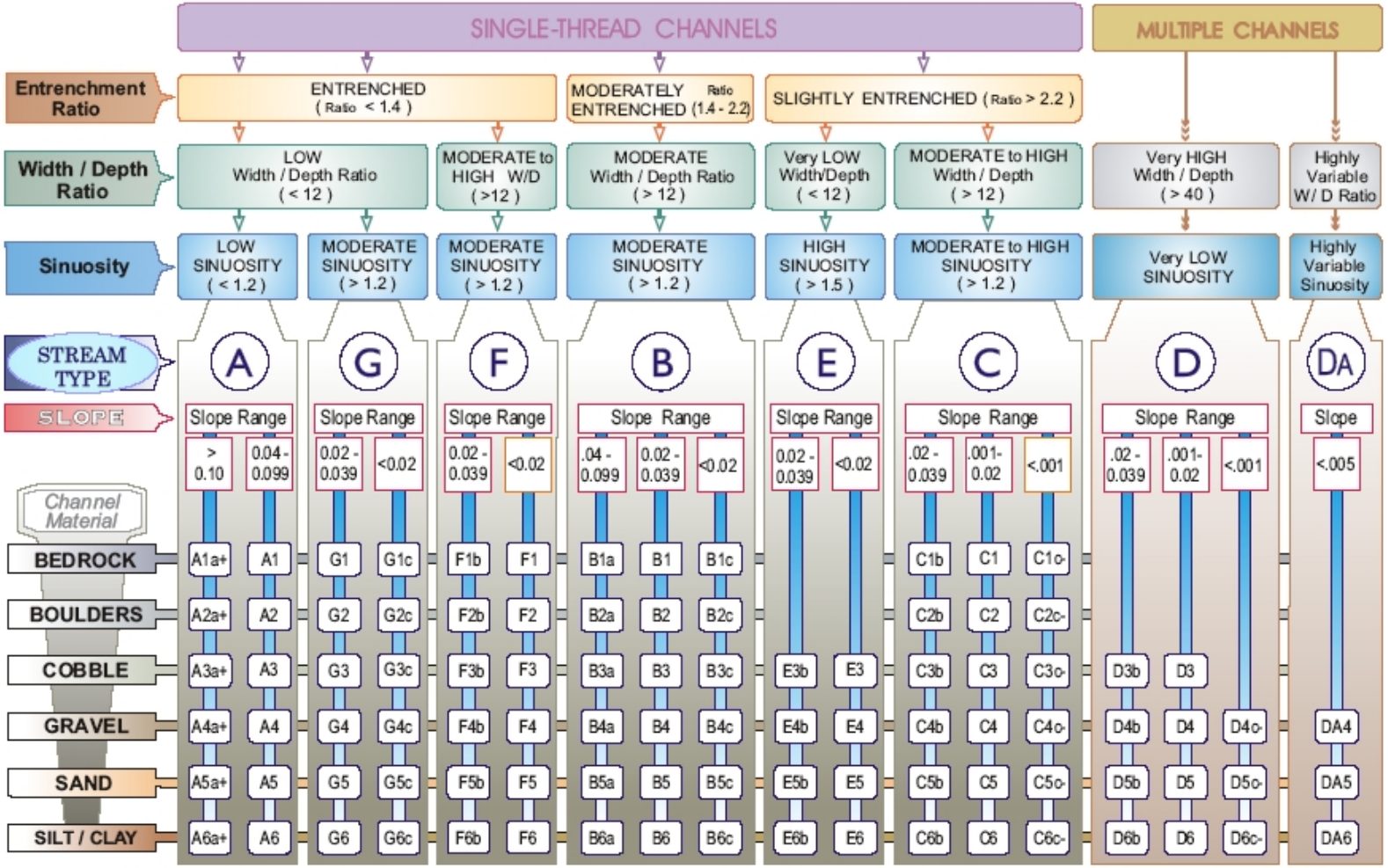
[b] Primary habit or form of locomotion, includes bu - burrower, cn - clinger, cb - climber, sk - skater, sp - sprawler, sw – swimmer. Some information for the particular taxa was not available.

[c] Tolerance Values, based on Hilsenhoff, modified for Maryland

APPENDIX D

ROSGEN STREAM CLASSIFICATION

The Key to the Rosgen Classification of Natural Rivers



KEY to the ROSGEN CLASSIFICATION of NATURAL RIVERS. As a function of the *"continuum of physical variables"* within stream reaches, values of ***Entrenchment*** and ***Sinuosity*** ratios can vary by +/- 0.2 units; while values for ***Width / Depth*** ratios can vary by +/- 2.0 units.

Source: Rosgen, D.L. 1996. *Applied River Morphology*. Wildland Hydrology, Pagosa Springs, CO.

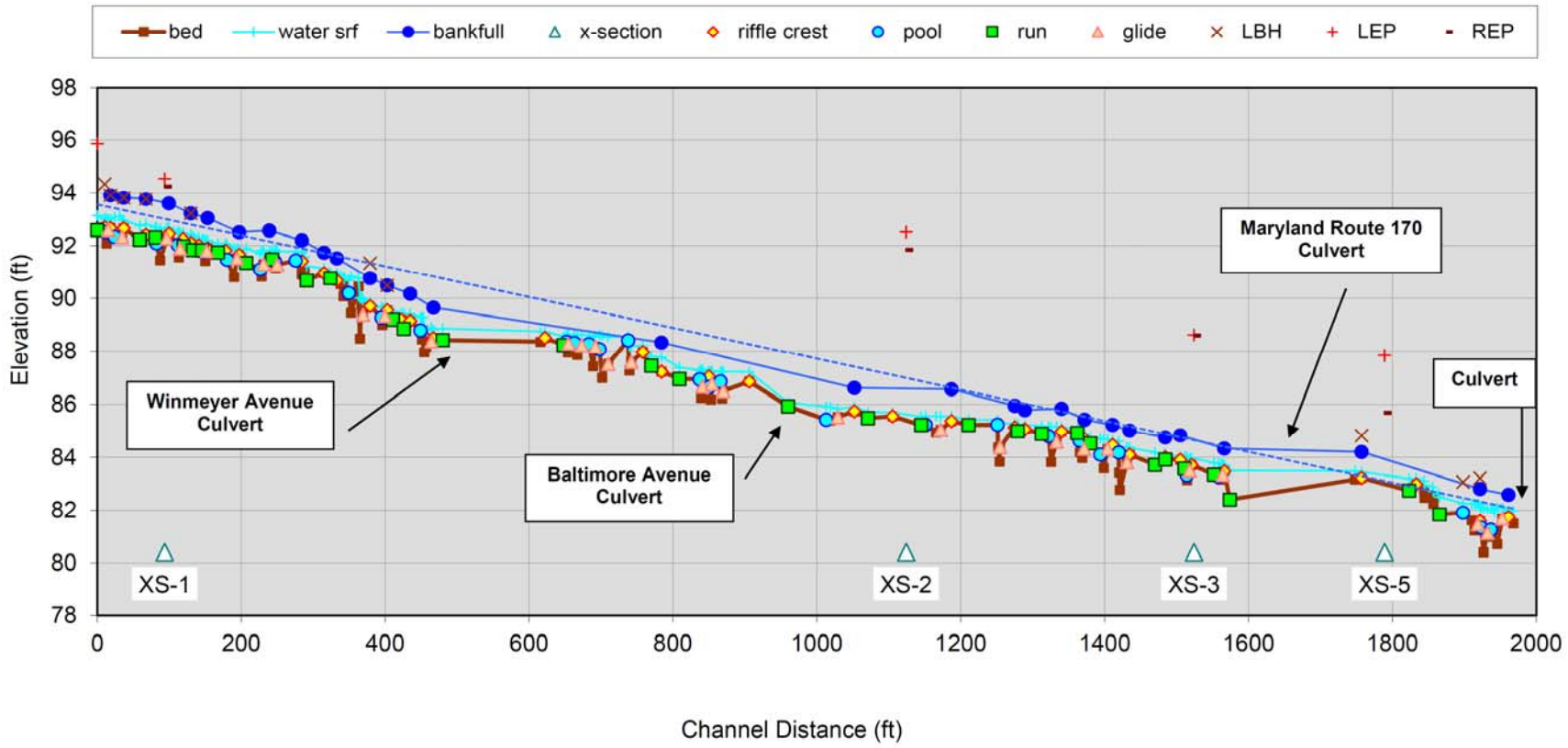
APPENDIX E

GEOMORPHIC ASSESSMENT RESULTS

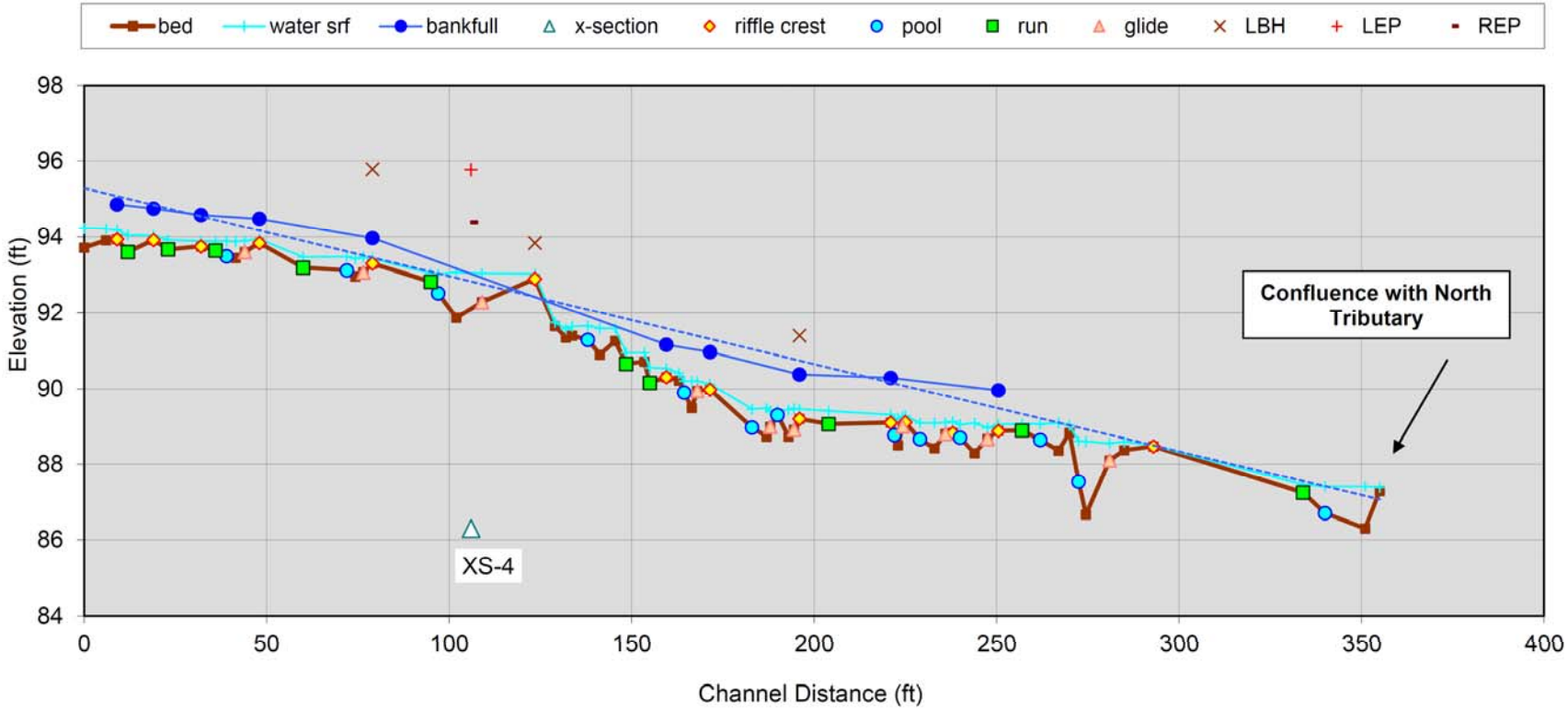
Picture Spring Branch
2014 Geomorphic Assessment Results Summary

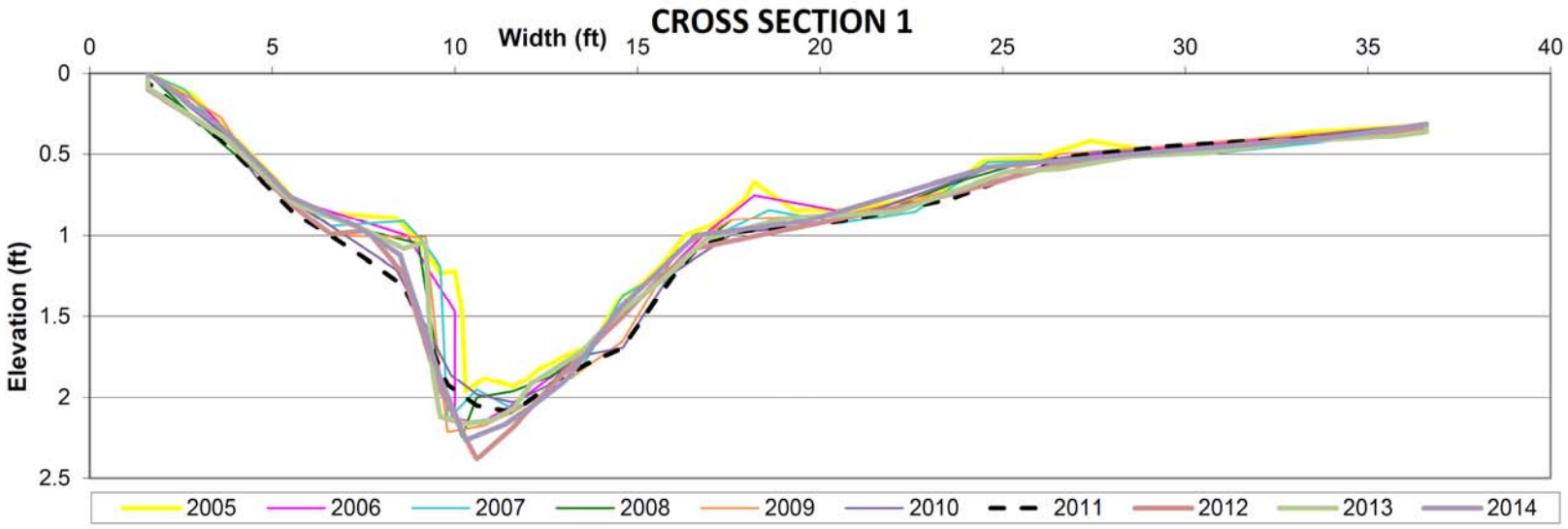
Assessment Parameter	Cross Section				
	XS-1 Run @ Sta. 0+93.5	XS-2 Run @ Sta. 11+24	XS-3 Run @ Sta. 15+24	XS-4 Run @ Sta. 1+06 on South Tributary	XS-5 Run @ Sta. 17+89
Classification	C5	F5	F5	E5	F5
Bankfull Width (ft)	7.5	9.3	11.6	3.5	19.2
Mean Depth (ft)	0.6	0.8	.06	1.0	0.6
Bankfull X-Sec Area (sq ft)	4.8	7.3	7.0	3.5	12.4
Width:Depth Ratio	11.7	11.7	19.1	3.5	29.7
Flood-Prone Width (ft)	53.8	15.2	14.0	24.2	30.6
Entrenchment Ratio	7.1	1.6	1.2	6.9	1.6
D50(mm)	0.19	0.18	0.23	0.56	0.52
Water Surface Slope (ft/ft)	0.007	0.003	0.005	0.02	0.003
Sinuosity	<1.2	<1.2	<1.2	<1.2	<1.2
Drainage Area (mi^2)	0.12	0.15	0.15	0.07	0.23
Adjustments?	Sin ↑, WD↑	Sin ↑, ER ↓, WD↑	Sin ↑	Sin ↑	Sin ↑, ER ↓

Picture Spring Branch
North Tributary Longitudinal Profile



Picture Spring Branch
South Tributary Longitudinal Profile







Upstream View



Downstream View

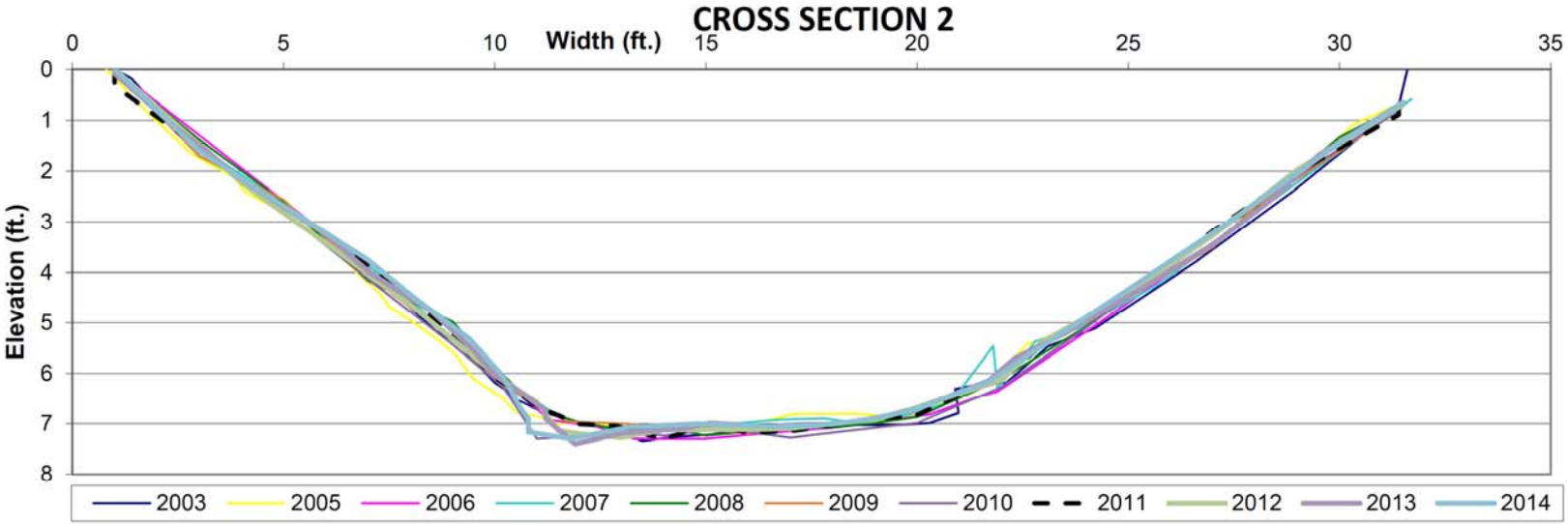


Left Bank View



Right Bank View

2014 Geomorphic Assessment Results	
Bankfull Width (W_{bkf}) (feet)	7.5
Mean Depth (d_{bkf}) (feet)	0.6
Bankfull Cross-sectional Area (A_{bkf}) ($feet_2$)	4.8
Width/Depth Ratio (W_{bkf}/d_{bkf})	11.7
Width of Flood-prone Area (W_{fpa}) (feet)	53.8
Entrenchment Ratio (ER) = W_{fpa}/W_{bkf}	7.1
Channel Materials D_{50} (millimeters)	0.19
Water Surface Slope (S)	0.007
Sinuosity (K) = stream length/valley length	<1.2
Adjustments?	Sin ↑, WD↑
STREAM TYPE	**C5**





Upstream View



Downstream View

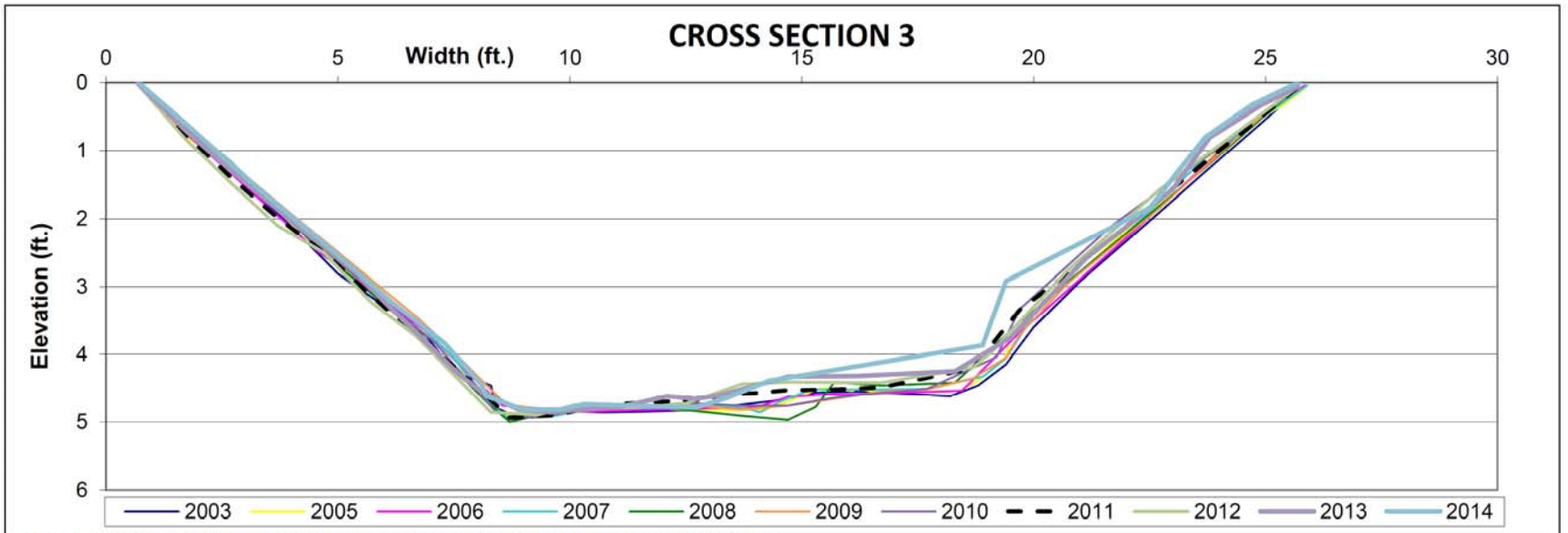


Left Bank View



Right Bank View

2014 Geomorphic Assessment Results	
Bankfull Width (W_{bkf}) (feet)	9.3
Mean Depth (d_{bkf}) (feet)	0.8
Bankfull Cross-sectional Area (A_{bkf}) ($feet_2$)	7.3
Width/Depth Ratio (W_{bkf}/d_{bkf})	11.7
Width of Flood-prone Area (W_{fpa}) (feet)	15.2
Entrenchment Ratio (ER) = W_{fpa}/W_{bkf}	1.6
Channel Materials D_{50} (millimeters)	0.18
Water Surface Slope (S)	0.003
Sinuosity (K) = stream length/valley length	<1.2
Adjustments?	Sin ↑, ER ↓, WD↑
STREAM TYPE	**F5**





Upstream View



Downstream View

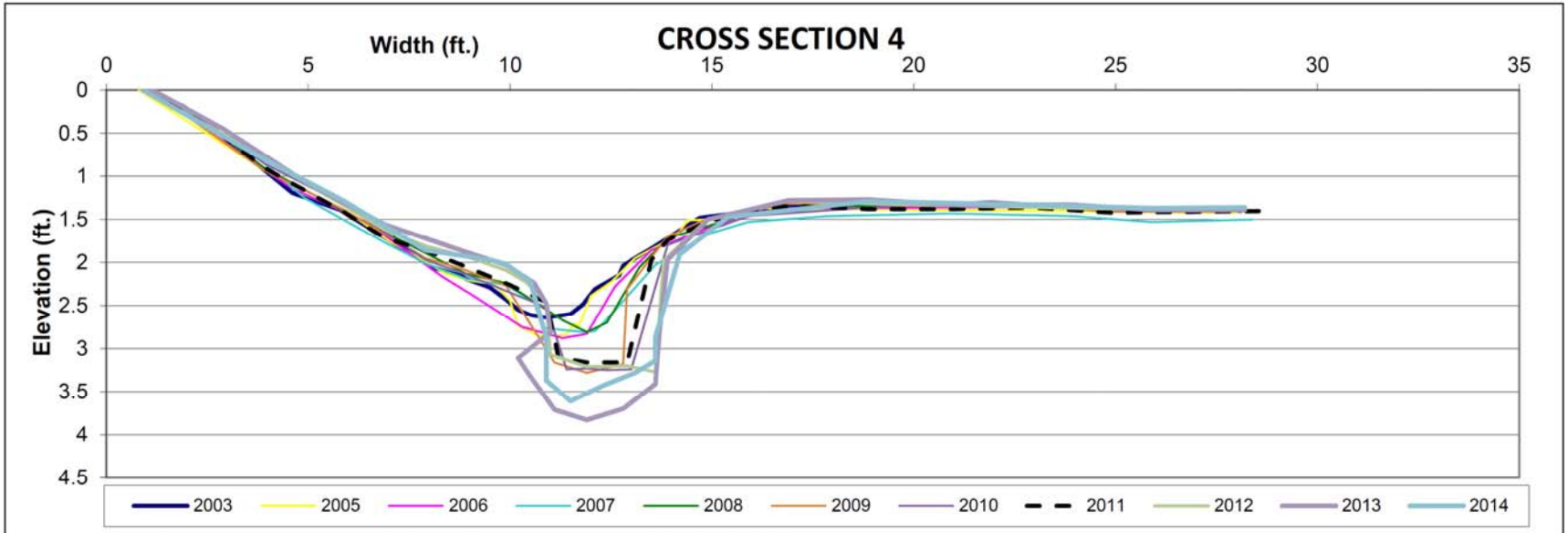


Left Bank View



Right Bank View

2014 Geomorphic Assessment Results	
Bankfull Width (W_{bkf}) (feet)	11.6
Mean Depth (d_{bkf}) (feet)	0.6
Bankfull Cross-sectional Area (A_{bkf}) ($feet_2$)	7.0
Width/Depth Ratio (W_{bkf}/d_{bkf})	19.1
Width of Flood-prone Area (W_{fpa}) (feet)	14.0
Entrenchment Ratio (ER) = W_{fpa}/W_{bkf}	1.2
Channel Materials D_{50} (millimeters)	0.23
Water Surface Slope (S)	0.005
Sinuosity (K) = stream length/valley length	<1.2
Adjustments?	Sin ↑
STREAM TYPE	**F5**





Upstream View



Downstream View

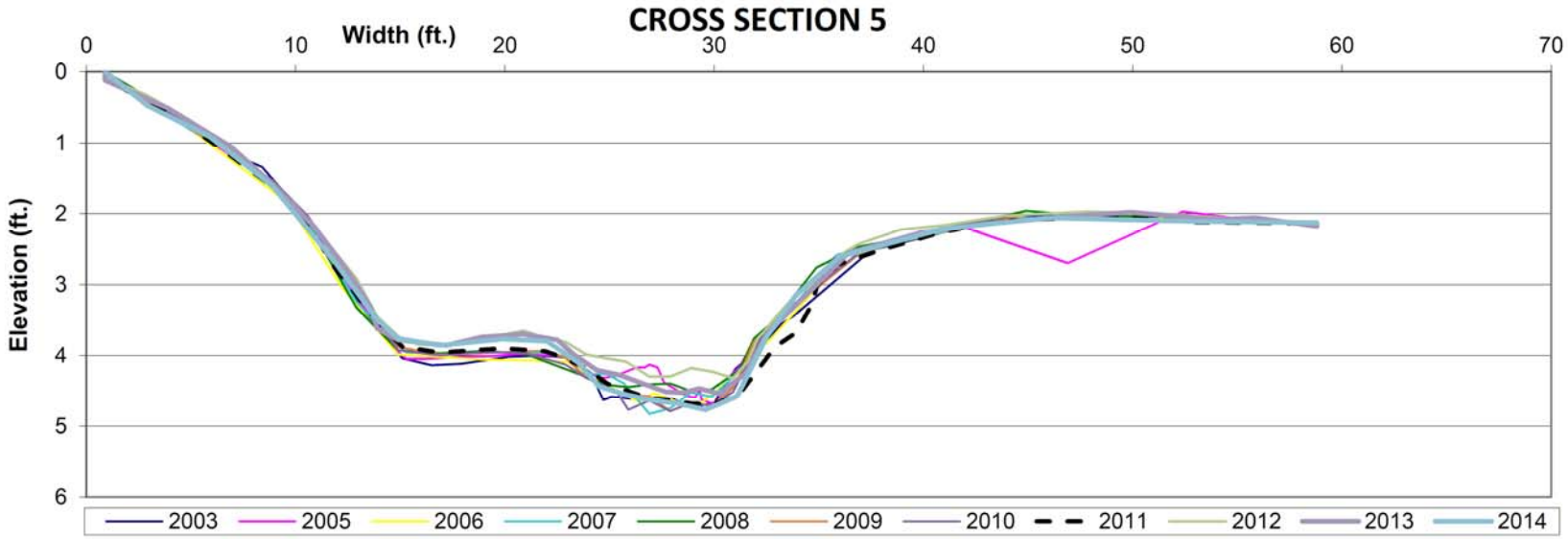


Left Bank View



Right Bank View

2014 Geomorphic Assessment Results	
Bankfull Width (W_{bkf}) (feet)	3.5
Mean Depth (d_{bkf}) (feet)	1.0
Bankfull Cross-sectional Area (A_{bkf}) ($feet_2$)	3.5
Width/Depth Ratio (W_{bkf}/d_{bkf})	3.5
Width of Flood-prone Area (W_{fpa}) (feet)	24.2
Entrenchment Ratio (ER) = W_{fpa}/W_{bkf}	6.9
Channel Materials D_{50} (millimeters)	0.56
Water Surface Slope (S)	0.02
Sinuosity (K) = stream length/valley length	<1.2
Adjustments?	Sin ↑
STREAM TYPE	**E5**





Upstream View



Downstream View

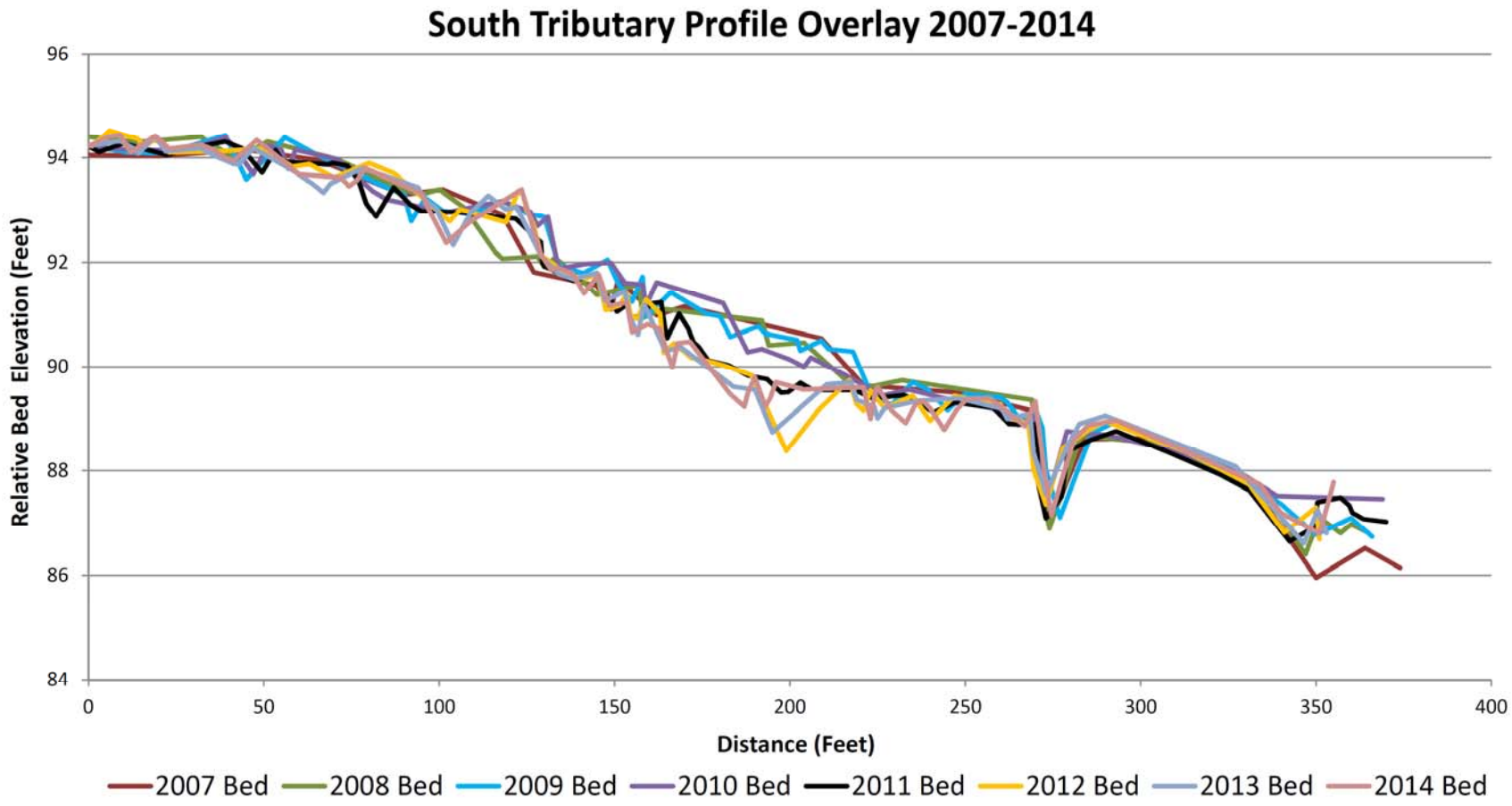


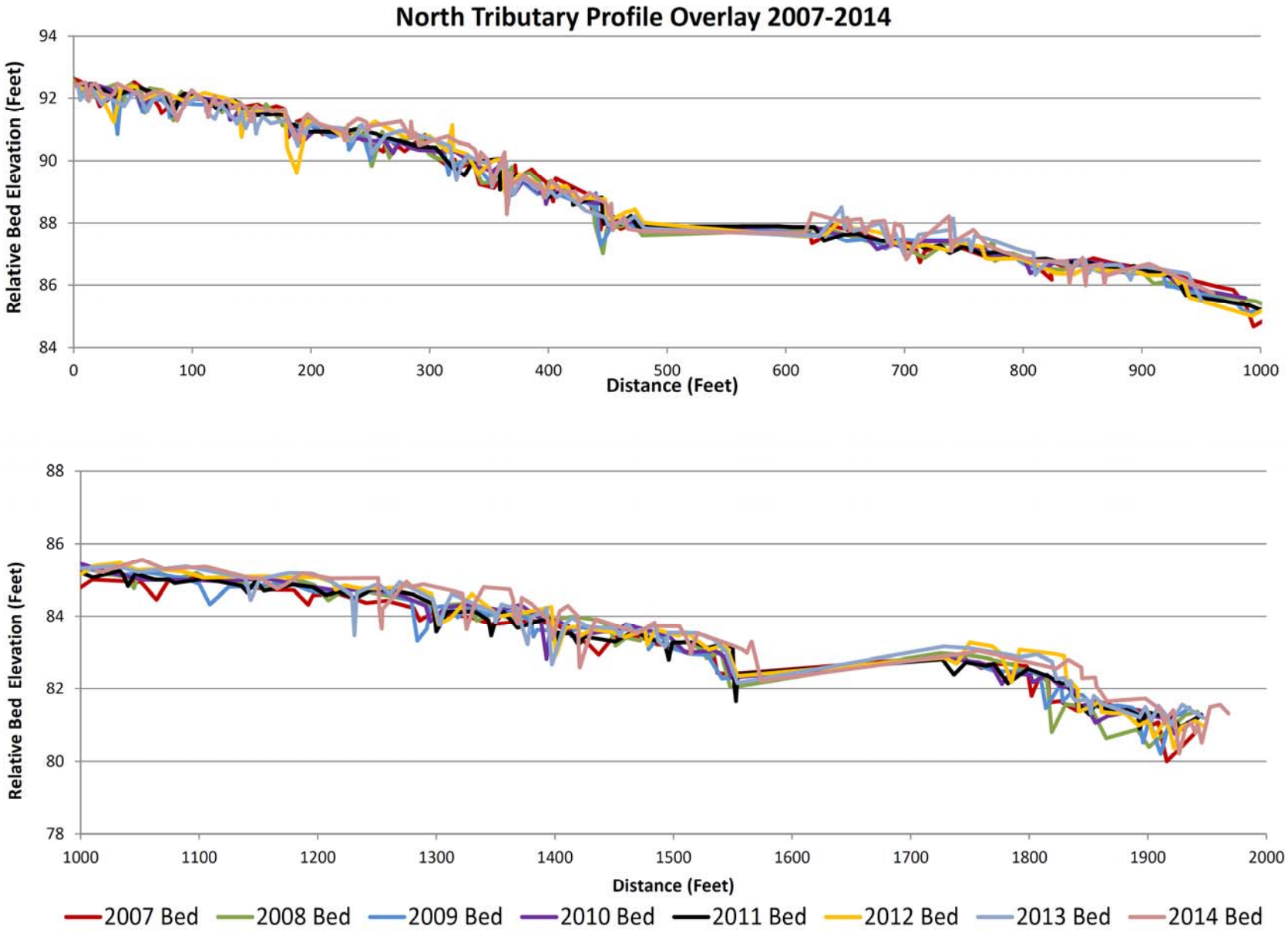
Left Bank View



Right Bank View

2014 Geomorphic Assessment Results	
Bankfull Width (W_{bkf}) (feet)	19.2
Mean Depth (d_{bkf}) (feet)	0.6
Bankfull Cross-sectional Area (A_{bkf}) ($feet_2$)	12.4
Width/Depth Ratio (W_{bkf}/d_{bkf})	29.7
Width of Flood-prone Area (W_{fpa}) (feet)	30.6
Entrenchment Ratio (ER) = W_{fpa}/W_{bkf}	1.6
Channel Materials D_{50} (millimeters)	0.52
Water Surface Slope (S)	0.003
Sinuosity (K) = stream length/valley length	<1.2
Adjustments?	Sin ↑, ER ↓
STREAM TYPE	**F5**


South Tributary Profile Overlay 2007-2014
Relative Bed Elevation (Feet)
96
94
92
90
88
86
84
0
50
100
150
200
250
300
350
400
Distance (Feet)
2007 Bed
2008 Bed
2009 Bed
2010 Bed
2011 Bed
2012 Bed
2013 Bed
2014 Bed


North Tributary Profile Overlay 2007-2014
Relative Bed Elevation (Feet)
94
92
90
88
86
84
0
100
200
300
400
500
600
700
800
900
1000
Distance (Feet)
Relative Bed Elevation (Feet)
88
86
84
82
80
78
1000
1100
1200
1300
1400
1500
1600
1700
1800
1900
2000
Distance (Feet)
2007 Bed
2008 Bed
2009 Bed
2010 Bed
2011 Bed
2012 Bed
2013 Bed
2014 Bed

APPENDIX F

BMP ACRONYMS

LIST OF ACRONYMS

BMP –	best management practice
BR –	bioretention
BS –	baysaver (hydrodynamic structure)
DP –	dry pond
DPW –	department of public works
DW –	dry well
EDSD –	extended detention structure, dry
EDSW –	extended detention structure, wet
ESD MB –	environmental site design, micro bioretention
ESD PERMP –	environmental site design, permeable pavers
ESD –	extended structure dry
ESD SGW –	environmental site design, subsurface gravel wetland
IB –	infiltration basin
IT –	infiltration trench
ITPE –	infiltration trench, partial exfiltration
SW –	swale
USG –	underground storage
WP –	wet pond

ILLICIT DISCHARGE DETECTION AND ELIMINATION

2014 ANNUAL REPORT

PERMIT NUMBER MD0068306

Submitted to

Anne Arundel County
Department of Public Works
2662 Riva Road
Annapolis, MD 21401

Submitted by

Versar, Inc.
9200 Rumsey Road
Columbia, MD 21045

October 2014

TABLE OF CONTENTS

Page

1 INTRODUCTION 1-1

2 METHODOLOGY 2-1
2.1 FIELD INVESTIGATION – OUTFALL INSPECTIONS 2-1
2.2 FIELD INVESTIGATION – ROUTINE SURVEY OF COMMERCIAL AND INDUSTRIAL WATERSHEDS 2-4
2.3 DATA ENTRY 2-4

3 Results 3-1
3.1 PHYSICAL FINDINGS 3-1
3.2 CHEMICAL FINDINGS 3-1
3.3 UPLAND POLLUTANT SOURCE FINDINGS 3-2

4 SUMMARY AND CONCLUSIONS 4-1

5 CORRECTIONS AND ENFORCEMENT ACTIONS 5-1

6 RECOMMENDATIONS 6-1

7 REFERENCES 7-1

APPENDICES

A EROSION AND STRUCTURAL ISSUES SITE-SPECIFIC REPORTS A-1
B ILLICIT CONNECTIONS SITE-SPECIFIC REPORTS B-1
C UPLAND POLLUTANT SOURCES SITE-SPECIFIC REPORTS C-1
D MAPS D-1
E ACCESS DATABASE FOR ILLICIT INSPECTIONS E-1
F COUNTY INSPECTION COMPLIANCE DATABASE REPORTS F-1

LIST OF TABLES

Table **Page**

2-1. Analytes, testing ranges, and action criteria for dry weather discharge screening in Anne Arundel County. 2-3
3-1. Structural issues identified in field in 2014 3-1
3-2. Potential illicit discharges identified in field in 2014 3-2
3-3. Summary of upland pollutant source findings identified in 2014 3-2
4-1. Summary of outfall inspections performed in 2014 4-1
5-1. 2014 Illicit Discharge Detection and Elimination Program: Investigative activities and follow-up actions 5-2

1 INTRODUCTION

Under its National Pollutant Discharge Elimination System (NPDES) Municipal Separate Storm Sewer System (MS4) permit #MD0068306, Part III.E.3., Anne Arundel County is required to implement an inspection and enforcement program to ensure that all discharges to and from the municipal separate storm sewer system that are not composed entirely of stormwater are either permitted by the Maryland Department of the Environment (MDE) or eliminated. The requirements are broken down into five main components: field screening of a minimum of 150 storm drain outfalls annually, conducting routine surveys of commercial and industrial watersheds to find and eliminate pollutant sources, maintaining a program to address illegal dumping and spills, maintaining appropriate enforcement procedures for investigating and eliminating non-permitted discharges, and reporting of all discharge detection and elimination activities.

The County's program uses outfall field screening to locate illegal storm drain connections or other non-permitted dry-weather discharges through the municipal storm sewer systems. Versar, Inc. (with LimnoTech as subcontractor) has a contract with the County to perform the field screening. Where dry-weather effluent from municipal storm sewers is found, it is tested for contaminants. If contamination is found, the program requires that it be eliminated or permitted.

Within each area where dry weather screening of outfalls is performed, Versar and LimnoTech field teams perform routine visual surveys of commercial and industrial drainage areas. Inspectors drive through each commercial and industrial area, looking for signs of pollution. If pollutant sources are present, the site is flagged for review by the County and possible enforcement action.

The Anne Arundel County Department of Inspections and Permits (I&P) maintains an inspection and enforcement program for identifying, reporting, and eliminating non-stormwater discharges into the County storm drain system, which includes illicit dumping and spills. This program is complaint-based with complaints filed by the public, other County inspectors or departments, and Versar/LimnoTech.

In the event of dumping, a spill, or an illegal connection, I&P corrects the situation or refers the matter to MDE for correction. If food waste-related concerns (e.g., overflowing or leaking dumpsters and/or grease collection facilities) are identified, the Anne Arundel County Department of Health (Health) corrects the situation. Both County agencies and MDE maintain appropriate enforcement procedures to ensure correction of these activities.

This report summarizes the outfall and commercial and industrial watershed screening activities conducted by Versar and LimnoTech field teams during the 2014 reporting period. The 2014 reporting period extended from July 2013 through June 2014. Also included are Anne Arundel County-led screening activities and investigations resulting from complaints received during the 2014 reporting period as well as compliance or enforcement updates from illicit discharges, upland pollutant sources, or structural issues reported during the 2014 reporting period.

2 METHODOLOGY

2.1 FIELD INVESTIGATION – OUTFALL INSPECTIONS

Dry weather discharges from illegal sources have a higher likelihood of originating from commercial and industrial land uses (MDE, 1997). The areas targeted for the 2014 field effort included: Hanover, Linthicum Heights, and Glen Burnie. Target outfalls draining portions of commercial and industrial land uses were identified using a GIS desktop analysis. Anne Arundel County's GIS coverage of storm drains and closed storm drain utility grids were used to create base maps for field activities for the targeted areas. Base maps loaded onto a differential GPS unit were used in the field to identify the extent of the systems, locations of outfalls, and contributing businesses or facilities.

Field crews inspected 152 outfalls during the reporting period. The water chemistry and physical condition of each outfall and its surrounding area were recorded in electronic field sheets. Additional details pertaining to each outfall were recorded in the "notes" section of the field sheets. Physical parameters recorded at each outfall included structural condition, deposits, vegetative condition, erosion, floatables, odor, color, and clarity. Each outfall was photographed. The inspection methodologies for these physical parameters are discussed below.

Assessing the structural condition of each outfall involved inspecting the outfall pipe and outfall structure for cracking, spalling, stability, and pipe separations. Often, outfall pipes or structures can be damaged or impaired by large scour holes at the outfall or severe downstream channel erosion that undermines the storm drain outfall. Other conditions such as excessive debris or pipe corrosion can impact the structural integrity of an outfall. When identified, significant conditions at the outfall that were affecting the structural integrity of the storm drain pipe or outfall structure were recorded on electronic field data sheets and reported as a structural issue to the Anne Arundel County Infrastructure Management Division (IMD).

Deposits and stains present in an outfall can indicate the past discharge of a contaminant. If significant deposits or staining were present, the upstream areas were investigated to determine the source.

Vegetative condition is a physical parameter that can be used to indicate excessive nutrients or chemicals/compounds that may be in a discharge that harm or inhibit growth. If unusual vegetative conditions were found, the field team attempted to determine the cause.

The banks of the channel leading away from the outfall were inspected for signs of erosion. Significant erosion within 25 feet of the outfall was recorded.

If dry-weather flow was observed, the discharge was inspected to determine the presence of floatables. The presence of floatables such as trash, sewage, or oil sheen can be evidence of an ongoing illicit connection, poor housekeeping, or a recent spill. If significant floatables were found in the discharge, efforts were made to identify the source.

The odor was recorded at each site where dry weather flow was observed. If a rancid-sour, sewage, gas, etc. odor was present, it was recorded on the field sheets. These odors can indicate an illegal connection or spill. If these odors were detected, the field crew attempted to locate the source.

Algae growth present at each outfall was recorded. The presence of algae growth may indicate nutrients or sewage contained within the discharge. If significant algae growth was found within the storm drain pipe or in the receiving channel, the field team attempted to identify the source.

Similarly, the color and clarity of the discharge can indicate contaminants in the discharge. A cloudy or opaque discharge typically means solids are suspended. The color of a discharge can be a clue to help assess the composition of the discharge, including chemicals or sewage contained within. If the field team found abnormal color or clarity, field teams attempted to identify the source of the potential contaminant.

In some cases, outfalls were either completely or partially submerged as a result of changing deposition patterns at the outfall or in the downstream channel, or its positioning in a tidal area. In these cases, field crews attempted to collect flowing discharge samples from the upstream storm drain structures. Submerged conditions do not necessarily indicate a storm drain structural problem.

Field crews chemically tested dry weather discharge from outfalls using Chemetrics color comparator test kits (detergents, phenols, copper, chlorine, and ammonia), an Extech single analyte tester (fluoride), and a YSI multi-parameter sonde (water temperature and pH). All field screening took place following a minimum of 72-hours of dry-weather. Results of screening tests were compared to criteria presented in Table 2-1 to determine which results should be considered abnormal and warrant further investigation for possible illicit connections.

If an outfall was found with a concentration above the action criteria, it was revisited within 24 hours, but at least four hours after the first test. This requirement was followed to account for any discharge anomalies, and to confirm the results of the chemical test conducted on the first visit.

Any outfall with dry weather flow that was found to have a concentration above any of the action criteria (Table 2-1) during both inspections was recorded as a possible illicit connection. Possible illicit connections also included situations where an observable pollutant had been discharged through a storm drain system, but at the time of inspection the system was not flowing or the discharge did not contain the pollutant. To identify the source of any illicit discharge, the field crews followed the storm drain systems upstream, testing flows through manholes and inlets as necessary and practical, until the source was identified or the discharge could not reasonably be tracked further. Evidence of illicit discharges, including the probable cause(s) was photo-documented.

Table 2-1. Analytes, testing ranges, and action criteria for dry weather discharge screening in Anne Arundel County.

Analyte	Effluent Type Indicated	Action Criterion	Minimum Detection Limit	Instrument Range	Kit or Probe
Chlorine (Cl)	industrial, drinking water, sewage	≥ 0.40 mg/l[(a)]	0.05 mg/l	0 to 5 mg/l	Chemetrics color comparator
Copper (Cu)	industrial	≥ 0.21 mg/l[(a)]	0.05 mg/l	0 to 10 mg/l	Chemetrics color comparator
Phenols	dry cleaning	≥ 0.17 mg/l[(a)]	0.05 mg/l	0 to 12 mg/l	Chemetrics color comparator
Detergents*	sewage, washwater	≥ 0.5 mg/l (residential)[(a)]	0.15 mg/l	0.15 to 3 mg/l	Chemetrics color comparator
Ammonia	sewage	≥ 1.0 mg/l[(b)]	N/A	0 to 300 mg/l	Chemetrics color comparator
Fluoride	Sewage, drinking water	≥ 0.75 mg/l[(c)]	N/A	0 to 10 mg/l	Extech fluoride meter
pH	Industrial washwater	≤ 6.5 or ≥ 8.5	N/A	0 to 14	YSI sonde
Water Temperature	Sewage	N/A	N/A	N/A	YSI sonde

[(a)] MDE 1997
[(b)] CWP 2004 and Pitt 2004
[(c)] Anne Arundel County (2011)
* Field test results may fall below instrument range when using color comparators

Site-specific reports were prepared for each identified storm drain structural issue found in the field and were submitted to the Anne Arundel County MS4 Program Manager. The reports were then typically forwarded to the IMD for correction. In some instances, the identified structural issues can be associated with non-County-owned infrastructure. In these instances the reports were generally forwarded to I&P for follow-up site visits, inspections, and appropriate enforcement. Copies of site-specific reports detailing structural issues identified in the field are included in Appendix A.

Reports of possible identified illicit-connections were prepared and submitted to the Anne Arundel County MS4 Program Manager. The reports were then forwarded to I&P for each possible illicit connection found in the field. I&P performed follow-up site visits and inspections for these reported problems, and pursued enforcement action as appropriate. Copies of the illicit-connection reports detailing the findings by Versar and LimnoTech are included in Appendix B.

During the illicit discharge outfall investigations, many storm drain outfalls were found that were not on the County's infrastructure mapping. A GPS point was recorded at the locations of these new outfalls. The locations of all previously unmapped outfalls found during the field investigations will be forwarded to the County to update the County's GIS coverage.

No complaint-driven outfalls were provided to field teams by the County for inspection during the 2014 reporting period.

2.2 FIELD INVESTIGATION – ROUTINE SURVEY OF COMMERCIAL AND INDUSTRIAL WATERSHEDS

Commercial and industrial land uses were identified on the field maps using the Maryland Department of Planning 2010 land cover GIS shapefile to help facilitate the surveys of these properties and to discover and eliminate any upland pollutant sources. Field crews inspected commercial and industrial land uses within the same target areas as the outfall screening field effort. Each commercial and industrial property was visited in these areas to identify storm drain systems and document upland pollutant sources. Upland pollutant source identification includes evidence of spills or dumping, poor housekeeping, poor maintenance of drainage systems, or other unpermitted activity. Any upland pollutant source identified by field crews was recorded on electronic field data sheets and photo-documented.

Evidence of upland pollutant sources identified by Versar and LimnoTech was reported to the Anne Arundel County MS4 Program Manager. These reports were then typically forwarded to I&P or Health as needed for correction. Site-specific reports were prepared for any site that the Versar and LimnoTech field teams determined required further investigation or correction. Copies of these reports are included in Appendix C.

As part of the County's program to address spills and illegal dumping, the County received complaints from residents or identified possible problems during regular field activities. No sites were provided by the County during the 2014 reporting period for Versar to investigate.

2.3 DATA ENTRY

All of the information entered into the outfall inspection field sheets was transferred into an ACCESS database. This database was prepared in the format required by MDE, and is included in Appendix E. The database contains an entry for each visit to an outfall site. Any outfall that had dry-weather flow containing a high concentration of a contaminant was re-screened to verify the results of the initial test. The data gathered during the second visit was recorded in the database as a separate entry. The database format specified by the County's permit provides several options for each of the following: structural condition, deposits, vegetative condition, erosion, floatables, odor, color, and clarity. Any specific details or findings in the field that did not match one of these options were described in the "notes" field to be used as a guide for future maintenance activities.

Two maps are included in Appendix D that show the locations of screened outfalls in 2014. One of the maps shows potential upland pollutant sources identified in 2014. The second map shows all outfalls screened in 2014, and structural/erosional issues identified by field crews.

3 RESULTS

3.1 PHYSICAL FINDINGS

Seven physical issues (Table 3-1) that significantly affected stormwater infrastructure were identified by Versar and LimnoTech within the targeted areas of Anne Arundel County during the 2014 reporting period. Site-specific reports on these sites can be found in Appendix A.

Table 3-1. Structural issues identified in field in 2014

Location	Town	Outfall ID	Inspection Date	Issue
510 McCormick Drive	Glen Burnie	N/A	5/6/2014	Collapsing asphalt near grate inlet
705 East Ordnance Road	Glen Burnie	N04H2O015	5/15/2014	Outfall is blocked by sediment
1300 Concourse Drive	Linthicum Heights	N/A	5/27/2014	Cracked inlet grate
7201 Standard Drive	Hanover	N/A	6/16/2014	Collapsed pavement and associated curb
1591 West Nursery Road	Linthicum Heights	N/A	7/7/2014	Corner of curb inlet is undermined
5179 Raynor Avenue	Linthicum Heights	K02C6O013	7/7/2014	Blocked outfall
832 Oregon Avenue	Linthicum Heights	N/A	7/7/2014	Damaged asphalt and gutter pan bordering an inlet

3.2 CHEMICAL FINDINGS

Of the 152 outfalls screened by Versar and LimnoTech, 24 had dry-weather flow. Where possible at each of these outfalls, a sample was collected and tested for phenols, chlorine, copper, detergents, ammonia, and fluoride. Air and water temperature and pH were also recorded. Of the screened outfalls containing dry-weather flow, six yielded a result above the action criteria limit for one or more of the tested contaminants. Three of the six outfalls had concentrations that were above at least one action level when retested (Table 3-2), and one outfall exhibited above action criteria concentrations for two retests. Site-specific reports for these three outfalls can be found in Appendix B.

All of the 159 inspection results (152 initial tests and 7 retests) are included in the ACCESS database that is found in Appendix E. Each site visit to these outfalls is recorded as a separate entry.

Table 3-2. Potential illicit discharges identified in field in 2014

Outfall	Date of Test	Test Description	Chlorine (mg/l)	Copper (mg/l)	Phenols (mg/l)	Detergents (mg/l)	Ammonia (mg/l)	Fluoride (mg/l)	pH
I03E8O003	5/14/14	Initial	0	0	0	0.15	0.2	8.6[a]	7.45
	5/15/14	Retest	0	0	0.05	**0.5**	0.1	0.3	7.41
J04A7O026NEW2	6/3/14	Initial	0.2	0	0	0	0	N.T.	**10.21**
	6/4/14	Retest	0.05	0	0	0	0	0	**10.60**
J04C1O018	5/20/14	Initial	0.01	0	0	**0.6**	**25**	**1**	7.93
	5/21/14	Retest	0.01	N.T.	N.T.	**2.5**	**25**	**0.9**	8.19
	5/27/14	Retest[b]	N.T.	N.T.	N.T.	**1.5**	**10**	N.T.	7.95

Bold = Exceeds (or falls below for pH) action criteria
N.T. = not tested
[a] Fluoride result high due to mis-calibration.
[b] Outfall retested a second time as part of I&P investigation

3.3 UPLAND POLLUTANT SOURCE FINDINGS

Twenty-four upland pollutant sources were identified by Versar and LimnoTech during the routine survey of the commercial and industrial sites within the targeted areas of Anne Arundel County. Table 3-3 summarizes the results of the upland pollutant source investigations. Site-specific reports on these sites can be found in Appendix C.

Table 3-3. Summary of upland pollutant source findings identified in 2014

Address	Town	Business Name	Inspection Date	Stream Buffer Dumping	Poor Housekeeping (solid waste)	Poor Housekeeping (liquid waste)
220 8th Avenue, NW	Glen Burnie	Multiple	4/21/2014		X	
7400 Block Baltimore & Annapolis Blvd.	Glen Burnie	B&A Snowball	4/21/2014	X		
7548 Old Telegraph Rd.	Glen Burnie	Morningside House of Friendship	4/22/2014		X	
6608 Governor Ritchie Highway	Glen Burnie	AMF Bowling Alley	5/5/2014		X	
6717 Governor Ritchie Highway	Glen Burnie	Target	5/5/2014		X	
6637 Governor Ritchie Highway	Glen Burnie	Chuck E. Cheese's	5/5/2014		X	
6617 Ritchie Highway	Glen Burnie	Hampton Inn	5/5/2014		X	
6721 Chesapeake Center Dr.	Glen Burnie	Walmart	5/5/2014		X	
530 McCormick Drive	Glen Burnie	Multiple	5/6/2014		X	
7502 Connelley Dr. Unit 112	Glen Burnie	BWI Plaza Domino's Pizza	5/7/2014			X
1350 Dorsey Road	Glen Burnie	Cantina Mamma Lucia	5/7/2014		X	

Table 3-3. Summary of upland pollutant source findings identified in 2014 (Continued)

Address	Town	Business Name	Inspection Date	Stream Buffer Dumping	Poor Housekeeping (solid waste)	Poor Housekeeping (liquid waste)
7748 Ritchie Highway	Glen Burnie	Mission BBQ	5/15/2014		X	
6319 Ritchie Highway	Glen Burnie	Gavigan's Furniture	5/15/2014		X	
597 East Ordnance Road	Glen Burnie	PetSmart	5/15/2014		X	
near 1745 West Nursery Road	Linthicum Heights	Hilton BWI	6/2/2014		X	
7226 Parkway Drive	Hanover	Belair Produce	6/16/2014			X
1591 West Nursery Rd	Linthicum Heights	Hoyt's Cinema 14	7/7/2014		X	
123 Crain Highway North	Glen Burnie	H&R Block	7/7/2014		X	
550 Crain Highway North	Glen Burnie	Multiple	7/7/2014		X	
706 Crain Highway North	Glen Burnie	Custom Kitchen Countertop	7/7/2014		X	
18 Ordnance Road	Glen Burnie	Ledo Pizza	7/7/2014			X
7400 Ritchie Highway	Glen Burnie	CVS	7/25/2014		X	
7546 Ritchie Highway	Glen Burnie	Family Dollar #6625	7/25/2014		X	
7730 Ritchie Highway	Glen Burnie	Home Goods	7/25/2014		X	

4 SUMMARY AND CONCLUSIONS

As required in Condition III.E.3.a, Illicit Discharge Detection and Elimination, of Anne Arundel County's NPDES municipal stormwater permit #MD0068306, Versar and LimnoTech field crews visited 152 outfalls for the 2014 reporting period. The results of these visits are recorded in the ACCESS database included in Appendix E.

Table 4-1 shows a physical and chemical parameter summary of the 152 outfalls inspected for the 2014 reporting period. Only the results from the first visit of rescreened outfalls are included in the table.

Table 4-1. Summary of outfall inspections performed in 2014

Condition	Number of Outfalls
Observable Flow	24
Chlorine present	8
Detergents present	19
Ammonia present	2
Fluoride present	22
Excessive vegetation	10
Algae growth	12
Cloudy water	1
Opaque water	2
Outfall damage	13
Concrete cracking	4
Concrete spalling	4
Sediment deposits	64
Submerged	2
Moderate erosion	14
Severe erosion	1
Oil sheen	1
Trash present	21
Oil/Gas/Sulfur/Sewage odor	3
Rancid/sour odor	3
Other than Clear color	3

*Note: Several sites had multiple findings, resulting in an overall total greater than 152.

Seven stormwater structures exhibiting structural or erosion problems were identified by Versar and LimnoTech within the targeted areas of Anne Arundel County for the 2014 reporting period. A summary of these findings, and the corrective actions associated with these sites, is included in Table 5-1 and in Appendix A.

Of the outfalls screened by Versar and LimnoTech containing dry-weather flow, three yielded results above the action criteria for tested contaminants within the targeted areas of Anne

Arundel County for the 2014 reporting period. A detailed summary of these findings, and the corrective actions associated with this site, is included on Table 5-1 and in Appendix B.

As required in Condition III.E.3.b, commercial and industrial sites were investigated to determine if any upland pollutant sources were present within the target areas. Twenty-four upland pollutant sources were identified by Versar and LimnoTech during these surveys for the 2014 reporting period. A detailed summary of these findings, and the corrective actions associated with these sites, is included in Table 5-1 and in the Appendix C.

To comply with Condition III.E.3.c, Anne Arundel County maintained an environmental hotline to provide the residents of the County a method for reporting environmental-related complaints, including illegal dumping and spills. Environmental hotline complaints typically involve sediment control issues, illegal grading activities, or potential violations of Critical Area regulations. In the 2014 reporting period, I&P received 32 complaints that were applicable to the NPDES MS4 requirements for IDDE, including those forwarded to the County by Versar. All of these complaints are included in Appendix F, which is a summary of the compliance cases that fall under the IDDE program. In the event that illegal dumping or a spill is reported, County personnel immediately mobilize to correct the problem, or refer it to MDE.

As required by Condition III.E.3.c and d, Anne Arundel County used appropriate enforcement procedures to correct any illicit discharge, upland pollutant source, spill, or illegal dumping activities identified within the County. The Corrections and Enforcement Actions section of this report below discusses follow-up actions in further detail for the problems identified during the illicit discharge inspections and routine survey of commercial and industrial watersheds (see Table 5-1 and Appendix F).

Condition III.E.3.e of the County's NDPES municipal stormwater permit requires that all efforts to comply with the illicit discharge detection and elimination requirements are documented and submitted with the County's Annual Report. This report was prepared to comply with this permit requirement. As required, a Recommendations section is included below to document the proposed changes to the program for subsequent efforts.

5 CORRECTIONS AND ENFORCEMENT ACTIONS

As presented in Table 5-1, all illicit connections and upland pollutant sources (e.g., leaking dumpsters) identified during the 2014 investigations were forwarded to either I&P or to the County Health Department. Structural issues were forwarded to IMD or Maryland State Highway Administration for appropriate action.

I&P used a phased approach to eliminating and enforcing illicit storm drain discharges. Phase I Enforcement consists of a Violation Notice sent by first class and certified mail to the property owner. The Phase 1 Violation Notice includes an explanation of the violation and requests a written commitment to immediately cease the illicit discharge. Upon written receipt of the commitment to comply, the Department monitors the site for up to 60 days. If compliance is maintained, the violation is considered abated. Should the Department fail to receive written commitment to comply, or if further violations are observed, the Department proceeds to Phase 2 enforcement. At the Phase 2 enforcement level, the Department posts a Stop Work Order on the property and issues a $1000 civil citation to the property owners. The civil citation must be paid and the violation abated or the civil citations are litigated in court.

For the 2014 reporting period all illicit discharge complaints and referrals were successfully enforced by the Department without the need for any referrals to MDE.

Appendix F contains inspection compliance database reports from the I&P Complaint Tracking System for each identified illicit connection, upland pollutant source, or environmental hotline complaint that is relevant to this report. These reports detail County efforts in determining if remediation is necessary and if action was taken.

Table 5-1. 2014 Illicit Discharge Detection and Elimination Program: Investigative activities and follow-up actions					
Survey Date	**Survey Date**	**Survey Date**	**Survey Date**	**Survey Date**	**Survey Date**
April 21, 2014	E-2014-228	7400 Block B&A Blvd.	The IDDE field team identified a dumpsite in the floodplain of Sawmill Branch during the joint field calibration day. The team was attempting to locate an outfall at the rear of the property and discovered what appeared to be freshly dumped soil and material on the northern periphery of the parking area. The name and address of the property could not be immediately ascertained, however it appeared that the building in the rear is an operating snowball stand and the building adjacent to the road had been a bait and tackle shop. Additionally, at the rear of the premises were two areas of stored and discarded material; however, the material was on pervious surfaces located approximately 20 meters from the stream. The material consisted of five-gallon buckets and other articles of plastic. An inspection by staff from Inspections and Permits (I&P) determined that site conditions did not reflect an illicit stormdrain discharge or a violation of the County's Grading or Stormwater Codes. However, the case was referred to Zoning Enforcement. The dumping observed had already been partially cleaned up at the time of the inspection.	May 8, 2014: Received from Versar. May 12, 2014: Sent to I&P. May 13, 2014: Field inspection performed by I&P. Referred to Planning and Zoning for follow up on dumping issue. Reported resolved by P&Z. August 19, 2014: Follow up sent to I&P August 22, 2014: Property owner corrected issue. CASE CLOSED.	RESOLVED
April 21, 2014	NA	220 8th Avenue, NW	While conducting outfall screening in the target area, the IDDE field team noted a Waste Management roll-away dumpster, uncovered, with debris exceeding capacity in the parking area of the subject property. The field team documented the condition with photo-graphs. The exposure of debris above the rim of the container, and debris deposited on the ground alongside the container, may allow trash to blow off-site or leak potentially contaminating contents onto surfaces that could lead to adjacent storm drain inlets or open water. The field team also noted that the main building on the property was undergoing renovation and site conditions may be temporary. After notification by the HD, the property owner corrected the issue and the case was closed.	June 4, 2014: Received from Versar. June 6, 2014: Reported to HD. August 15, 2014: Follow up sent to HD. August 19, 2014: HD corrected issue. CASE CLOSED.	RESOLVED
April 22, 2014	NA	7548 Old Telegraph Road	The IDDE field team documented a waste management issue when traveling to a target outfall on the subject property. The area at which the problem was found is up-gradient of a stormwater management area which receives flow from the impervious surfaces of the facility. Staff found a waste grease container with wet staining adjacent to it. The dumpsters were found to be open. The waste grease spillage and the open dumpster may cause pollutants to be washed to the storm sewer network and eventually to the stormwater pond and surface waters. A drum of liquid material was also noted in the dumpster stall area. An inspection by the HD resulted in the issues being corrected and the case was closed.	May 8, 2014: Received from Versar May 12, 2014: Sent to HD August 15, 2014: Follow up sent to HD. August 19, 2014: HD corrected issue. CASE CLOSED	RESOLVED

Table 5-1. (Continued)

Survey Date	Survey Date	Survey Date	Survey Date	Survey Date	Survey Date
May 5, 2014	NA	6721 Chesapeake Center Drive	The IDDE field team screened outfalls in the vicinity of the Walmart store at the above address. While investigating the immediate area for hotspot concerns, staff noticed a large number of shopping carts containing trash and discarded material lined up against the rear of the building. The field team photo-documented the condition and also the presence of bales of cardboard placed near a storm drain inlet. The Health Department (HD) inspected the site soon after this report was received from the IDDE team. The HD found that the trash had been removed. No additional violations were observed and the case was closed.	May 8, 2014: Received from Versar May 12, 2014: Sent to HD May 16, 2014: HD inspection found trash removed and no other violations. CASE CLOSED.	RESOLVED
May 5, 2014	NA	6608 Governor Ritchie Highway	While conducting outfall screening in the target area, the IDDE field team discovered a large, uncovered pile of mulch, extending across several parking spaces in the parking area behind the bowling alley at the above location: Governor Ritchie Highway, between Shelly Road and West Ordnance Road. The field team documented the condition with photographs. The placement of mulch on an impervious surface introduces the risk of distribution, by wind or rain, of mulch particles and associated nutrients which could drift into adjacent storm drain inlets or open water. Upon discussion with both I&P and the HD, it was determined that temporary placement of mulch is not regulated.	June 4, 2014: Received from Versar. June 6, 2014: Reported to HD. Not regulated by HD or I&P CASE CLOSED	RESOLVED
May 5, 2014	NA	6617 Governor Ritchie Highway	While conducting outfall screening in the target area, the IDDE field team noted debris and food alongside a Waste Management dumpster in the parking area of the subject property. The field team documented the condition with photographs. Debris (cardboard and plastic) that is not properly stored in a closed container could be transported to nearby storm drain inlets and either enter or clog the inlet. If the debris includes material that can leach contaminants or concentrated substances to the impervious surface, it may also be transported to the storm drain inlet in storm runoff. Food may introduce nutrients and contaminants to the storm system through a nearby inlet. There is also a concern for attracting pests to the site. After follow up by the HD, the area was cleaned up.	June 4, 2014: Received from Versar. June 6, 2014: Reported to HD. August 15, 2014: Follow up sent to HD. August 19, 2014: HD corrected issue. CASE CLOSED.	RESOLVED
May 5, 2014	NA	6717 Governor Ritchie Highway	While conducting outfall screening in the target area, a LimnoTech and Versar field team discovered a full, uncovered roll-off dumpster with scattered debris surrounding it alongside the Target building at the above location: Ritchie Highway at Vernon Avenue. The field team documented the condition with photographs. The exposure of debris at the rim of the container, and debris deposited on the ground alongside the container, may allow trash to blow off-site or leak potentially contaminating contents onto surfaces that could lead to adjacent storm drain inlets or open water. After follow up by the HD, the area was cleaned up.	June 4, 2014: Received from Versar. June 6, 2014: Reported to HD. August 15, 2014: Follow up sent to HD. August 19, 2014: HD corrected issue. CASE CLOSED.	RESOLVED

Table 5-1. (Continued)

Survey Date	Survey Date	Survey Date	Survey Date	Survey Date	Survey Date
May 5, 2014	NA	6637 Governor Ritchie Highway	While conducting outfall screening in the target area, the IDDE field team discovered a large, uncovered pile of mulch, extending across several parking spaces in the parking area behind the Chuck E. Cheese's restaurant at the listed address. The field team documented the condition with a photograph. The placement of mulch on an impervious surface introduces the risk of distribution, by wind or rain, of mulch particles and associated nutrients which could drift into adjacent storm drain inlets or open water. No action was taken as such mulch piles are not against County regulations.	June 4, 2014: Received from Versar. June 6, 2014: Reported to HD. Not regulated by HD or I&P CASE CLOSED	RESOLVED
May 6, 2014	E-2014-229	510 McCormick Drive	While conducting outfall screening in the target area, the IDDE field team noted a hole in the asphalt near a storm drain inlet in the south parking area at the property of interest's address. Upon closer inspection, the interior of the catch basin could be clearly seen through the open hole. While no vehicles were parked in this area, the weakened asphalt could create a falling hazard for passers-by or cause damage to vehicles. If there is an erosion problem, the condition could worsen. I&P staff determined that there is a stormwater maintenance agreement with the County for this facility requiring the property owner to perform regular maintenance in accordance with that agreement. A meeting on-site was held with the property manager, who assured the inspector that this matter would be quickly corrected.	May 8, 2014: Received from Versar. May 12, 2014: Sent to I&P. Complaint opened. May 29, 2014: Inspection by I&P confirming issue. August 5, 2014: I&P follow up meeting with property manager to discuss issue. August 19, 2014: WPRP sent follow up sent to I&P. August 22, 2014: Investigation and follow up on-going. September 3, 2014: Case pending. CASE OPEN.	UNRESOLVED
May 6, 2014	NA	530 McCormick Drive	The IDDE field team identified two open dumpsters, one of which was overflowing with trash, at the subject property. Nearby, two recycling containers were overflowing with recycling material. Both problems were noted in the north, rear portion of the parking area of the above address. Both conditions may cause trash to blow out of containment and into the stormwater management area, storm infrastructure, or stream located on the north side of the parking lot. Two businesses nearby the problem were identified as Terminix and Vision Technologies. The issues were corrected after inspection by HD staff.	May 8, 2014: Received from Versar May 12, 2014: Sent to HD August 15, 2014: Follow up sent to HD. August 19, 2014: HD corrected issue. CASE CLOSED.	RESOLVED
May 7, 2014	NA	7502 Connelley Drive	While conducting outfall screening in the target area, the IDDE field team noted a Valley Proteins container, intended for the disposal of waste kitchen grease, with an open lid in the parking area of the subject property. The field team documented the condition with a photograph. An open container of grease poses a concern if rainwater enters the container and overflows, distributing contaminants to adjacent impervious surfaces and eventually to storm drain inlets or open water. There is also a concern for attracting pests to the site. After follow up by the HD, the area was properly cleaned.	June 4, 2014: Received from Versar. June 6, 2014: Reported to HD. August 19, 2014: HD corrected issue. CASE CLOSED.	RESOLVED

Table 5-1. (Continued)

Survey Date	Survey Date	Survey Date	Survey Date	Survey Date	Survey Date
May 7, 2014	NA	1350 Dorsey Road	While conducting outfall screening in the target area, the IDDE field team noted debris alongside a Waste Management dumpster in the parking area of the subject property. The field team documented the condition with a photograph. Debris (cardboard and plastic) that is not properly stored in a closed container could be transported to near-by storm drain inlets and either enter or clog the inlet. If the debris includes material that can leach contaminants or concentrated sub-stances to the impervious surface, that may also be transported to the storm drain inlet with rainwater. After follow up by the HD, the property owner corrected the issue and the case was closed.	June 4, 2014: Received from Versar. June 6, 2014: Reported to HD. August 15, 2014: Follow up sent to HD. August 19, 2014: HD corrected issue. CASE CLOSED.	RESOLVED
May 14, 2014	E-2014-252	1300 Concourse Drive (IDDE)	The IDDE field team conducted site visits to several targeted outfalls in the vicinity of Concourse Drive on May 14th. At 1:45 p.m., the field team screened outfall I03E8O003, which discharges to a wet pond and was partially submerged. A visual inspection of the 1st manhole up from the outfall in the middle of Concourse Dr. showed flowing water. A faint rancid odor was noted when the water sample was collected at the outfall, with the results above action the action level for fluoride and elevated for detergents and ammonia. On the following day, the field team retested water obtained from the flowing pipe, rather than the stagnant water at the outfall. The retest yielded results that caused the field staff to trace the source of the flow. During trackdown, the field team tested flowing water in a manhole located in the southeast entrance driveway of 1302 Concourse Drive. Again, testing results showed high parameters of interest. Field staff also noted white residue on the interior surface of the storm drain pipe and a stronger odor. The field team followed the odor, whitish residue, and flowing water through the curb inlets on the northern edge of 1300 Concourse Dr. (Embassy Suites) to the end of the system, which terminated in a curb inlet located down-gradient from the hotel loading dock. Within this curb inlet, the field team found some standing gray water with a strong foul odor. Testing of the water again yielded elevated detergents and ammonia concentra-tions. A general inspection of the area around the curb inlet and of the loading dock area showed no signs of active illicit discharge activi-ties. The field crew noted and photodocumented conditions of the dock area as the curb inlet grate was generally untidy, with some staining of the pavement from the direction of the loading dock towards the curb inlets readily apparent. Some residual puddled grey water was also found in the area, but staff couldn't discern the source. Field crew noted the condition of the loading dock to be messy, with clear signs of regular discharge (i.e.- a stain line to the drain and apparent residual discharge) from a large rollaway dumpster. Two standard-sized dumpsters were also placed beside the dock; they were over-flowing with cardboard and some trash was noted around them. A waste cooking oil vat was also noted beside the dock but appeared to be in good condition. A mop pail was also present on the loading dock, suggesting that hotel staff may be disposing of wash water onto the parking lot.	May 16, 2014: Received from Versar May 30, 2014: Site visit by I&P staff and Versar staff. Identified as a cross connection between sanitary sewer and stormdrain. August 19, 2014: Follow up sent to I&P. August 23, 2014: No cross connection here, just a leaking dumpster and improper disposal of mop water. August 29, 2014: Follow up with Hotel by I&P inspector. Status of dumpster replacement questioned. Trash around existing dumpster observed; hotel instructed to perform cleanup. September 3, 2014: Status inquiry sent to I&P regarding dumpster replacement. September 5, 2014: Update from I&P states that dumpster not replaced at this time. CASE OPEN	UNRESOLVED

Table 5-1. (Continued)

Survey Date	Survey Date	Survey Date	Survey Date	Survey Date	Survey Date
			An inspection by I&P found that the source of the discharges characterized above came from used mop water being regularly disposed of on the loading dock and from a leaking dumpster. Hotel staff were counseled to dispose of all mop water into floor drains connected to the sanitary sewer. The dumpster for the hotel is slated for replacement.		
May 15, 2014	NA	597 East Ordnance Road	While conducting outfall screening in the target area, the IDDE field team noted multiple large pieces of furniture and building materials on the ground alongside an open, and possibly full, AmeriWaste dumpster and scattered broken pallets and loose debris behind the adjacent business at the subject property. The field team documented the condition with photographs. Furniture and building materials exposed to the elements may include materials that can leach contaminants to the impervious surface that could be transported to the storm drain inlet in storm runoff. Large, bulky items left in a parking lot can also trap light debris that drifts into them via wind or water. The loose boards and nails associated with the scattered and broken pallets present hazards to motorists and pedestrians. The loose cardboard from either area may float or be blown toward storm drain inlets and block flows. The HD instructed the property owner to correct the issue.	June 13, 2014: Received from Versar June 25, 2014: Reported to HD August 15, 2014: Follow up sent to HD. August 19, 2014: HD corrected issue. CASE CLOSED.	RESOLVED
May 15, 2014	NA	7748 Ritchie Highway	While conducting outfall screening in the target area, the IDDE field team noted debris on the ground alongside an open, and possibly full, Bay Area Disposal dumpster behind the restaurant at this address. The field team documented the condition with a photograph. Debris (cardboard, plastic bottles, metal lids, and bagged trash) that is not properly stored in a closed container could be transported to nearby storm drain inlets and either enter or clog the inlet. If the debris includes material that can leach contaminants or concentrated sub-stances to the impervious surface, it may also be transported to the storm drain inlet in storm runoff. Food, if present in the debris, may introduce nutrients and contaminants to the storm system through a nearby inlet. There is also a concern for attracting pests to the site. Corrective action was required by the HD and the case was closed.	June 13, 2014: Received from Versar June 25, 2014: Reported to HD July 2, 2014: HD reports that site has been cleaned up. CASE CLOSED.	RESOLVED
May 15, 2014	NA	6319 Ritchie Highway	While conducting outfall screening in the target area, the IDDE field team discovered a large, uncovered pile of mulch, extending across several parking spaces in the parking alongside the Gavigan's Home Furnishings store at the following location: Governor Ritchie Highway, between 6th Avenue and Georgia Avenue, NE. The field team documented the condition with a photograph. The placement of mulch on an impervious surface introduces the risk of distribution, by wind or rain, of mulch particles and associated nutrients which could drift into adjacent storm drain inlets or open water. Upon consultation with the HD and I&P, it was learned that these mulch piles are apparently unregulated under the stormwater ordinance.	June 13, 2014: Received from Versar June 25, 2014: Reported to I&P Mulch piles like these are unregulated by HD or I&P CASE CLOSED.	RESOLVED

Table 5-1. (Continued)

Survey Date	Survey Date	Survey Date	Survey Date	Survey Date	Survey Date
May 15, 2014	E-2014-469	705 East Ordinance Road	While conducting outfall screening in the target area, the IDDE field team discovered an outfall (N04H2O015) almost completely blocked by hard sediment. The outfall drains a parking lot to a stormwater pond behind the building at the subject location. The photograph, taken by the field crew on May 15, shows some standing water near the outlet. A thin, top layer of algae downstream of the pipe opening suggests that water may continue to trickle through the pipe; the field crew reported that the outlet was not draining on the day of the field visit. Sluggish drainage of the parking lot in this corner may pose a hazard for motorists and pedestrians with accumulating debris, leaves, standing water, and ice. An inspection by the HD found a number of serious deficiencies that are now slated for correction. A re-inspection is scheduled for September 29, 2014.	August 22, 2014: Received from Versar. August 22, 2014: Sent to I&P. August 29, 2014: Site inspection of stormwater pond noted a number of issues that require correction, including sediment removal, grass cutting, securing access, and other items. Property owner informed. Inspection planned for 9/29/14. CASE OPEN	UNRESOLVED
May 20, 2014	E-2014-271	1099 Winterson Road	On May 20th, the IDDE field team conducted site visits to several targeted and non-targeted outfalls in the vicinity of International Drive and Winterson Road. At 3:25 p.m., the field team screened outfall J04C1O018, which is a non-targeted outfall in a commercial area. The outfall orifice was dry, as was the concrete apron. The apron was coated with a paper-like material, which field staff suspected was floatable material from sanitary sewerage. Additionally, the area had a rancid-sour smell, similar to a portable toilet. Just up the network from the outfall, staff found flowing water, which was exiting the pipe between pipe sections and bypassing the end-pipe piece. On the plunge pool below the outfall was a film coating; the outfall apron was also suspended above the plunge pool. The screening parameters tested above action levels for fluoride, detergents, and ammonia. On the following day, the field team retested the water in the pipe, again with results above action levels. Staff initiated trackdown procedures. The flow, however, was not as obvious as they traveled up the network in the direction of a car wash. Staff reported the illicit discharge, without definite source, to the Environmental Hotline on May 21st. After the inconclusive result of the trackdown and the conclusion of the field day, field staff realized that they had inadvertently missed a portion of the network during trackdown. They had tracked the flow only along the southern branch of the network and that a northern branch had not been checked. The northern branch collected drainage from a Hyatt hotel. Working together, I&P inspectors and the IDDE team determined that the source of the illicit discharge was the Hyatt hotel. Upon further detailed inspection, I&P discovered a cross connection of the sanitary lines of several rooms to the hotel's roof drainage system. Additionally, the pool's backwashing system was also illegally connected to the stormdrain system. The inspector ordered corrective action to begin immediately and the Hotel staff and management were cooperative. The rooms in question were closed, with the toilet supply lines removed to ensure they could not be used. Repairs began and were concluded on or around August 27, 2014. Repairs to the pool backwash system were completed in September.	May 21, 2014: Reported to Hotline by Versar. May 23, 2014: Received from Versar August 19, 2014: Follow up sent to I&P. August 22, 2014: Work on-going. Grey water lines have been disconnected. Pool backwash system disconnection underway. Source of outfall flow is 940 International Drive. Outfall is located at 1099 Winterson Road. August 27, 2014: Cross connection of rooms to sanitary sewer corrected. Pool backwash system repairs underway. September 22, 2014: Pool backwash system has been separated from the storm drain system. While all issues appear to have been corrected, case still considered unresolved as additional testing by I&P will continue to ensure all issues have been resolved. September 30, 2014: Continued re-inspections have shown no violations. CASE CLOSED.	RESOLVED

Table 5-1. (Continued)

Survey Date	Survey Date	Survey Date	Survey Date	Survey Date	Survey Date
May 27, 2014	NA	1300 Concourse Drive (infrastructure)	While conducting outfall screening in the target area, the IDDE field team noted a cracked grate over a storm drain inlet in the north parking area at the subject property. There is a concern that the weight of a vehicle parked over the crack may damage the grate further. If significantly damaged, the grate may not be strong enough to support a vehicle. A partially opened inlet would pose a threat to pedestrians, cyclists, and motorists. After consultation with MPD and I&P, it was determined that the County does not regulate such minor infrastructure issues. However, I&P discussed the issue with staff at the hotel on site and the case was closed.	June 13, 2014: Received from Versar June 25, 2014: Reported to Infrastructure August 19, 2014: Follow up sent to AW. September 4, 2014: Follow up sent to AW. September 22, 2014: Based on correspondence with AW, this issue sent to I&P for follow up. September 29, 2014: I&P doesn't generally regulate such minor infrastructure issues. However, I&P contacted hotel engineer to let them know about the issue. CASE CLOSED.	RESOLVED
June 2, 2014	E-2014-538	1745 W. Nursery Road	While conducting outfall screening in the target area, a Versar field team discovered two large, uncovered piles - one salt and one sand - at the above location, which is the parking area across the street from the Hilton BWI Airport Hotel. The field team documented the condition with photographs. The sand pile was uncontained and uncovered. Sand was evident in the parking area between the sand pile and the storm drain inlet at the corner of the parking lot. The field crew documented that there was sand in the storm drain, itself. The salt pile was partly contained with a section of concrete barrier (Jersey wall) and some tires, and partially covered. The placement of sand and salt on an impervious surface introduces the risk of distribution, by wind or rain, of particles and associated contaminants which could be transported into adjacent storm drain inlets or open water. An inspection was performed by I&P. One of the two piles was no longer present. However, the remaining pile was not being covered properly and salt was observed in the parking lot and in the storm-drain system. The property owner was instructed to secure the pile and remove the salt from the parking lot and the stormdrain system.	July 2, 2014: Received from Versar. September 29, 2014: Sent to I&P for review. Site inspected same day. October 1, 2014: Property owner notified and asked to correct issue. CASE OPEN	UNRESOLVED
June 3, 2014	E-2014-284	1741 W. Nursery Road	While inspecting outfalls in the vicinity of 1741 W. Nursery Road, the IDDE field team discovered a new outfall at approximately 12:30 p.m. The pH of the discharging water was 10.20. A whitish film could be seen on the surface of the water backing up into the outfall. Nothing else unusual was noted. The following afternoon, the field crew returned at approximately 2:30 p.m. The pH of the flowing water at the outfall was 10.60 and the whitish film on the water surface at the outfall was again noted. Field staff then initiated track-down procedures to determine the source of the flow. The Hotel (Aloft Hotels) at 1741 W. Nursery Rd. is newly built and therefore the building and stormwater infrastructure is not on the maps or in GIS coverage. The team investigated the stormwater infrastructure using line-of-sight to determine connections. The field crew opened the 1st manhole upstream of the outfall and found it to be a junction of two pipes that were both partially submerged. The pipe coming in from the left side (when facing up-network) was flowing slightly and the field crew obtained a pH of 10.90. This pipe also showed signs of a mineral deposit at its end. The field crew proceeded to the first inlet	June 4, 2014: Received from Versar. June 6, 2014: Reported to I&P August 6, 2014: Inspected by I&P. August 19, 2014: Follow up sent to I&P. August 28, 2014: Case formally closed by I&P, but follow up pH tests are planned for the future. CASE CLOSED.	RESOLVED

Table 5-1. (Continued)

Survey Date	Survey Date	Survey Date	Survey Date	Survey Date	Survey Date
			up the network from the first manhole. Within the first curb inlet, the field team found minimal water in it, which was insufficient to test. The field crew also noted whitish residue and deposition in the pipe. Up-network of the first curb inlet was a second curb inlet located on the other side of the hotel entrance. The second curb inlet was dry but seeping stains could be seen running down the inside wall from a gap in the concrete and into the pipe. After field inspections by I&P, it was determined that this was a groundwater intrusion. The site has a history of high groundwater and the mineral deposits over which this discharge flows are thought to cause the elevated pH. Follow up pH tests are planned by I&P in the future.		
June 16, 2014	NA	7226 Parkway Drive (Belair Produce	The IDDE field team discovered an actively polluting condition at a roll-away dumpster found behind a Belair Produce building on the subject property. The over-full dumpster was observed leaking a foul, sour-smelling liquid onto the parking lot. The area affected by the leaching material was extensive, spanning an area from the dumpster, along the edge of the parking lot, to the adjacent woods. The field team observed a stream in the woods, but could not ascertain whether the leachate was entering the stream (due to thick vegetation barring passage) on the day of the field visit. An inspection by the HD led to the property owners agreeing to replace the dumpster, which has occurred.	June 17, 2014: Received email from Versar. Report delivered on June 25. June 25, 2014: Sent to HD August 15, 2014: Follow up sent to HD. August 19, 2014: Dumpster to be replaced at instruction of the HD. September 4, 2014: Follow up sent to HD to see if dumpster has been replaced. September 10, 2014: I&P reports that dumpster has been replaced. CASE CLOSED	RESOLVED
June 16, 2014		7201 Standard Drive, Hanover	While conducting outfall screening in the target area, a Versar field team discovered a section of parking lot pavement that had collapsed along with the adjoining curb in the parking lot behind the building at the above location. The field team documented the condition with photographs. No vehicles were parked in this area; however, the weakened asphalt could create a falling hazard for passersby or cause damage to vehicles. Interpretation of the photographs suggests that there may be an erosion problem, and the condition could worsen. The site may have been repaired previously. County GIS coverage indicates that a storm drain inlet is in the near vicinity and may be part of the problem area.	July 2, 2014: Received from Versar. September 29, 2014: Sent to IMD for review and guidance. CASE OPEN	UNRESOLVED
July 7, 2014	NA	832 Oregon Avenue, Linthicum Heights, MD	The IDDE field team investigating the stormwater infrastructure along Oregon Avenue noted damage to the asphalt and gutter which has caused partial collapse of these surfaces bordering an inlet down the street from a warehouse at the subject address (Lighting Maintenance, Inc. occupies Suite A of 832 Oregon Avenue). The field crew also observed that sediment had accumulated in the inlet box; water flow to the connected pipe did not appear to be blocked, yet. The cause of the damage could not be ascertained on the day of the site visit. The field crew did note that trucks - displaying logos that were not obviously associated with the Lighting Maintenance	July 18, 2014: Received from Versar August 1, 2014: Reported to Andy Watcher (Infrastructure) August 4, 2014: Assigned to Ron Rose for follow up August 19, 2014: Follow up sent to AW. September 4, 2014: Follow up sent to AW. September 16, 2014: Follow up sent to AW. Inspector requested to investigate issue. CASE OPEN.	UNRESOLVED

Table 5-1. (Continued)

Survey Date	Survey Date	Survey Date	Survey Date	Survey Date	Survey Date
			company - were parked alongside the curb (i.e., spanning several parking spaces) on the same side of the street as the inlet. One could surmise that the parking area and gutter damage around the inlet grate may have been caused by bearing the excessive weight of a parked truck for extended periods of time. If the inlet box structure has been compromised, or the sub-surface of the parking asphalt is being saturated due to leaks in the infrastructure, there is increased potential for damage or collapse in the future.		
July 7, 2014	E-2014-468	1591 West Nursery Road, Linthicum Heights, MD (housekeeping)	While the IDDE field team was investigating a structural problem at a curb inlet in the parking lot behind the Hoyt's Cinema 14 at the subject address, team members detected a foul smell. The crew removed the manhole cover and inspected the contents of the catch basin. The field crew determined that the debris found in the bottom of the catch basin is the likely cause of the disagreeable odor, as the trapped material was rotting in place. The field team noted that the dumpsters are slightly uphill from the inlet; it is possible that the debris in the inlet has accumulated from loose debris associated with the dumpster (an open cover which allows loose debris to be carried out with strong winds or debris that is not properly inserted into the dumpster). I&P inspected the facility and confirmed the field team's findings. Research is underway to determine if a SWMA exists and I&P has made contact with the property owner and has asked for these issues to be corrected.	July 18, 2014: Received from Versar. August 1, 2014: Sent to I&P August 19, 2014: Follow up sent to I&P. August 22, 2014: Re-sent the original report and the tax ID number. I&P inspection performed. August 25, 2014: I&P opened complaint case and is researching if a stormwater management agreement exists for this facility. September 4, 2014: Follow up sent to I&P. September 15, 2014: I&P sent an email to the business owner requesting that the issues be resolved as soon as possible. CASE OPEN	UNRESOLVED
July 7, 2014	NA	1591 West Nursery Road, Linthicum Heights, MD (infrastructure)	A Versar field team discovered a hole in the ground under the corner of a curb inlet in the parking lot behind the Hoyt's Cinema 14 at the subject property. The loss of ground support under the bricks may contribute to a weakened state in the future and present a hazard. In another photograph taken by the field crew, there is evidence of possible structural compromises in the curb inlet support: the corner block does not show supporting mortar and there is an uneven crack through the gutter suggesting a shift in underlying support associated with the same corner. The field team investigated the condition but did not find evidence of an obvious cause for the missing dirt. If there is an erosion problem, the condition could worsen. I&P contacted property owner and asked for this issue to be corrected.	July 18, 2014: Received from Versar August 1, 2014: Sent to Infrastructure (AW). August 4, 2014: Reply from AW—private facility. August 19, 2014: Follow up sent to AW. September 4, 2014: Follow up sent to AW. September 15, 2014: Sent to I&P for consultation and possible action. September 16, 2014: I&P contacted property owner for correction. CASE OPEN.	UNRESOLVED
July 7, 2014	NA	5179 Raynor Ave.	The IDDE field team investigating the stormwater infrastructure between the Motel 6 and the McDonald's restaurant at the subject address discovered a partially clogged outlet for a pipe that drains the Motel 6 parking lot. The outlet is occluded with hard sediment. One crew member inspected the interior of the pipe and reported that he was not able to see an opening for water passage. The presence of similar sedimentation around the opening suggests that the discharged fine silt has been accumulating over time, and a thin top layer of algae on the sediment suggests that water may be still	July 18, 2014: Received from Versar August 1, 2014: Sent to infrastructure (AW). August 4, 2014: Reply from AW—private facility. August 19, 2014: Follow up sent to AW. September 4, 2014: Follow up sent to AW. September 15, 2014: Sent to I&P for consultation and possible action. CASE OPEN.	UNRESOLVED

Table 5-1. (Continued)

Survey Date	Survey Date	Survey Date	Survey Date	Survey Date	Survey Date
			trickling through the pipe, although the drainage is no longer fully effective. Sluggish drainage of the parking lot in this corner may pose a hazard for motorists and pedestrians with accumulating debris, leaves, standing water, and ice.		
July 7, 2014	E-2014-397	706 Crain Highway	While conducting outfall screening in the target area, the IDDE field team discovered a work area in the parking lot behind the Custom Kitchen Countertop business. The apparatus and materials (i.e.-tile, stone, etc.) found on site indicated a countertop-cutting facility is present. The field team documented the condition with a photograph. Dust, cuttings, and materials left on the impervious surface of the parking lot, without benefit of canopy cover, have the potential for washoff into the storm drain system and subsequently polluting surface waters downstream. Two inspections by I&P staff along with discussions with the business owner resulted in the issue being resolved.	July 18, 2014: Received from Versar August 1, 2014: Sent to I&P August 4, 2014: Inspection performed by I&P. Follow up scheduled. August 8, 2014: Re-inspection performed. No issues observed. CASE CLOSED.	RESOLVED
July 7, 2014	NA	18 Ordnance Road, Glen Burnie	While conducting outfall screening in the target area, the IDDE field team discovered a Valley Proteins container, intended for the disposal of waste kitchen grease, with oil on the parking lot around the container. The field crew did not inspect the container, so the oil may be from a leak in the container or a spill during attempts to empty oil into the container. There was an obvious stain on the wall behind the container, suggesting that emptying vessels into the container is not always an effective operation. The field team noted that several filled bags were on the ground near the container; the crew did not investigate the contents of the bags. The field team documented the condition with a photograph. Cooking oil on an impervious surface poses a hazard to pedestrians; in a rain event, the oil may also distribute contaminants to adjacent impervious surfaces and eventually to storm drain inlets or open water. There is also a concern for attracting pests to the site. An inspection by the HD showed the area to be in good order.	July 18, 2014: Received from Versar. August 1, 2014: Sent to HD. August 13, 2014: Report from HD says area in order CASE CLOSED.	RESOLVED
July 7, 2014	NA	550 Crain Highway North, Glen Burnie	While conducting outfall screening in the target area, the IDDE field team noted several filled bags and loose debris on the ground alongside a dumpster at the subject address. The dumpster may be used by more than one business adjacent to the parking lot. The field team documented the condition with a photograph. Debris deposited on the ground alongside the containers may allow trash to blow off-site or leak potentially contaminating contents onto surfaces that could lead to adjacent storm drain inlets or open water. A HD inspection resulted in the correction of the issue.	July 18, 2014: Received from Versar. August 1, 2014: Sent to HD. August 15, 2014: Follow up sent to HD. August 19, 2014: HD corrected issue. CASE CLOSED.	RESOLVED

Table 5-1. (Continued)

Survey Date	Survey Date	Survey Date	Survey Date	Survey Date	Survey Date
July 7, 2014	NA	H&R Block, 123 Crain Highway North, Glen Burnie	While conducting outfall screening in the target area, the IDDE field team noted several filled bags and loose debris on the ground alongside a dumpster at the subject address. On the other side of the pair of dumpsters, the field team observed that there was a trail of liquid that had leaked from the dumpsters. The field team documented the condition with photographs. Debris deposited on the ground alongside the containers may allow trash to blow off-site or leak potentially contaminating contents onto surfaces that could lead to adjacent storm drain inlets or open water. An inspection by the HD resulted in the issue being corrected.	July 18, 2014: Received from Versar. August 1, 2014: Sent to HD. August 15, 2014: Follow up sent to HD. August 19, 2014: HD corrected issue. CASE CLOSED.	RESOLVED
July 25, 2014		7546 Governor Ritchie Highway, # 6625	While conducting outfall screening in the target area, the IDDE field team noted several filled bags and loose debris on the ground around an over-full dumpster at the subject address. The dumpster was intended to collect materials for recycling, according to the sign affixed to the front of the unit, and may have received materials from more than one business in the shopping center. At the time of the field visit, the field crew observed that the dumpster was filled beyond capacity, so that the lid could not be closed. The field team documented the condition with a photograph. The dumpster's position was very close to a curb inlet and the inlet was partially blocked by a filled bag and loose debris on the day of the visit. Debris deposited on the ground alongside the container may allow trash to blow off-site or leak potentially contaminating contents onto surfaces that could lead to the adjacent storm drain inlet or open water. An inspection by the HD resulted in the issue being corrected.	August 14, 2014: Received from Versar. August 14, 2014: Sent to HD. August 15, 2014: Follow up sent to HD. August 19, 2014: HD corrected issue. CASE CLOSED.	RESOLVED
July 25, 2014		7400 Governor Ritchie Highway (CVS)	While conducting outfall screening in the target area, the IDDE field team noted a large amount of cardboard boxes piled on the ground alongside a dumpster at the subject address. The dumpster (Vert-I-Pack) is a compactor - in this case, for cardboard - that operates with a key. The field team documented the condition with a photograph. Debris deposited on the ground alongside the container may allow trash to blow off-site or encourage dumping by others which could leak potentially contaminating contents onto surfaces. Ultimately the material may wash or be blown into nearby storm drain inlets or open water. An inspection by the HD resulted in the issue being corrected.	August 14, 2014: Received from Versar. August 14, 2014: Sent to HD August 15, 2014: Follow up sent to HD. August 19, 2014: HD corrected issue. CASE CLOSED.	RESOLVED
July 25, 2014		7730 Governor Ritchie Highway,	While conducting outfall screening in the target area, the IDDE field team noted excessive loose debris scattered on the ground around a dumpster at the subject address. The field team documented the condition with a photograph. The photograph also reveals a large amount of broken glass at the base of the unit, and many pieces distributed further away, which present safety hazards for workers and passers-by. Debris deposited on the ground alongside the container may allow trash to blow off-site or leak potentially contaminating contents onto surfaces that could lead to adjacent storm drain inlets or open water. An inspection by the HD resulted in the issue being corrected.	August 14, 2014: Received from Versar. August 14, 2014: Sent to HD. August 15, 2014: Follow up sent to HD. August 19, 2014: HD corrected issue. CASE CLOSED.	RESOLVED

6 RECOMMENDATIONS

The County's illicit discharge detection and elimination program has been successful in the identification and removal of a wide variety of sources of pollutants, including illicit connections, upland pollutant sources, dumping and spills. At this time, no recommendations are being made for improvements to the program.

7 REFERENCES

Anne Arundel County, Maryland Department of Public Works Bureau of Utility Operations. 2011. 2011 Drinking Water Quality Report.

Center for Watershed Protection. 2004. Illicit Discharge Detection and Elimination, A Guidance Manual for Program Development and Technical Assessments.

Center for Watershed Protection. 2004. Illicit Discharge Detection and Elimination, Technical Appendices.

Maryland Department of the Environment. 1997. Dry Weather Flow and Illicit Discharges in Maryland Storm Drain Systems.

Pitt, R. 2004. Methods for Detection of Inappropriate Discharge to Storm Drain Systems. IDDE Project Support Material.

APPENDIX A
EROSION AND STRUCTURAL ISSUES
SITE-SPECIFIC REPORTS

Anne Arundel County Infrastructure Site Visit Report

Location: 510 McCormick Drive, southern edge of parking lot
Date: May 6, 2014
Investigators: M. Berlett and N. Eshleman
Concern: Structural: collapsing asphalt near grate inlet

While conducting outfall screening in the target area, a Versar field team noted a hole in the asphalt near a storm drain inlet (Figure 1 and Figure 2) in the south parking area at the above address. Upon closer inspection, the interior of the catch basin could be clearly seen through the open hole (Figure 3). No vehicles were parked in this area, however the weakened asphalt could create a falling hazard for passers-by or cause damage to vehicles. If there is an erosion problem, the condition could worsen. An area map appears in Figure 4.



Figure 1. Hole in asphalt near grated inlet, 510 McCormick Drive



Figure 2. Inlet with nearby hole in asphalt



Figure 3. Interior of catch basin as viewed through the hole



Figure 4. Area map

Anne Arundel County Infrastructure Site Visit Report

Location: 705 East Ordnance Road
Date: May 15, 2014
Investigators: G. Zuknick and B. Perry
Concern: Structural: outfall is blocked by sediment

While conducting outfall screening in the target area, a LimnoTech and Versar field team discovered an outfall (N04H2O015) almost completely blocked by hard sediment (Figure 1). The outfall drains a parking lot to a stormwater pond behind the building at the above location. The photograph, taken by the field crew on May 15, shows some standing water near the outlet. A thin, top layer of algae downstream of the pipe opening suggests that water may continue to trickle through the pipe; the field crew reported that the outlet was not draining on the day of the field visit. Sluggish drainage of the parking lot in this corner may pose a hazard for motorists and pedestrians with accumulating debris, leaves, standing water, and ice. An area map appears in Figure 2.



Figure 1. Evidence of a storm infrastructure outfall blocked by sediment



Figure 2. Area map

Anne Arundel County Infrastructure Site Visit Report

Location: 1300 Concourse Drive, northern corner of the parking lot
Date: May 27, 2014
Investigators: M. Berlett and B. Hood
Concern: Structural: cracked grate at inlet

While conducting outfall screening in the target area, a Versar field team noted a cracked grate over a storm drain inlet (Figure 1) in the north parking area at the above address. There is a concern that the weight of a vehicle parked over the crack may damage the grate further. If significantly damaged, the grate may not be strong enough to support a vehicle. A partially opened inlet would pose a threat to pedestrians, cyclists, and motorists. An area map is provided in Figure 2.



Figure 1. Cracked inlet grate, indicated by pointed end of the pick axe, 1300 Concourse Drive

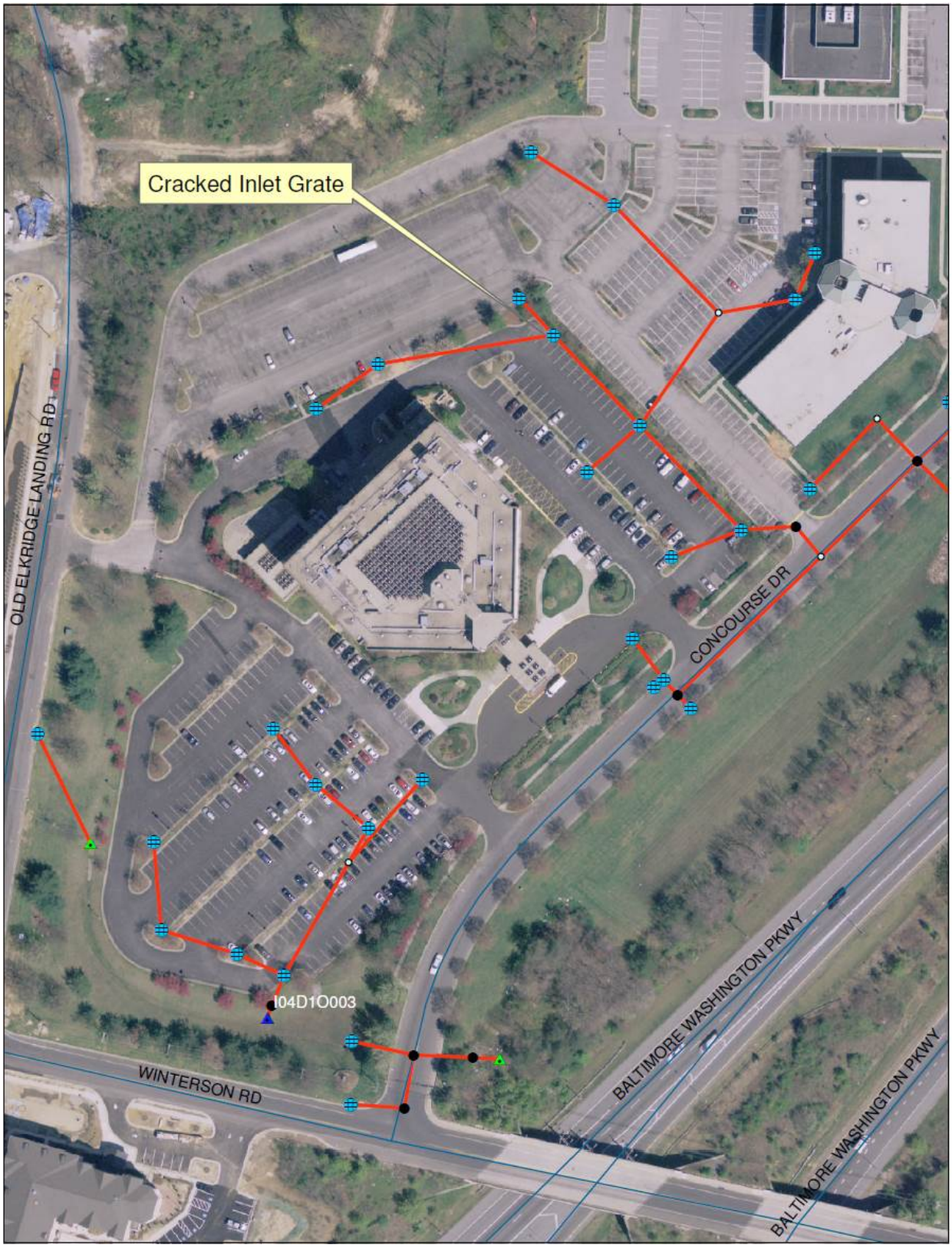


Figure 2. Area map

Anne Arundel County Infrastructure Site Visit Report

Location: Scientific Specialties Service, Inc, 7201 Standard Drive, Hanover
Date: June 16, 2014
Investigators: B. Hood and I. Turcsányi
Concern: Infrastructure issues: collapsed pavement and associated curb

While conducting outfall screening in the target area, a Versar field team discovered a section of parking lot pavement that had collapsed along with the adjoining curb (Figure 1 and Figure 2) in the parking lot behind the building at the above location. The field team documented the condition with photographs. No vehicles were parked in this area; however, the weakened asphalt could create a falling hazard for passers-by or cause damage to vehicles. Interpretation of the photographs suggests that there may be an erosion problem, and, if that is true, the condition could worsen. The site may have been repaired previously. County GIS coverage indicates that a storm drain inlet is in the near vicinity and may be part of the problem area. An area map appears in Figure 3.



Figure 1. A section of parking lot pavement that had collapsed and the associated damaged curb



Figure 2. A view of the extent of the collapse and the jutting curb sections

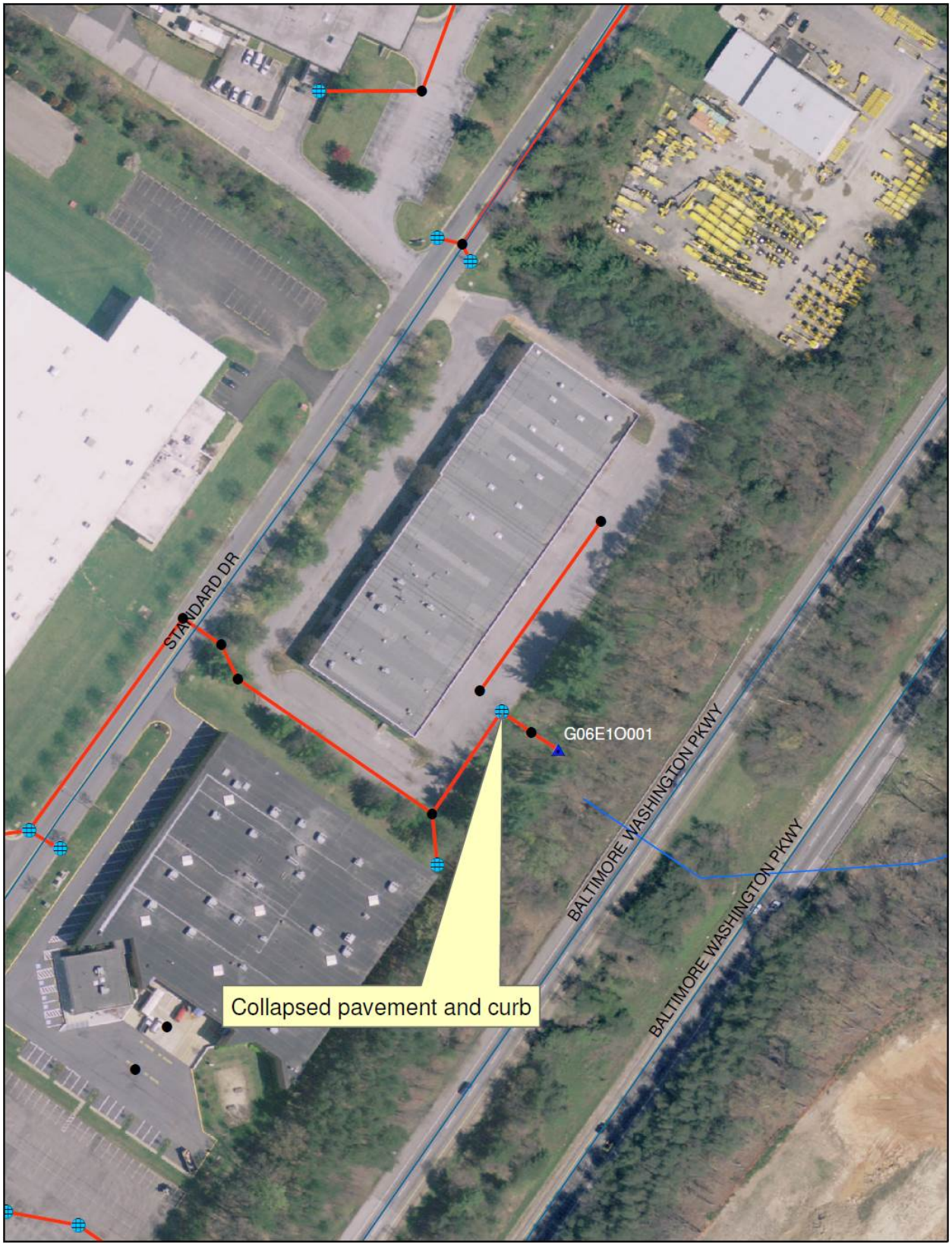


Figure 3. Area map

Anne Arundel County Infrastructure Site Visit Report

Location: 1591 West Nursery Road, Linthicum Heights, MD
Date: July 7, 2014
Investigators: M. Berlett and B. Hood
Concern: Infrastructure: corner of curb inlet is undermined

A Versar field team discovered a hole in the ground under the corner of a curb inlet (Figure 1) in the parking lot behind the Hoyt's Cinema 14 at the address given above. The loss of ground support under the bricks may contribute to a weakened state in the future and present a hazard. In another photograph taken by the field crew, there is evidence of possible structural compromises in the curb inlet support: the corner block does not show supporting mortar and there is an uneven crack through the gutter suggesting a shift in underlying support associated with the same corner (Figure 2). The field team investigated the condition but did not find evidence of an obvious cause for the missing dirt. If there is an erosion problem, the condition could worsen. An area map appears in Figure 3.



Figure 1. Evidence of ground support missing from the corner of the curb inlet



Figure 2. Evidence of a possible separation of the supporting block and a split in the gutter (lower right corner of the photograph)

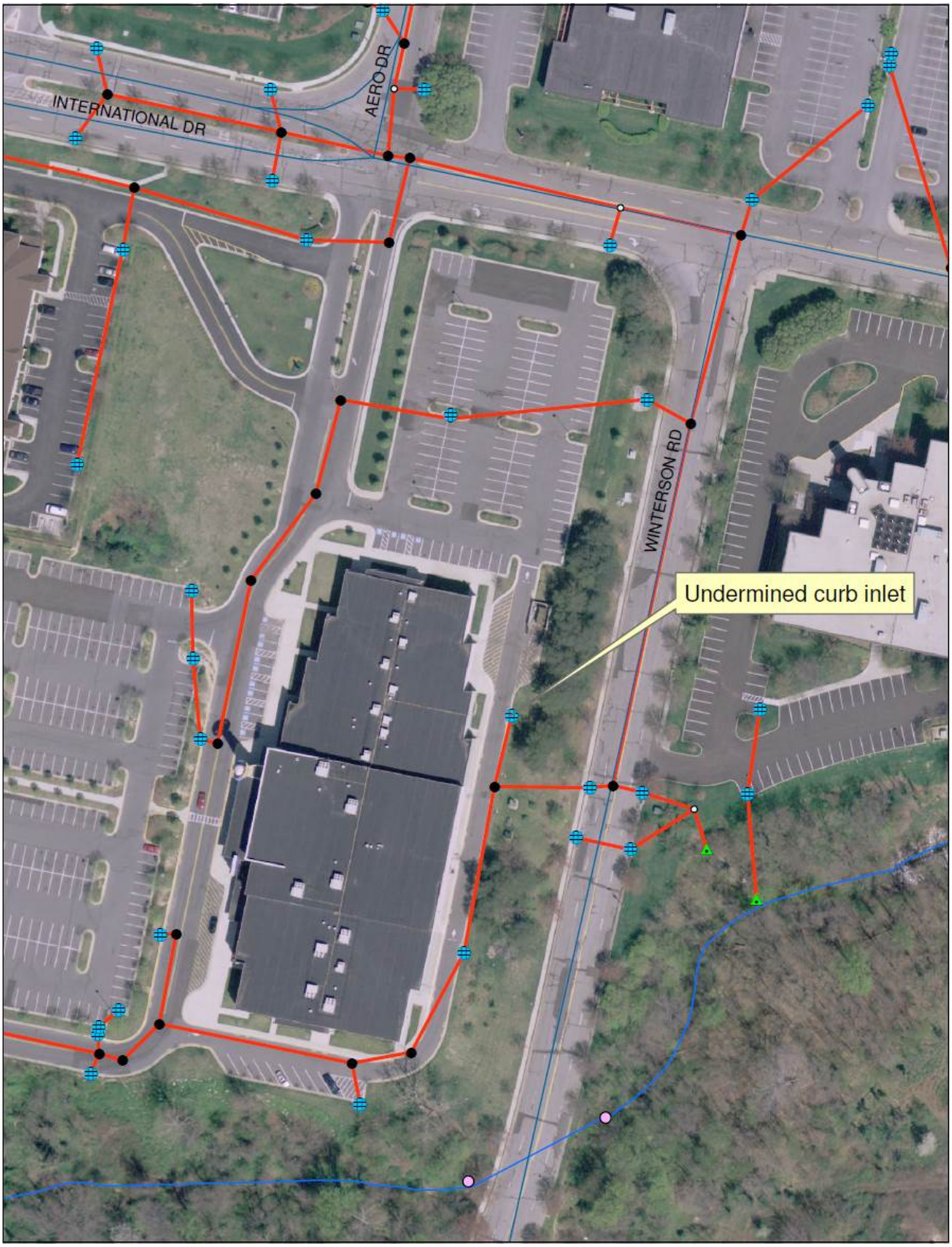


Figure 3. Area map

Anne Arundel County Infrastructure Site Visit Report

Location: 5179 Raynor Avenue, Linthicum Heights, MD
Date: July 7, 2014
Investigators: M. Berlett and B. Hood
Concern: Infrastructure: clogged pipe

A Versar field team investigating the stormwater infrastructure between the Motel 6 and the McDonald's restaurant at the above location discovered a partially clogged outlet for a pipe that drains the Motel 6 parking lot (Figure 1 and Figure 2). The outlet is occluded with hard sediment. One crew member inspected the interior of the pipe and reported that he was not able to see an opening for water passage. The presence of similar sedimentation around the opening suggests that the discharged fine silt has been accumulating over time, and a thin top layer of algae on the sediment suggests that water may be still trickling through the pipe, although the drainage is no longer fully effective. Sluggish drainage of the parking lot in this corner may pose a hazard for motorists and pedestrians with accumulating debris, leaves, standing water, and ice. An area map appears in Figure 3.



Figure 1. Evidence of sediment accumulation in and around the pipe outlet draining the Motel 6 parking lot; there is algae growth extending downstream of the pipe opening



Figure 2. Close-up view of the pipe opening showing the level of accumulated sediment; the interior of the pipe is also occluded with sediment

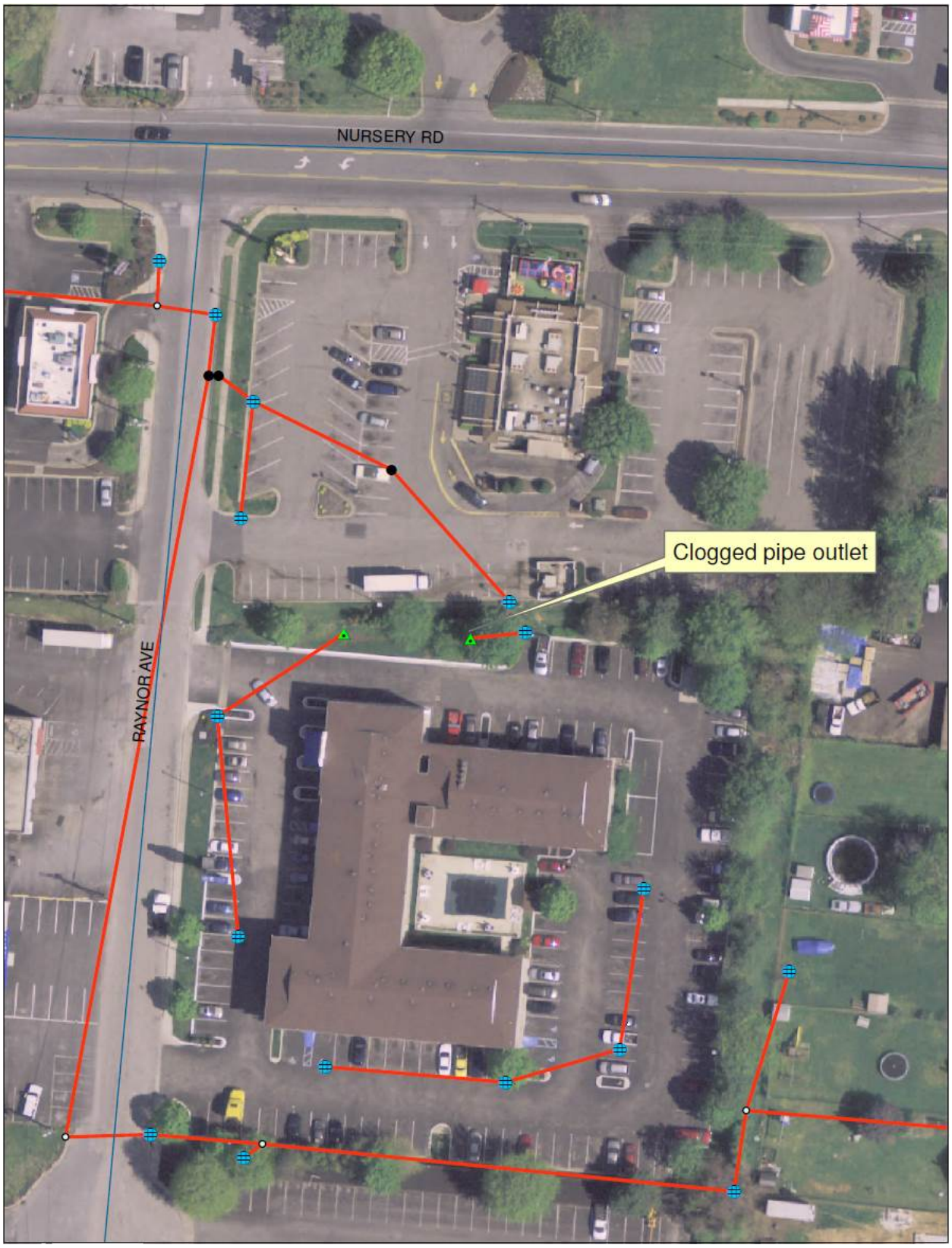


Figure 3. Area map

Anne Arundel County Infrastructure Site Visit Report

Location: 832 Oregon Avenue, Linthicum Heights, MD
Date: July 7, 2014
Investigators: M. Berlett and B. Hood
Concern: Infrastructure: damaged asphalt and gutter bordering an inlet

A Versar field team investigating the stormwater infrastructure along Oregon Avenue noted damage to the asphalt and gutter which has caused partial collapse of these surfaces (Figure 1 and Figure 2) bordering an inlet down the street from a warehouse at the above address (Lighting Maintenance, Inc., occupies Suite A of 832 Oregon Avenue). The field crew also observed that sediment had accumulated in the inlet box; water flow to the connected pipe did not appear to be blocked, yet. The cause of the damage could not be ascertained on the day of the site visit. The field crew did note that trucks - displaying logos that were not obviously associated with the Lighting Maintenance company - were parked alongside the curb (i.e., spanning several parking spaces) on the same side of the street as the inlet. One could surmise that the parking area and gutter damage around the inlet grate may have been caused by bearing the excessive weight of a parked truck for extended periods of time. If the inlet box structure has been compromised, or the sub-surface of the parking asphalt is being saturated due to leaks in the infrastructure, there is increased potential for damage or collapse in the future. An area map appears in Figure 3.



Figure 1. View of the asphalt and gutter damage and partial collapse as seen from the right of the inlet grate



Figure 2. View of the asphalt and gutter damage and partial collapse as seen from the left of the inlet grate



Figure 3. Area map

APPENDIX B
ILLICIT CONNECTIONS SITE-SPECIFIC REPORTS

Anne Arundel County Illicit Discharge Site Visit Report

Outfall ID: I03E8O003
Location: Stormwater pond across from 1302 Concourse Dr.
Date: May 14, 2014
Investigators: C. Tonkin and B. Hood
Concern: Above action detergents, elevated ammonia, and unusual odor

Versar field staff conducted site visits to several targeted outfalls in the vicinity of Concourse Drive on May 14. At 1:45 p.m., the field team screened outfall I03E8O003, which discharges to a wet pond and was partially submerged (Figure 1). A visual inspection of the first manhole up from the outfall in the middle of Concourse Drive showed flowing water. A faint rancid odor was noted when the water sample was collected at the outfall. The screening results were above action levels (8.6 mg/l[1]) for fluoride, but elevated for detergents (0.15mg/l) and ammonia (0.20 mg/l; Table 1).

On the following day, the field team retested water obtained from the flowing pipe, rather than from the stagnant water at the outfall. The retest yielded a lower fluoride result (0.3 mg/l). Detergent levels were above the action level (0.50 mg/l) while ammonia was elevated (0.10 mg/l).

Because of the elevated detergent result, field staff traced the source of the flow. During trackdown, the field team tested flowing water in a manhole located in the southeast entrance driveway of 1302 Concourse Drive. The results were high for detergents (0.75 mg/l) and ammonia (0.20 mg/l). Field staff also noted white residue on the interior surface of the storm drain pipe and a stronger odor. The field team followed the odor, whitish residue, and flowing water through the curb inlets on the northern edge of 1300 Concourse Drive (Embassy Suites) to the end of the system, which terminated in a curb inlet located down-gradient from the hotel loading dock (Figure 2).

Within this curb inlet, the field team found some standing gray water with a strong foul odor (Figure 3). Testing of the water again yielded elevated detergents (0.75 mg/l) and elevated ammonia (0.2 mg/l). A general inspection of the area around the curb inlet and of the loading dock area showed no signs of active illicit discharge activities. The field crew noted and photo-documented conditions of the dock area as the curb inlet grate was generally grungy and some staining of the pavement from the direction of the loading dock toward the curb inlet was readily apparent (Figure 4). Some residual puddled grey water was found in the area as well but staff couldn't discern the source. Field crew noted the condition of the loading dock to be messy. One large rollaway dumpster had some residual fluid on the ground adjacent to the dumpster and

[1] The field team later determined that the fluoride meter was mis-calibrated and the actual concentration was likely much lower.

there was a stain line toward the drain. Two standard-sized dumpsters were also placed beside the dock; they were over-flowing with cardboard, and some trash was dispersed around them (Figure 5). The field crew also noted a waste cooking oil vat beside the dock but it appeared to be in good condition. A mop pail was also present on the loading dock, suggesting that hotel staff may be disposing of wash water onto the parking lot (Figure 6). Field crew noted these conditions on a hotspot data sheet, but they are included with this confirmed illicit discharge report. An area map is provided in Figure 7.

Table 1. Chemical test results (red values indicate above action level concentration)

	Action Level	**Test 1 Result (outfall)**	**Test 2 Result (up-network pipe)**
pH	≤ 6.5 or ≥ 8.5	7.45	7.41
Temperature (°F)		68	71.4
Ammonia (mg/l)	≥ 1	0.20	0.10
Total Chlorine (mg/l)	≥ 0.4	0.00	0.00
Detergents (mg/l)	≥ 0.5	0.15	**0.50**
Fluoride (mg/l)	≥ 0.75	**8.6***	0.30
Phenols (mg/l)	≥ 0.17	0.00	0.05
Copper (mg/l)	≥ 0.21	0.00	0.00

* The field team later determined that the fluoride meter was mis-calibrated and the actual concentration was likely much lower.



Figure 1. Outfall I03E8O015 with standing water in the orifice



Figure 2. Curb inlet in the loading dock area of Embassy Suites, 1300 Concourse Drive



Figure 3. Interior of curb inlet in the loading dock area of Embassy Suites, 1300 Concourse Drive, showing off-color water; detergent concentration was 0.75 mg/l



Figure 4. Stains leading from the loading dock area to the curb inlet, behind Embassy Suites, 1300 Concourse Drive



Figure 5. Overflowing dumpsters, behind 1300 Concourse Drive



Figure 6. Loading dock area showing mop pail and puddles of water

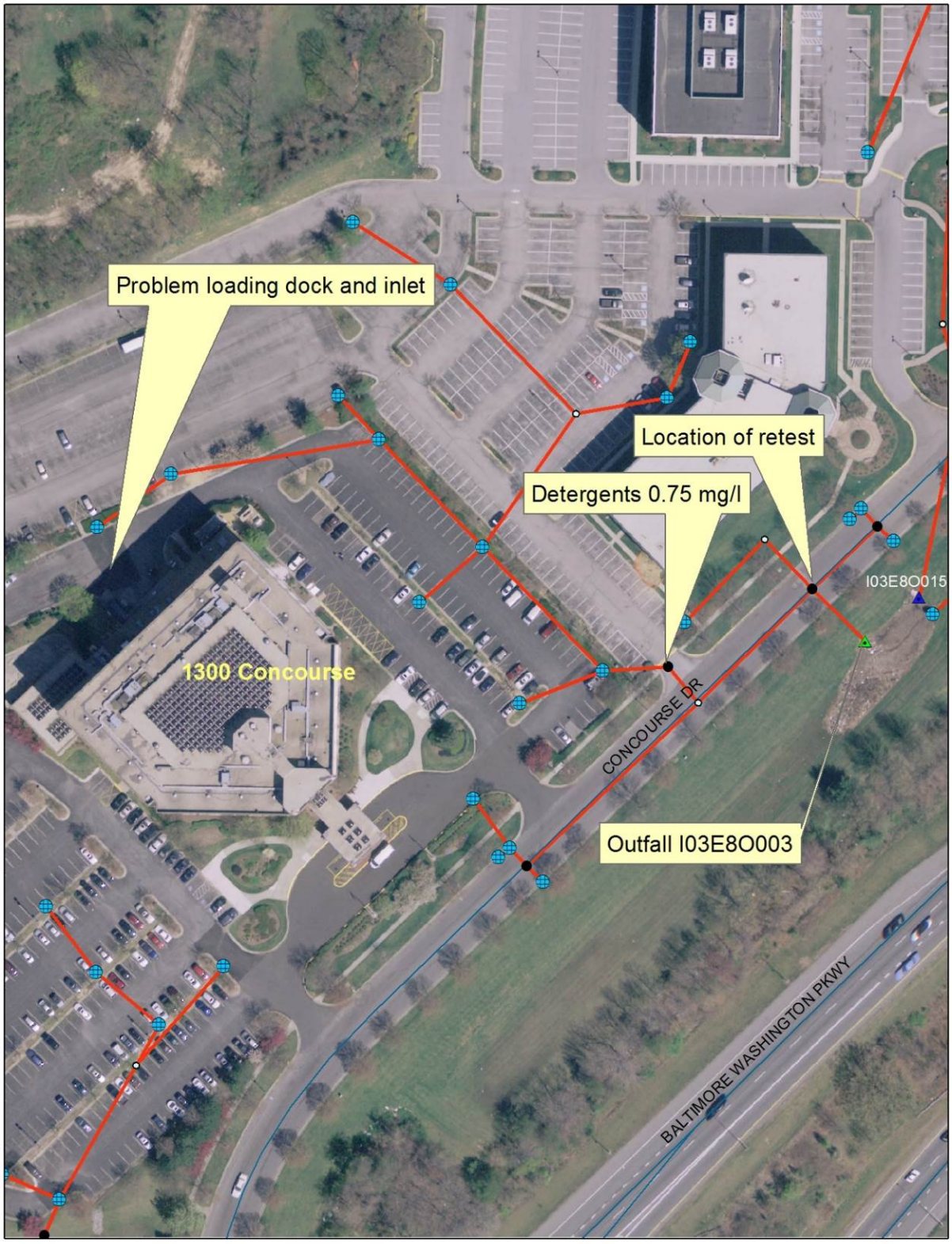


Figure 7. Area map of 1300 Concourse Drive

Anne Arundel County Illicit Discharge Site Visit Report

Outfall ID: J04C1O018
Location: Behind 1099 Winterson Road
Date: May 20, 2014
Investigators: C. Tonkin and N. Eshleman
Concern: Above action detergents, ammonia, and fluoride, sewage odor, floatables

On May 20th, Versar field staff conducted site visits to several targeted and non-targeted outfalls in the vicinity of International Drive and Winterson Road. At 3:25 p.m., the field team screened outfall J04C1O018, which is a non-targeted outfall in a commercial area (Figure 1). The outfall orifice was dry, as was the concrete apron. The apron was coated with a paper-like material, which field staff suspected was floatable material from sanitary sewerage (Figure 2). Additionally, the area had a rancid-sour smell, similar to a portable toilet. Just up the network from the outfall, staff found flowing water, which was exiting the pipe between pipe sections and bypassing the end-pipe piece. On the plunge pool below the outfall was a film coating; the outfall apron was also suspended above the plunge pool. The screening parameters tested above action levels for fluoride (1.0 mg/l), detergents (0.60 mg/l), and ammonia (25 mg/l; Table 1, Test 1).

On the following day, the field team retested the water in the pipe (Table 1, Test 2). The water tested again above action levels for fluoride (0.9 mg/l), detergents (2.5 mg/l), and ammonia (25 mg/l). Staff initiated trackdown procedures. The flow, however, was not as obvious as they traveled up the network in the direction of a car wash (Figure 3). Staff reported the illicit discharge, without definite source, to the Environmental Hotline on May 21st.

After the inconclusive result of the trackdown and the conclusion of the field day, field staff realized that they had inadvertently missed a portion of the network during the trackdown process. They had tracked the flow only along the southern branch of the network and that a northern branch had not been checked. The northern branch includes a Hyatt hotel.

After an interposing rainstorm, Versar's field team returned to the field and met with staff members from the Anne Arundel County Inspections and Permits (I&P) agency on May 30th. The joint team tested the outfall effluent a third time (obtaining positive results once again) and proceeded to track the flow to a curbside inlet in the parking lot of Hyatt Place, 940 International Drive (Figure 4 and Figure 5). Within the catch basin, a pipe was found that was discharging and that appeared to originate from the direction of the hotel. Field staff also captured a water sample that had characteristics of sanitary sewerage. I&P staff then made personal contact with the hotel manager on-duty to demonstrate the evidence of the issues within the stormdrain system near the hotel.

Table 1. Chemical test results (red values indicate above action level concentration)			
	Action Level	**Test 1 Result**	**Test 2 Result**
pH	≤ 6.5 or ≥ 8.5	7.45	8.19
Temperature (°F)		67.5	66.4
Ammonia (mg/l)	≥ 1	**25**	**25**
Total Chlorine (mg/l)	≥ 0.4	0.01	0.01
Detergents (mg/l)	≥ 0.5	**0.60**	**2.5**
Fluoride (mg/l)	≥ 0.75	**1.0**	**0.9**
Phenols (mg/l)	≥ 0.17	0.0	N.T.
Copper (mg/l)	≥ 0.21	0.0	N.T.



Figure 1. Outfall J04C1O018



Figure 2. Close-up of Outfall J04C1O018 showing the paper-like material on the apron



Figure 3. Interior of a junction manhole near the car wash showing moisture but no flow entering from the side pipe



Figure 4. Sanitary sewerage discharging into catch basin (green pipe, center)

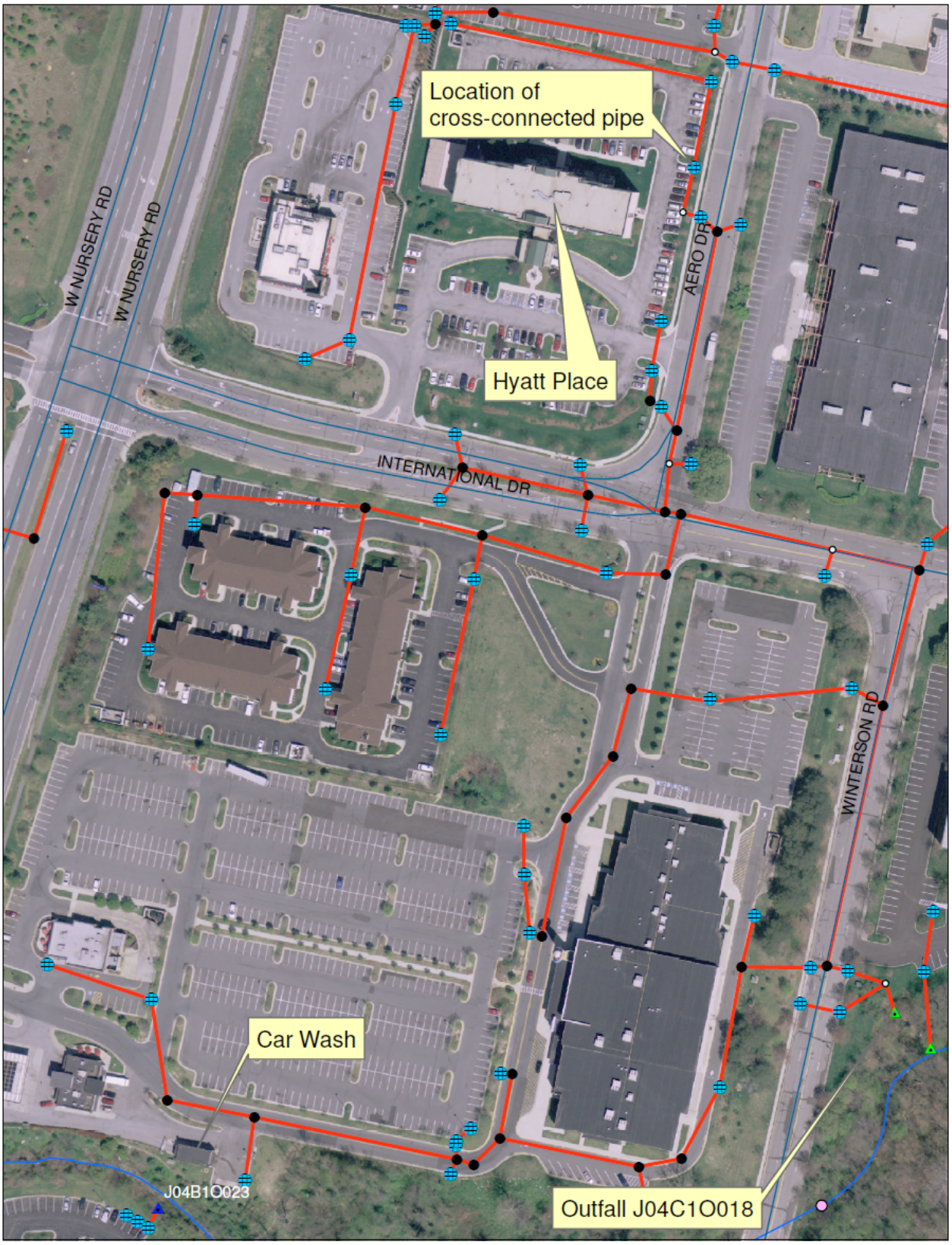


Figure 5. Area map of drainage to Outfall J04C1O018

Anne Arundel County Illicit Discharge Site Visit Report

Outfall ID: J04A7O026NEW2
Location: Stormwater pond at 1741 W. Nursery Rd. (Aloft Hotel)
Date: June 3, 2014
Investigators: C. Tonkin, A. Burton, and I. Turcsányi
Concern: Above action pH level

While inspecting outfalls in the vicinity of 1741 W. Nursery Road on June 3rd, field staff discovered a new outfall (Figure 1) at approximately 12:30 p.m. The pH of the discharging water was 10.20 (Table 1, Test 1). A whitish film could be seen on the surface of the water backing up into the outfall. Nothing else unusual was noted.

The following afternoon, the field crew returned at approximately 2:30 p.m. The pH of the flowing water at the outfall was 10.60 (Table 1, Test 2) and the whitish film on the water surface at the outfall was again noted (Figure 2). Field staff then initiated trackdown procedures to determine the source of the flow. The hotel (Aloft Hotels) at 1741 W. Nursery Road is newly built and therefore the building and stormwater infrastructure are not on the County orthophotography or in GIS data sets. The team investigated the stormwater infrastructure using line-of-sight to determine connections. The field crew opened the first manhole upstream of the outfall and found it to be a junction of two pipes that were both partially submerged (Figure 3). The pipe coming in from the left side (when facing up-network) was flowing slightly and the field crew obtained a pH of 10.90. This pipe also showed signs of a mineral deposit at its end. The field crew proceeded to the first inlet up the network from the first manhole. Within the first curb inlet, the field team found minimal water, which was insufficient to test; yet, the field crew noted whitish residue and deposition in the pipe (Figure 4). Up-network of the first curb inlet was a second curb inlet located on the other side of the hotel entrance. The second curb inlet was dry but seeping stains could be seen running down the inside wall, from a gap in the concrete, and into the pipe (Figure 5).

Table 1. Chemical test results (red values indicate above action level concentration)

	Action Level	**Test 1 Result (outfall)**	**Test 2 Result (up-network pipe)**
pH	≤ 6.5 or ≥ 8.5	**10.20**	**10.60**
Temperature (°F)		65	71
Ammonia (mg/l)	≥ 1	0.00	NA
Total Chlorine (mg/l)	≥ 0.4	0.20	0.05
Detergents (mg/l)	≥ 0.5	0.00	0.00
Fluoride (mg/l)	≥ 0.75	NA	0.00
Phenols (mg/l)	≥ 0.17	0.00	0.00
Copper (mg/l)	≥ 0.21	0.00	0.00



Figure 1. Outfall J04A7O026NEW2 at 1741 West Nursery Road



Figure 2. Whitish film on water surface at outfall



Figure 3. Inside of manhole upstream of outfall; the pipe on the left flows toward the outfall; the smaller pipe on the top right seen flowing and with depositional buildup is the probable source of the high pH levels



Figure 4. View of inside of first curb inlet showing mineral buildup and whitish residual staining



Figure 5. View inside second curb inlet; seepage and staining can be seen originating from a gap in the concrete on the left wall



Figure 6. Area map (the hotel was recently constructed and so is not included in County's orthophotography or in GIS stormwater data sets)

APPENDIX C
UPLAND POLLUTANT SOURCES
SITE-SPECIFIC REPORTS

Anne Arundel County Hotspot Site Investigation Visit Report

Location: 220 8th Avenue, NW
Date: April 21, 2014
Investigators: T. Jones and I. Turcsányi
Concern: Waste management: dumpster overflowing

While conducting illicit discharge screening in the target area, a Versar field team noted a Waste Management roll-away dumpster, uncovered, with debris exceeding capacity (Figure 1 and Figure 2) in the parking area at the above address. The field team documented the condition with photographs. The exposure of debris above the rim of the container, and debris deposited on the ground alongside the container, may allow trash to blow off-site or leak potentially contaminating contents onto surfaces that could lead to adjacent storm drain inlets or open water. The field team also noted that the main building on the property was undergoing renovation and site conditions may be temporary. An area map is provided as Figure 3.



Figure 1. Overflowing roll-away dumpster



Figure 2. Debris deposited alongside dumpster



Figure 3. Area map

Anne Arundel County Hotspot Site Investigation Visit Report

Location: 7400 Block Baltimore and Annapolis Boulevard
Date: April 21, 2014
Investigators: M. Berlett, I. Turcsányi, T. Jones, K. Dillow, B. Hood, and G. Zuknick
Concern: Dumpsite

A Versar and LimnoTech field team identified a dumpsite in the floodplain of Sawmill Branch during the joint field calibration day. The team was attempting to locate an outfall at the rear of the property and discovered freshly dumped soil and material on the northern periphery of the parking area (Figure 1 and Figure 2). The name and address of the property could not be immediately ascertained; however, it appeared that the building in the rear holds an operating snowball stand and the building adjacent to the road had been used for a bait and tackle shop. Additionally, at the rear of the premises were two areas of stored and discarded material; however, the material was on pervious surfaces located approximately 20 meters from the stream (Figure 3). The material consisted of five-gallon buckets and other articles of plastic. An area map appears in Figure 4 with the location of the problems indicated.



Figure 1. Dumping area in floodplain of Sawmill Branch



Figure 2. Dumpsite adjacent to parking area (foreground) and Sawmill Branch (background)



Figure 3. Discarded material in rear of property



Figure 4. Area map

Anne Arundel County Hotspot Site Investigation Visit Report

Location: Morningside House of Friendship Assisted Living, 7548 Old Telegraph Road
Date: April 22, 2014
Investigators: M. Berlett and I. Turcsányi
Concern: Waste management: grease container spill and open dumpsters

A Versar field team documented a waste management issue when traveling to a target outfall at the above property; the problems included an open dumpster, a grease spill, and a drum. The area of concern directly affects the up-gradient impervious surfaces associated with a stormwater management facility that receives their flows (Figure 1). Staff found a waste grease container with a wet stain adjacent to it (Figure 2 and Figure 3). On the day of the filed visit, the dumpsters were found to be open. The waste grease spillage and open dumpster may allow pollutants to be washed to the storm sewer network, the associated stormwater pond and surface waters. A drum of unidentified liquid material was also noted in the dumpster stall area. An area map appears in Figure 4 with the location of the problems indicated.



Figure 1. Dumpster area adjacent to a stormwater pond



Figure 2. Detail of a grease spill near the waste grease container

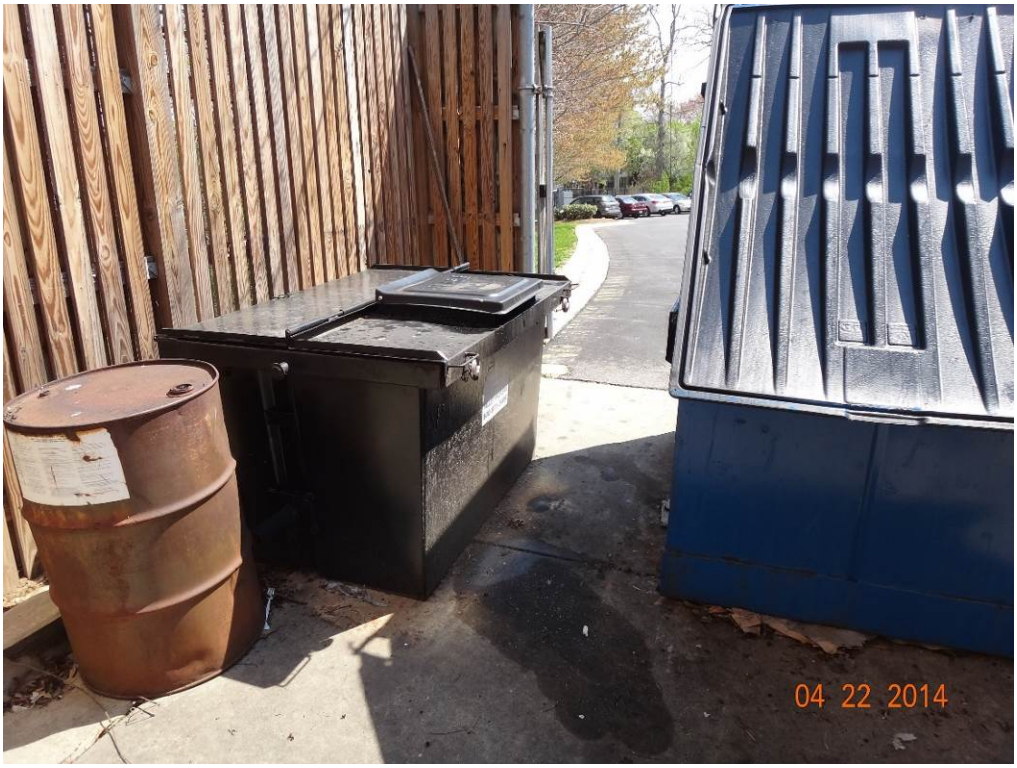


Figure 3. The waste grease container, open dumpster, and unidentified drum in the dumpster stall area



Figure 4. Area map

Anne Arundel County Hotspot Site Investigation Visit Report

Location: Behind AMF bowling alley, 6608 Governor Ritchie Highway (Route 2)
Date: May 5, 2014
Investigators: G. Zuknick and K. Dillow
Concern: Improper bulk solid storage

While conducting illicit discharge screening in the target area, a LimnoTech and Versar field team discovered a large, uncovered pile of mulch, extending across several parking spaces (Figure 1 and Figure 2) in the parking area behind the bowling alley at the above location: Governor Ritchie Highway, between Shelly Road and West Ordnance Road. The field team documented the condition with photographs. The placement of mulch on an impervious surface introduces the risk of distribution, by wind or rain, of mulch particles and associated nutrients which could drift into adjacent storm drain inlets or open water. An area map is provided as Figure 3.



Figure 1. Large, uncovered pile of mulch



Figure 2. Extent of mulch pile across several parking spaces

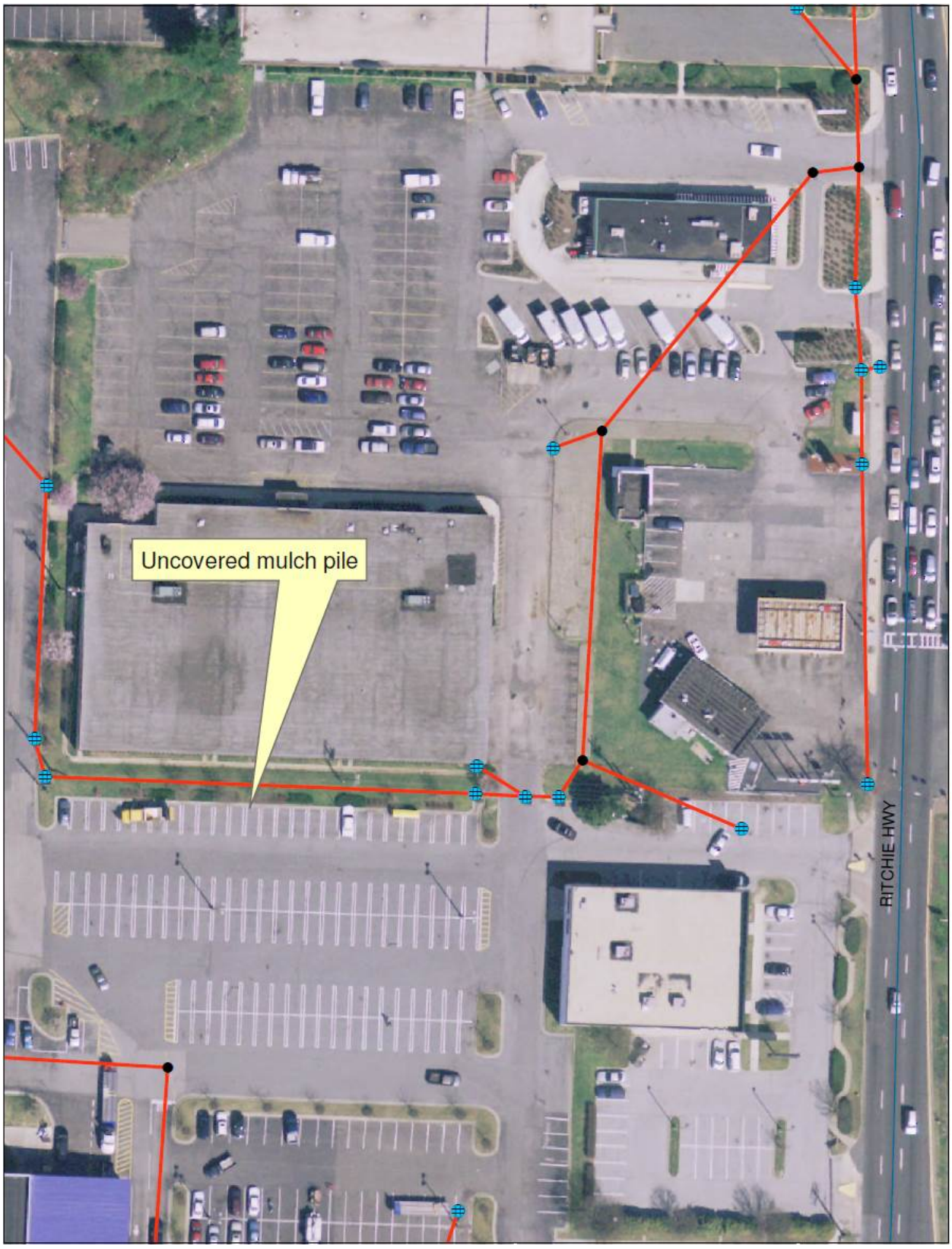


Figure 3. Area map

Anne Arundel County Hotspot Site Investigation Visit Report

Location: Target, 6717 Governor Ritchie Highway (Route 2)
Date: May 5, 2014
Investigators: G. Zuknick and K. Dillow
Concern: Waste management: full roll-off dumpster and adjacent debris

While conducting illicit discharge screening in the target area, a LimnoTech and Versar field team discovered a full, uncovered roll-off dumpster with scattered debris surrounding it (Figures 1 and 2) alongside the Target building at the above location: Ritchie Highway at Vernon Avenue. The field team documented the condition with photographs. The exposure of debris at the rim of the container, and debris deposited on the ground alongside the container, may allow trash to blow off-site or leak potentially contaminating contents onto surfaces that could lead to adjacent storm drain inlets or open water. An area map is provided as Figure 3.



Figure 1. Full roll-off dumpster alongside the Target building

9996



Figure 2. Debris between the roll-off dumpster and the Target building

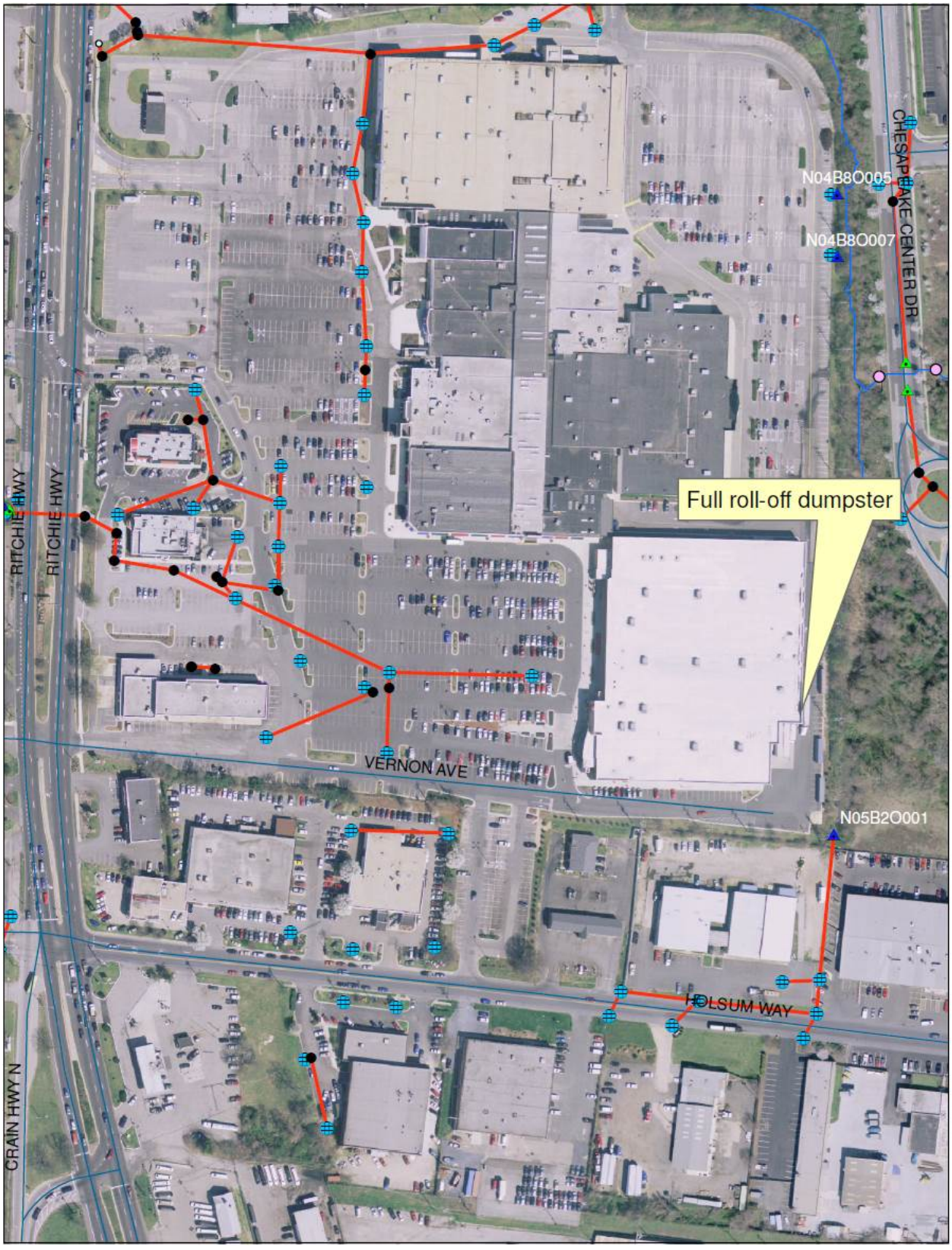


Figure 3. Area map

Anne Arundel County Hotspot Site Investigation Visit Report

Location: Behind Chuck E. Cheese's restaurant, 6637 Governor Ritchie Highway
Date: May 5, 2014
Investigators: G. Zuknick and K. Dillow
Concern: Improper bulk solid storage

While conducting illicit discharge screening in the target area, a LimnoTech and Versar field team discovered a large, uncovered pile of mulch, extending across several parking spaces (Figure 1) in the parking area behind the Chuck E. Cheese's restaurant at the above location: Governor Ritchie Highway, at East Ordnance Road. The field team documented the condition with a photograph. The placement of mulch on an impervious surface introduces the risk of distribution, by wind or rain, of mulch particles and associated nutrients which could drift into adjacent storm drain inlets or open water. An area map is provided as Figure 2.



Figure 1. Large, uncovered pile of mulch behind Chuck E. Cheese's restaurant

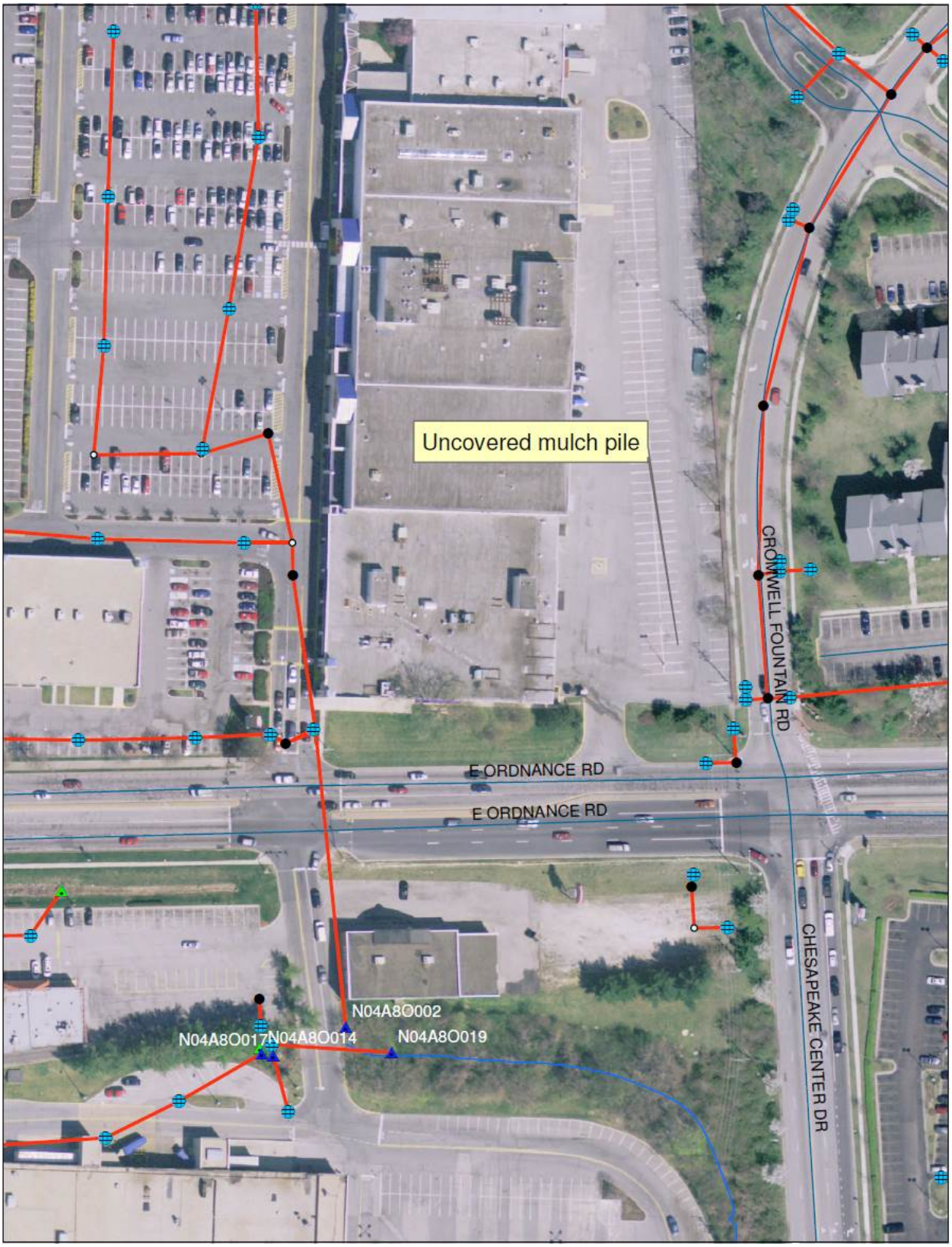


Figure 2. Area map

Anne Arundel County Hotspot Site Investigation Visit Report

Location: Hampton Inn, 6617 Governor Ritchie Highway (Route 2)
Date: May 5, 2014
Investigators: G. Zuknick and K. Dillow
Concern: Waste management: debris and food alongside dumpster

While conducting illicit discharge screening in the target area, a Versar field team noted debris and food alongside a Waste Management dumpster (Figure 1 and Figure 2) in the parking area at the above address. The field team documented the condition with photographs. Debris (cardboard and plastic) that is not properly stored in a closed container could be transported to nearby storm drain inlets and either enter or clog the inlet. If the debris includes material that can leach contaminants or concentrated substances to the impervious surface, it may also be transported to the storm drain inlet in storm runoff. Food may introduce nutrients and contaminants to the storm system through a nearby inlet. There is also a concern for attracting pests to the site. An area map is provided as Figure 3.



Figure 1. Cardboard, plastic, and food found alongside the dumpster, view 1



Figure 2. Cardboard, plastic, and food found alongside the dumpster, view 2

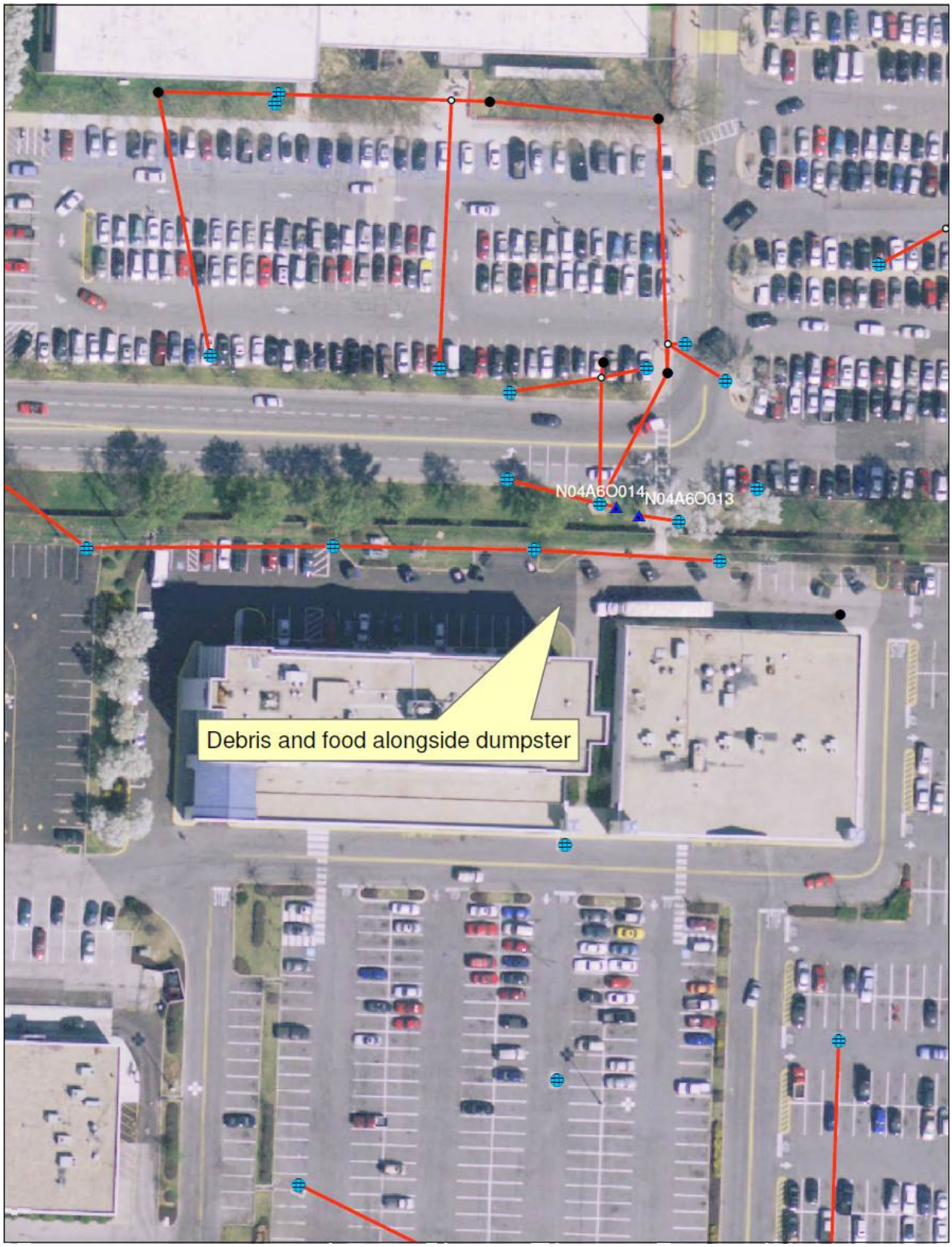


Figure 3. Area map

Anne Arundel County Hotspot Site Investigation Visit Report

Location: Walmart, 6721 Chesapeake Center Drive, rear lot
Date: May 5, 2014
Investigators: G. Zuknick and K. Dillow
Concern: Waste management: poor waste management practice

A LimnoTech and Versar team screened outfalls in the vicinity of the Walmart store at the above address. While investigating the immediate area for hotspot concerns, staff noticed a large number of shopping carts containing trash and discarded material lined up against the rear of the building (Figures 1 and 2). The field team photo-documented the condition and also the presence of bales of cardboard placed near a storm drain inlet (Figure 3). The lack of proper storage (preferably in closed containers under shelter) may allow trash to blow off-site and into the storm drain system. Additionally, discarded material should not be stored adjacent to storm drain inlets where leaching of pollutants may occur. An area map appears in Figure 4 with the location of the problem indicated.

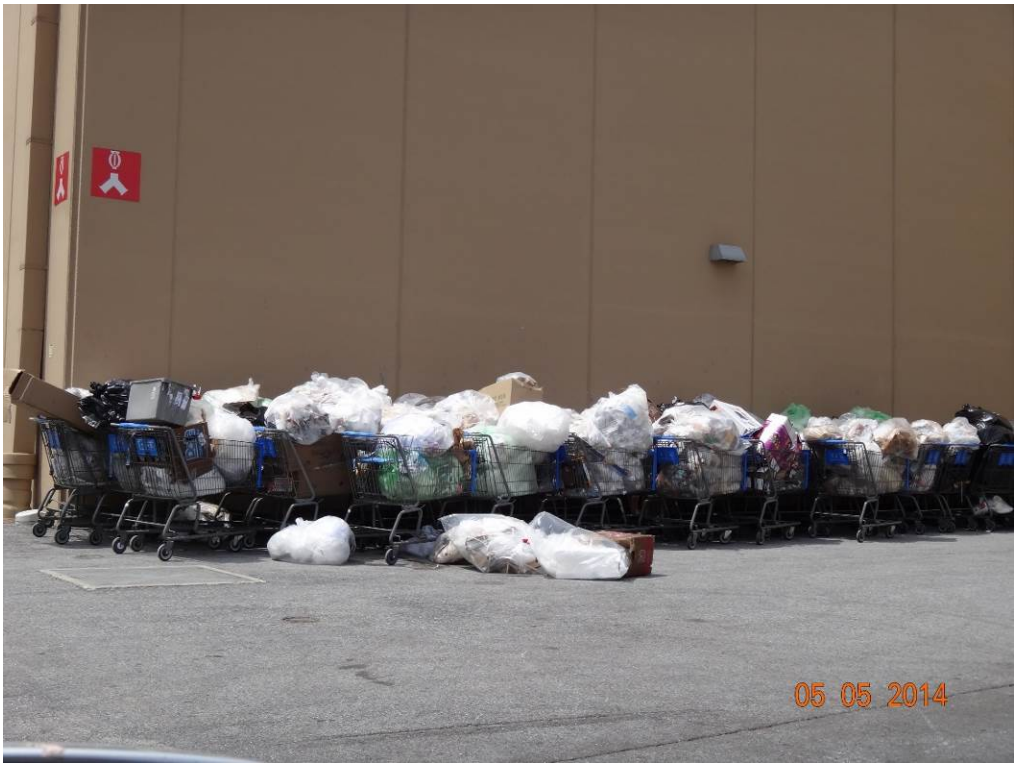


Figure 1. Row of shopping carts containing bags of trash



Figure 2. Two rows of shopping carts containing trash



Figure 3. Trash stored in shopping carts (foreground) and bales of cardboard near storm drain inlet (background)



Figure 4. Area map

Anne Arundel County Hotspot Site Investigation Visit Report

Location: 530 McCormick Drive
Date: May 6, 2014
Investigators: M. Berlett and N. Eshleman
Concern: Waste management: overflowing and open dumpsters

At the address above, a Versar field team identified two open dumpsters, one of which was overflowing with trash (Figure 1). Nearby, two recycling containers were overflowing with recycling material (Figure 2). Both problems were noted in the north, rear portion of the parking area of the above address. Both conditions may cause trash to blow out of containment and into the stormwater management area, storm infrastructure, or stream located on the north side of the parking lot. Two businesses nearby the problem were identified as Terminix and Vision Technologies. An area map appears in Figure 3 with the location of the problems indicated.



Figure 1. Overflowing and open dumpsters



Figure 2. Overflowing recycling bins



Figure 3. Area map

Anne Arundel County Hotspot Site Investigation Visit Report

Location: Domino's Pizza, 7502 Connelley Drive, Unit 112
Date: May 7, 2014
Investigators: M. Berlett and I. Turcsányi
Concern: Improper storage: cooking grease

While conducting outfall screening in the target area, a Versar field team noted a Valley Proteins container, intended for the disposal of waste kitchen grease, with an open lid (Figure 1) in the parking area at the above address. The field team documented the condition with a photograph. An open container of grease poses a concern if rainwater enters the container and overflows, distributing contaminants to adjacent impervious surfaces and eventually to storm drain inlets or open water. There is also a concern for attracting pests to the site. An area map is provided as Figure 2.



Figure 1. Open waste grease disposal container



Figure 2. Area map

Anne Arundel County Hotspot Site Investigation Visit Report

Location: Behind Cantina Mamma Lucia, 1350 Dorsey Road
Date: May 7, 2014
Investigators: M. Berlett and I. Turcsányi
Concern: Waste management: debris alongside dumpster

While conducting illicit discharge screening in the target area, a Versar field team noted debris alongside a Waste Management dumpster (Figure 1) in the parking area at the above address. The field team documented the condition with a photograph. Debris (cardboard and plastic) that is not properly stored in a closed container could be transported to nearby storm drain inlets and either enter or clog the inlet. If the debris includes material that can leach contaminants or concentrated substances to the impervious surface, that may also be transported to the storm drain inlet with rainwater. An area map is provided as Figure 2.



Figure 1. Cardboard and plastic containers found on the ground alongside the dumpster

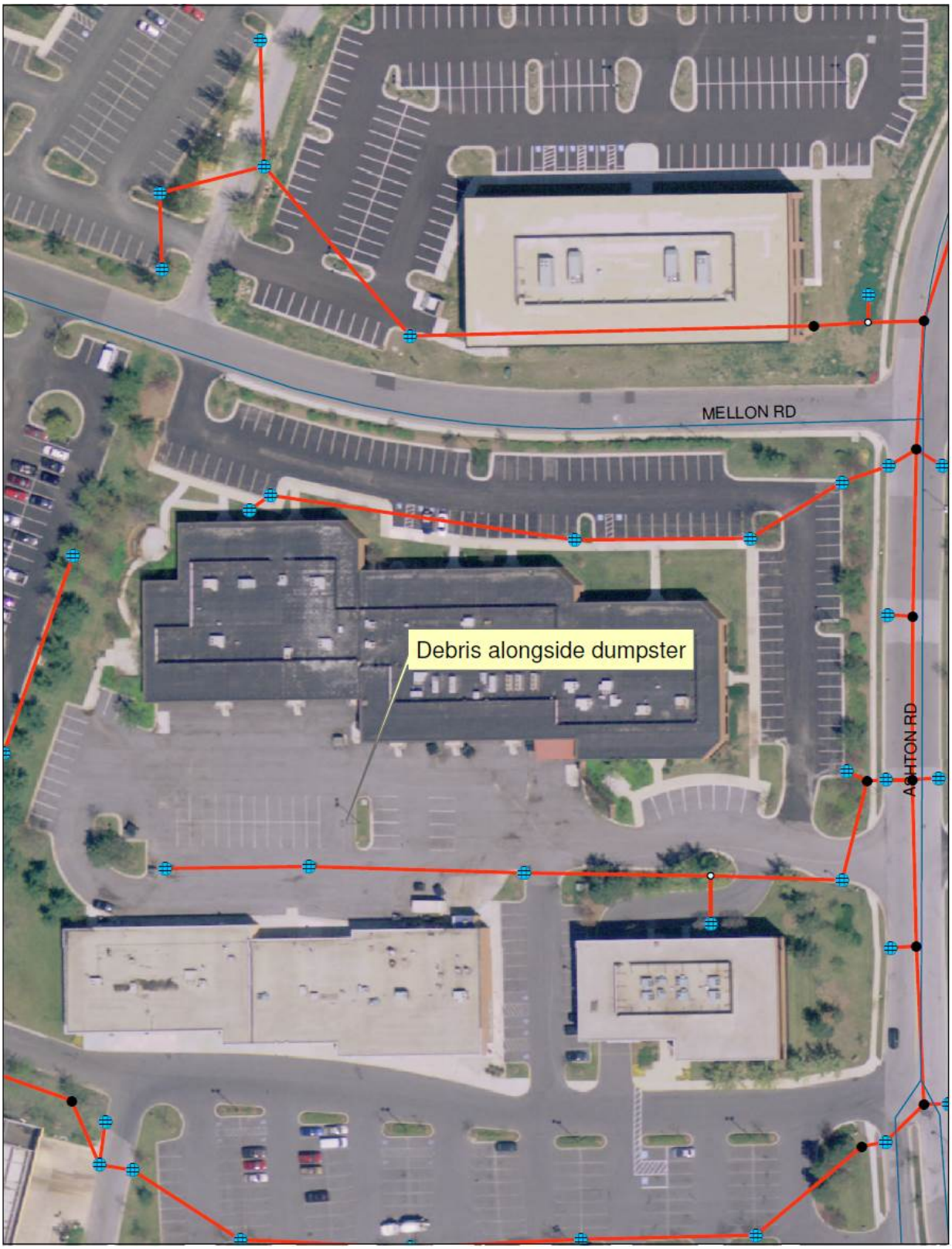


Figure 2. Area map

Anne Arundel County Hotspot Site Investigation Visit Report

Location: Mission BBQ restaurant, 7748 Governor Ritchie Highway (Route 2)
Date: May 15, 2014
Investigators: G. Zuknick and B. Perry
Concern: Waste management: debris alongside dumpster

While conducting illicit discharge screening in the target area, a Versar-LimnoTech field team noted debris on the ground alongside an open, and possibly full, Bay Area Disposal dumpster (Figure 1) behind the restaurant at the above address. The field team documented the condition with a photograph. Debris (cardboard, plastic bottles, metal lids, and bagged trash) that is not properly stored in a closed container could be transported to nearby storm drain inlets and either enter or clog the inlet. If the debris includes material that can leach contaminants or concentrated substances to the impervious surface, it may also be transported to the storm drain inlet in storm runoff. Food, if present in the debris, may introduce nutrients and contaminants to the storm system through a nearby inlet. There is also a concern for attracting pests to the site. An area map is provided as Figure 2.



Figure 1. Cardboard, plastic, and bagged trash found alongside the open dumpster

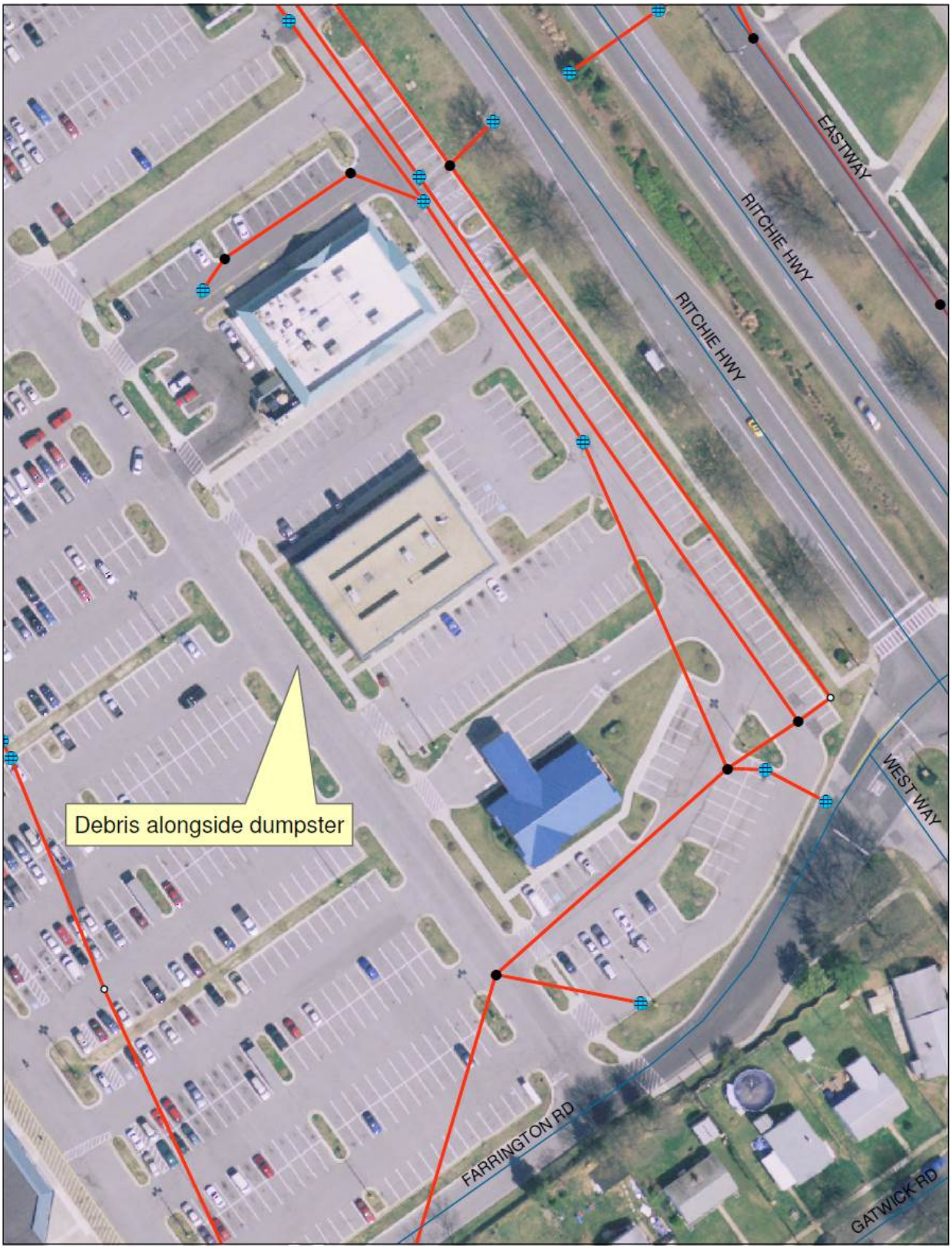


Figure 2. Area map

Anne Arundel County Hotspot Site Investigation Visit Report

Location: Gavigan's Home Furnishings store, 6319 Governor Ritchie Highway (Route 2)
Date: May 15, 2014
Investigators: G. Zuknick and B. Perry
Concern: Improper bulk solid storage

While conducting illicit discharge screening in the target area, a LimnoTech and Versar field team discovered a large, uncovered pile of mulch, extending across several parking spaces (Figure 1) in the parking alongside the Gavigan's Home Furnishings store at the above location: Governor Ritchie Highway, between 6th Avenue and Georgia Avenue, NE. The field team documented the condition with a photograph. The placement of mulch on an impervious surface introduces the risk of distribution, by wind or rain, of mulch particles and associated nutrients which could drift into adjacent storm drain inlets or open water. An area map is provided as Figure 2.



Figure 1. Large, uncovered pile of mulch

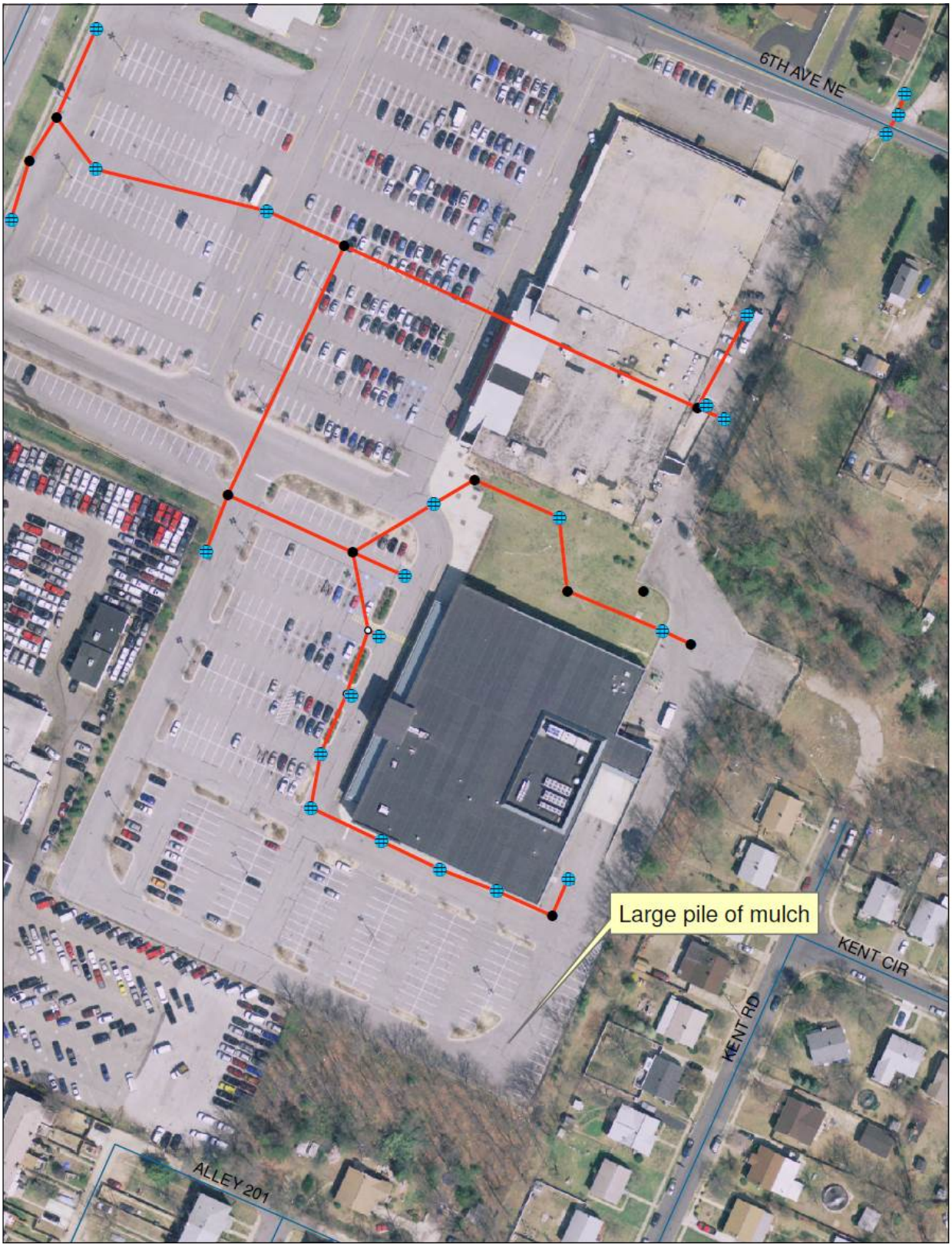


Figure 2. Area map

Anne Arundel County Hotspot Site Investigation Visit Report

Location: PetSmart store and Planet Fitness Gym, 597 East Ordnance Road
Date: May 15, 2014
Investigators: G. Zuknick and B. Perry
Concern: Waste management: debris alongside dumpster

While conducting illicit discharge screening in the target area, a LimnoTech and Versar field team noted multiple large pieces of furniture and building materials on the ground alongside an open, and possibly full, AmeriWaste dumpster (Figure 1), and scattered broken pallets and loose debris behind the building portion occupied by the adjacent business (Figure 2), at the above address. The field team documented the condition with photographs. Furniture and building materials exposed to the elements may include materials that can leach contaminants to the impervious surface that could be transported to the storm drain inlet in storm runoff. Large, bulky items left in a parking lot can also trap light debris that drifts into them via wind or water. The loose boards and nails associated with the scattered and broken pallets present hazards to motorists and pedestrians. The loose cardboard from either area may float or be blown toward storm drain inlets and block flows. An area map is provided as Figure 3.



Figure 1. Discarded furniture and building materials found alongside the open dumpster



Figure 2. Scattered and broken pallets and loose cardboard found behind the building

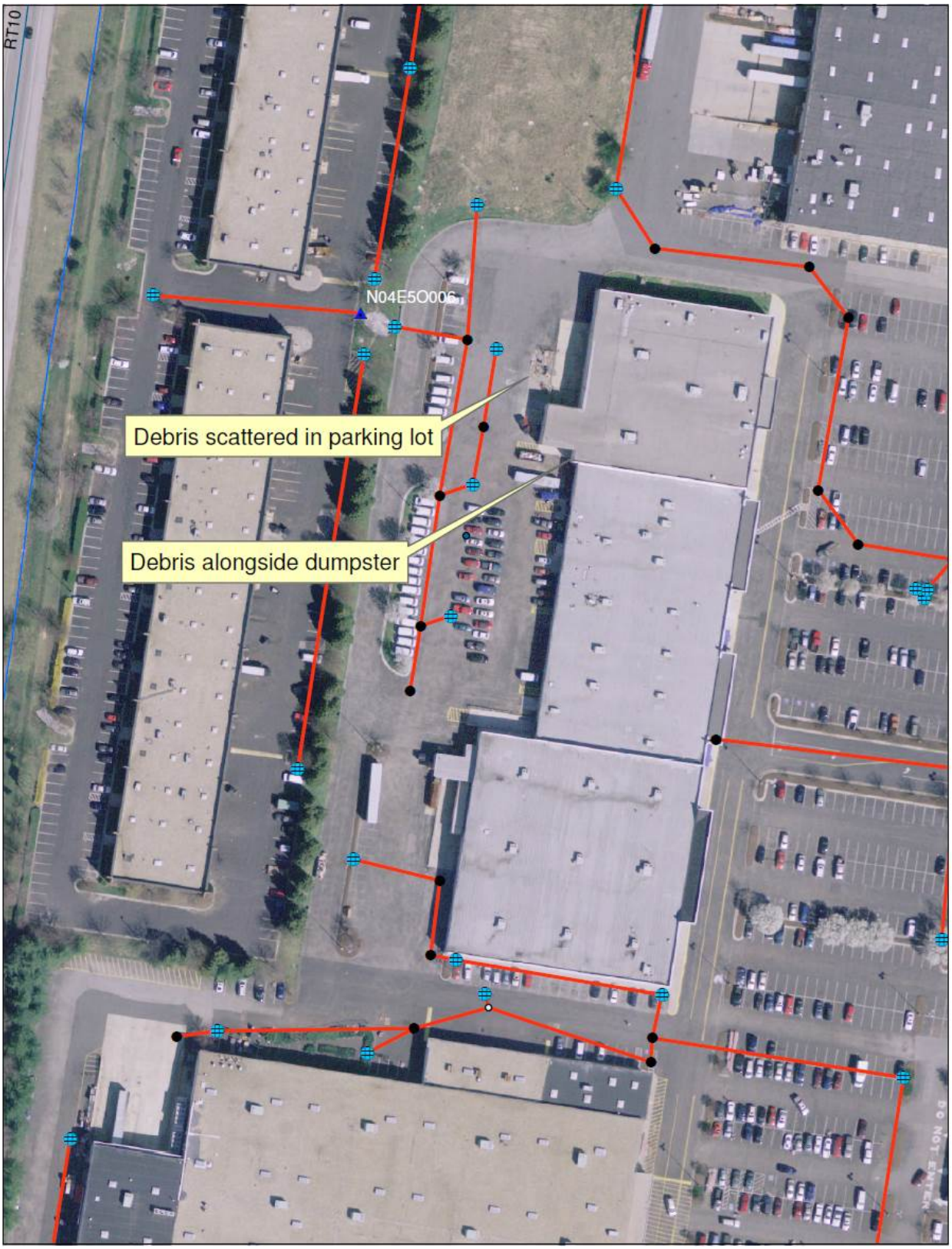


Figure 3. Area map

Anne Arundel County Hotspot Site Investigation Visit Report

Location: Parking lot adjacent to 1745 West Nursery Road, Linthicum Heights
Date: June 2, 2014
Investigators: C. Tonkin and I. Turcsányi
Concern: Improper bulk solid storage

While conducting illicit discharge screening in the target area, a Versar field team discovered two large, uncovered piles - one salt and one sand (Figure 1) - at the above location, which is the parking area across the street from the Hilton BWI Airport Hotel. The field team documented the condition with photographs. The sand pile was uncontained and uncovered (Figure 2). Sand was evident in the parking area between the sand pile and the storm drain inlet at the corner of the parking lot. The field crew documented that there was sand in the storm drain, itself (Figure 3). The salt pile was partly contained with a section of concrete barrier (Jersey wall) and some tires, and partially covered (Figure 4). The placement of sand and salt on an impervious surface introduces the risk of distribution, by wind or rain, of particles and associated contaminants which could be transported into adjacent storm drain inlets or open water. An area map is provided as Figure 5.



Figure 1. Two large piles in the parking area; salt is in the foreground, sand is in the background



Figure 2. Sand pile and some of the associated runoff in the parking area



Figure 3. Sand observed in the storm drain at the corner of the parking lot



Figure 4. A salt pile found in the parking area with inadequate cover and containment



Figure 5. Area map

Anne Arundel County Hotspot Site Investigation Visit Report

Location: Belair Produce, 7226 Parkway Drive, Hanover
Date: June 16, 2014
Investigators: B. Hood and I. Turcsányi
Concern: Waste management

A Versar field team discovered an actively polluting condition at a roll-away dumpster found behind a Belair Produce building at the above address (Figure 1). The over-full dumpster was observed leaking a foul, sour-smelling liquid onto the parking lot (Figure 2). The area affected by the leaching material was extensive, spanning an area from the dumpster, along the edge of the parking lot, to the adjacent woods (Figures 3 and 4). The field team observed a stream in the woods, but could not ascertain whether the leachate was entering the stream (due to thick vegetation barring passage) on the day of the field visit. An area map, indicating the location of the dumpster, is provided in Figure 5.



Figure 1. Roll-away dumpster found behind the Belair Produce building actively leaking fluid



Figure 2. Fluid observed leaking from the dumpster on June 16, 2014



Figure 3. Fresh leachate trail as observed facing the dumpster



Figure 4. Fresh leachate trail as observed facing away from the dumpster

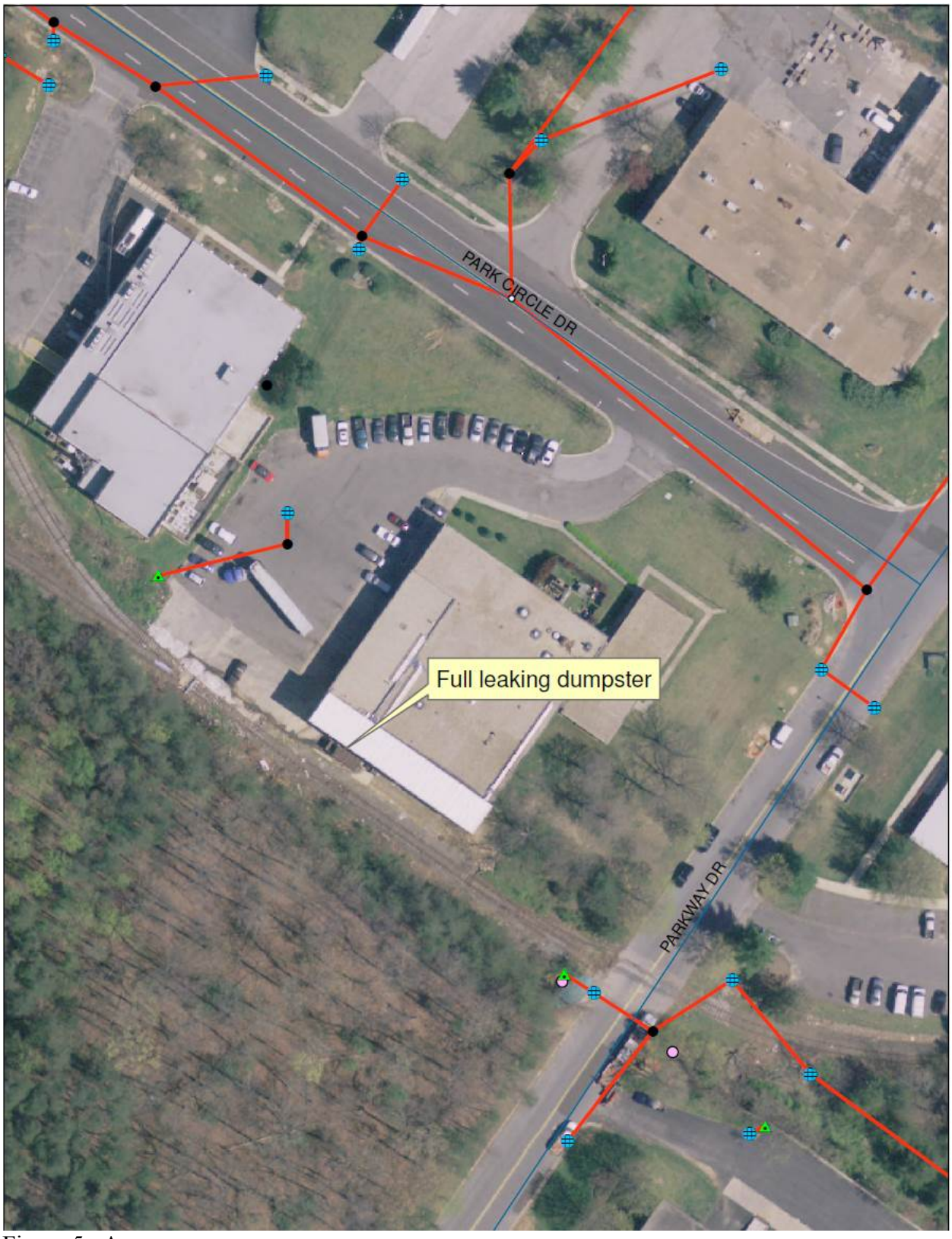


Figure 5. Area map

Anne Arundel County Hotspot Site Investigation Visit Report

Location: 1591 West Nursery Road, Linthicum Heights, MD
Date: July 7, 2014
Investigators: M. Berlett and B. Hood
Concern: Waste management: catch basin contains rotting debris

While a Versar field team was investigating a structural problem at a curb inlet in the parking lot behind the Hoyt's Cinema 14 at the address given above, team members detected a foul smell. The crew removed the manhole cover (Figure 1) and inspected the contents of the catch basin (Figure 2). The field crew noted that the debris found in the bottom of the catch basin is likely the cause of the disagreeable odor, as the trapped material is rotting in place. The field team noted that the dumpsters (seen in Figure 1) are slightly uphill from the inlet; it is possible that the debris in the storm drain system has accumulated from loose debris associated with the dumpsters (an open cover may allow loose debris to be carried out with strong winds; debris that is not properly inserted into the dumpster may become dislodged and fall to the ground). An area map appears in Figure 3.



Figure 1. Curb inlet with manhole cover removed; dumpsters in the background are slightly up-grade to the inlet



Figure 2. Foul-smelling debris observed within the curb inlet

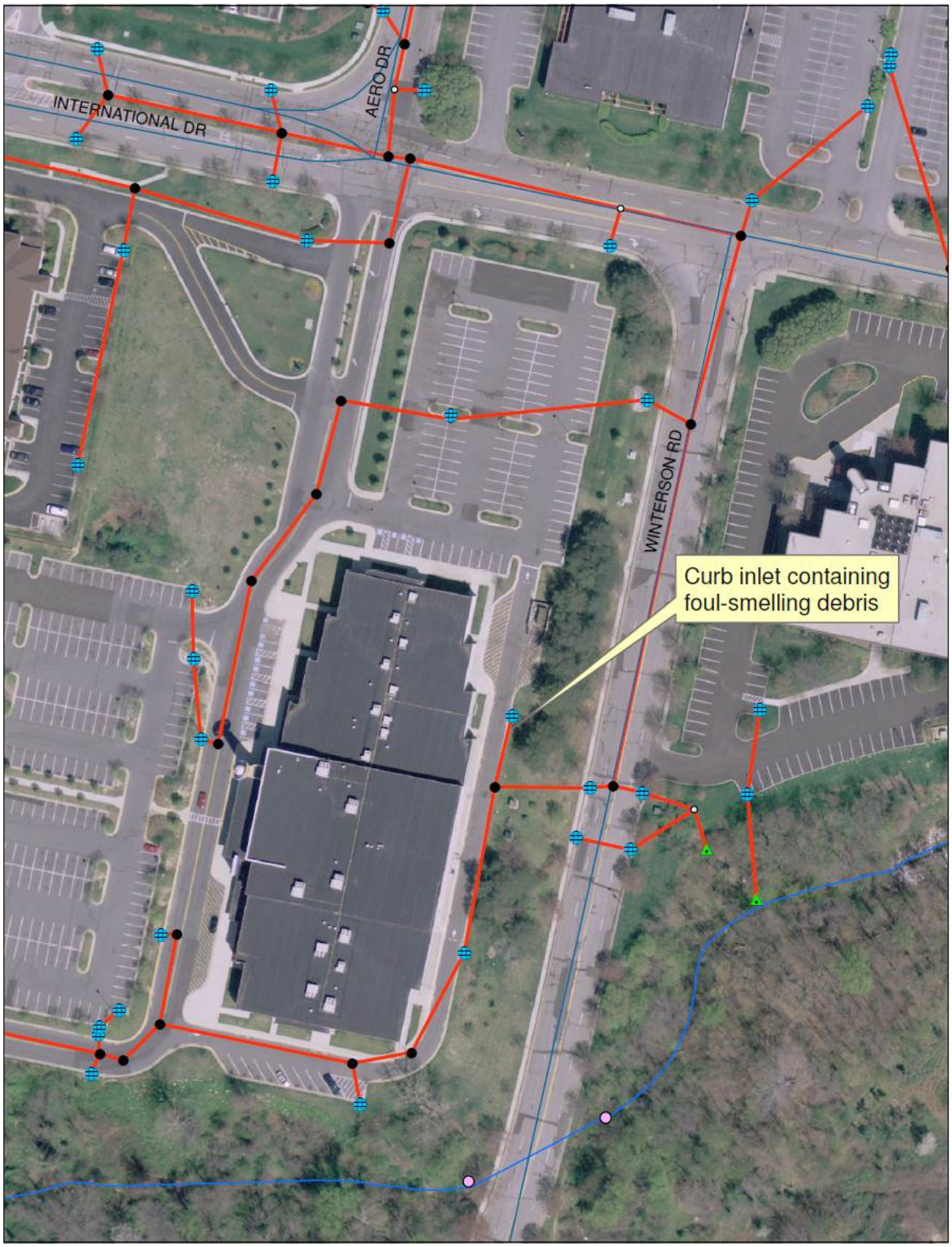


Figure 3. Area map

Anne Arundel County Hotspot Site Investigation Visit Report

Location: H&R Block, 123 Crain Highway North, Glen Burnie
Date: July 7, 2014
Investigators: G. Zuknick and B. Crary
Concern: Waste management: debris alongside dumpster

While conducting illicit discharge screening in the target area, a LimnoTech field team noted several filled bags and loose debris on the ground alongside a dumpster (Figure 1) at the above address. On the other side of the pair of dumpsters, the field team observed that there was a trail of liquid that had leaked from the dumpsters (Figure 2). The field team documented the condition with photographs. Debris deposited on the ground alongside the containers may allow trash to blow off-site or leak potentially contaminating contents onto surfaces that could lead to adjacent storm drain inlets or open water. An area map is provided as Figure 3.



Figure 1. Filled bags and loose debris found alongside the dumpster



Figure 2. Evidence of liquid leaking from dumpsters



Figure 3. Area map

Anne Arundel County Hotspot Site Investigation Visit Report

Location: 550 Crain Highway North, Glen Burnie
Date: July 7, 2014
Investigators: G. Zuknick and B. Crary
Concern: Waste management: debris alongside dumpster

While conducting illicit discharge screening in the target area, a LimnoTech field team noted several filled bags and loose debris on the ground alongside a dumpster (Figure 1) at the above address. The dumpster may be used by more than one business adjacent to the parking lot. The field team documented the condition with a photograph. Debris deposited on the ground alongside the containers may allow trash to blow off-site or leak potentially contaminating contents onto surfaces that could lead to adjacent storm drain inlets or open water. An area map is provided as Figure 2.



Figure 1. Filled bags and loose debris found alongside the dumpster

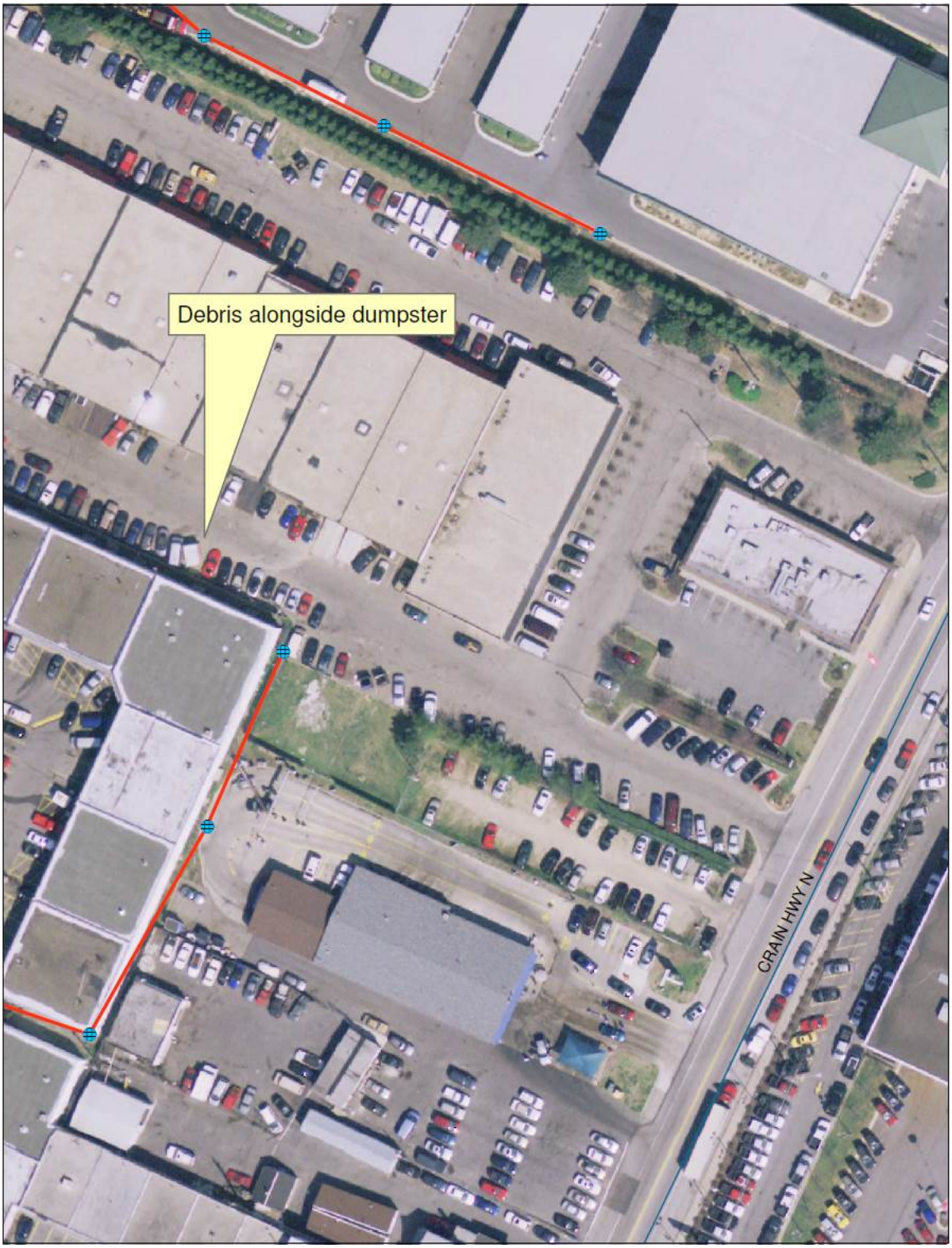


Figure 2. Area map

Anne Arundel County Hotspot Site Investigation Visit Report

Location: Custom Kitchen Countertop, 706 Crain Highway North, Glen Burnie
Date: July 7, 2014
Investigators: G. Zuknick and B. Crary
Concern: Improper bulk solid storage: tile cutting work area

While conducting illicit discharge screening in the target area, a LimnoTech field team discovered a work area in the parking lot behind the Custom Kitchen Countertop business. The apparatus and materials indicated a countertop-cutting facility (tile, stone, etc.; Figure 1). The field team documented the condition with a photograph. Dust, cuttings, and materials left on the impervious surface of the parking lot, without benefit of canopy cover, have the potential for wash-off into the storm drain system and subsequently polluting surface waters downstream. An area map is provided as Figure 2.



Figure 1. Tile-cutting work area established in the parking lot behind the building



Figure 2. Area map

Anne Arundel County Hotspot Site Investigation Visit Report

Location: Ledo Pizza, 18 Ordnance Road, Glen Burnie
Date: July 7, 2014
Investigators: G. Zuknick and B. Crary
Concern: Improper cooking oil storage

While conducting illicit discharge screening in the target area, a LimnoTech field team discovered a Valley Proteins container, intended for the disposal of waste kitchen grease, with oil on the parking lot around the container (Figure 1). The field team documented the conditions with a photograph. The field crew did not inspect the container; it is possible that the oil may be from a leak in the container or a spill during attempts to empty oil into the container. The photograph shows a stain on the wall behind the container; this suggests that emptying vessels into the container is not always an effective operation. The field team noted that several filled bags were on the ground near the container; the crew did not investigate the contents of the bags. Cooking oil on an impervious surface poses a hazard to pedestrians; in a rain event, the oil may also distribute contaminants to adjacent impervious surfaces and eventually to storm drain inlets or open water. There is also a concern for attracting pests to the site. An area map is provided as Figure 2.



Figure 1. Waste grease disposal container with oil on nearby parking lot areas, and several bags



Figure 2. Area map

Anne Arundel County Hotspot Site Investigation Visit Report

Location: CVS, 7400 Governor Ritchie Highway, Glen Burnie
Date: July 25, 2014
Investigators: G. Zuknick and B. Crary
Concern: Waste management: debris alongside dumpster

While conducting illicit discharge screening in the target area, a LimnoTech field team noted a large amount of cardboard boxes piled on the ground alongside a dumpster (Figure 1) at the above address. The dumpster (Vert-I-Pack) is a compactor - in this case, for cardboard - that operates with a key. The field team documented the condition with a photograph. Debris deposited on the ground alongside the container may allow trash to blow off-site or encourage dumping by others which could leak potentially contaminating contents onto surfaces that could lead to adjacent storm drain inlets or open water. An area map is provided as Figure 2.



Figure 1. Debris found alongside the dumpster (compactor)

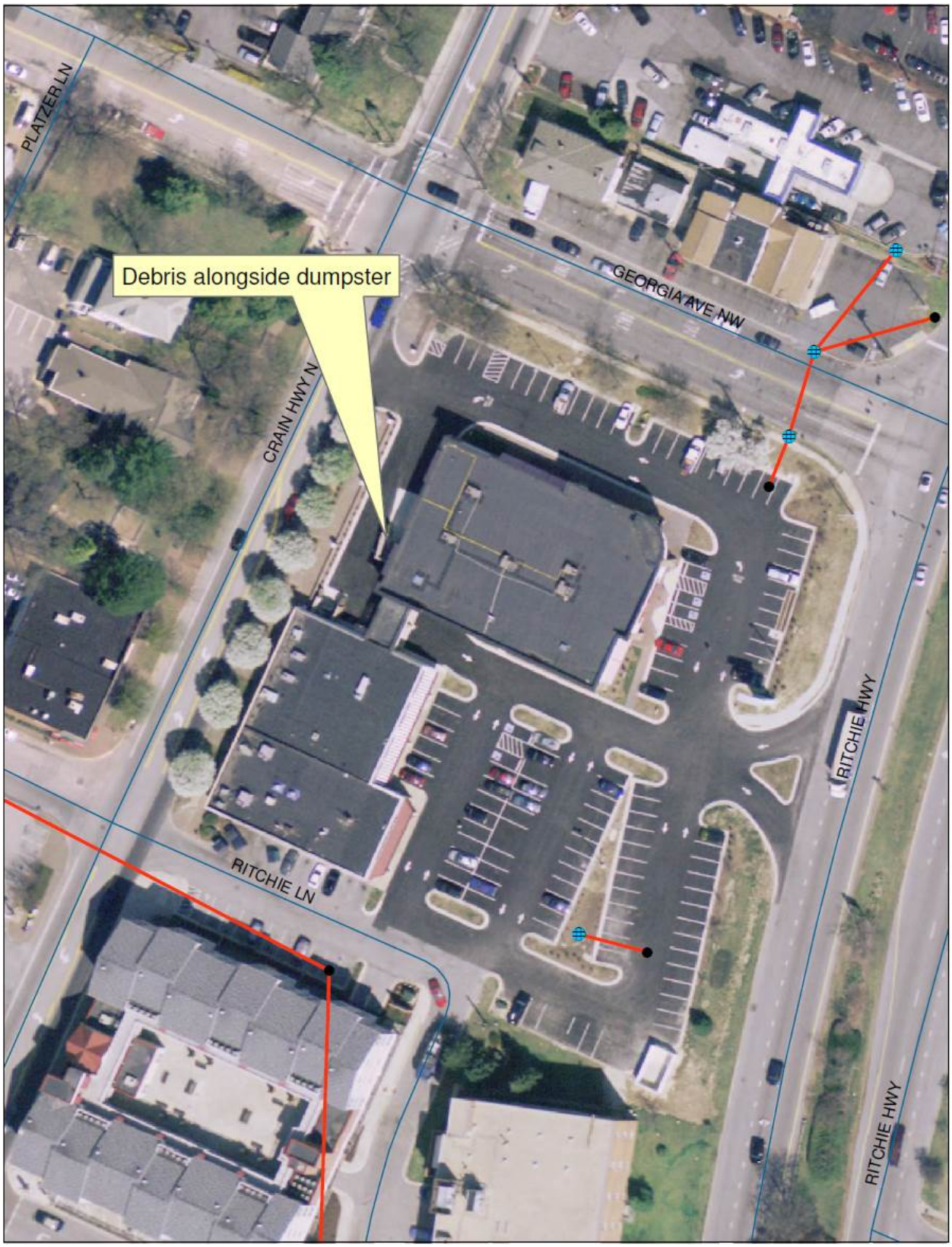


Figure 2. Area map

Anne Arundel County Hotspot Site Investigation Visit Report

Location: Family Dollar #6625, 7546 Governor Ritchie Highway, Glen Burnie
Date: July 25, 2014
Investigators: G. Zuknick and B. Crary
Concern: Waste management: debris alongside an over-full dumpster

While conducting illicit discharge screening in the target area, a LimnoTech field team noted several filled bags and loose debris on the ground around an over-full dumpster (Figure 1) at the above address. The dumpster was intended to collect materials for recycling, according to the sign affixed to the front of the unit, and may have received materials from more than one business in the shopping center. At the time of the field visit, the field crew observed that the dumpster was filled beyond capacity, so that the lid could not be closed. The field team documented the condition with a photograph. The dumpster's position was very close to a curb inlet, as is evident in Figure 1; the inlet was partially blocked by a filled bag and loose debris on the day of the visit. Debris deposited on the ground alongside the container may allow trash to blow off-site or leak potentially contaminating contents onto surfaces that could lead to the adjacent storm drain inlet or open water. An area map is provided as Figure 2.



Figure 1. Debris observed alongside the dumpster and blocking the storm drain inlet



Figure 2. Area map

Anne Arundel County Hotspot Site Investigation Visit Report

Location: Home Goods, 7730 Governor Ritchie Highway, Glen Burnie
Date: July 25, 2014
Investigators: G. Zuknick and B. Crary
Concern: Waste management: debris alongside dumpster

While conducting illicit discharge screening in the target area, a LimnoTech field team noted excessive loose debris scattered on the ground around a dumpster (Figure 1) at the above address. The field team documented the condition with a photograph. The photograph also reveals a large amount of broken glass at the base of the unit, and many pieces distributed further away, which present safety hazards for workers and passersby. Debris deposited on the ground alongside the container may allow trash to blow off-site or leak potentially contaminating contents onto surfaces that could lead to adjacent storm drain inlets or open water. An area map is provided as Figure 2.

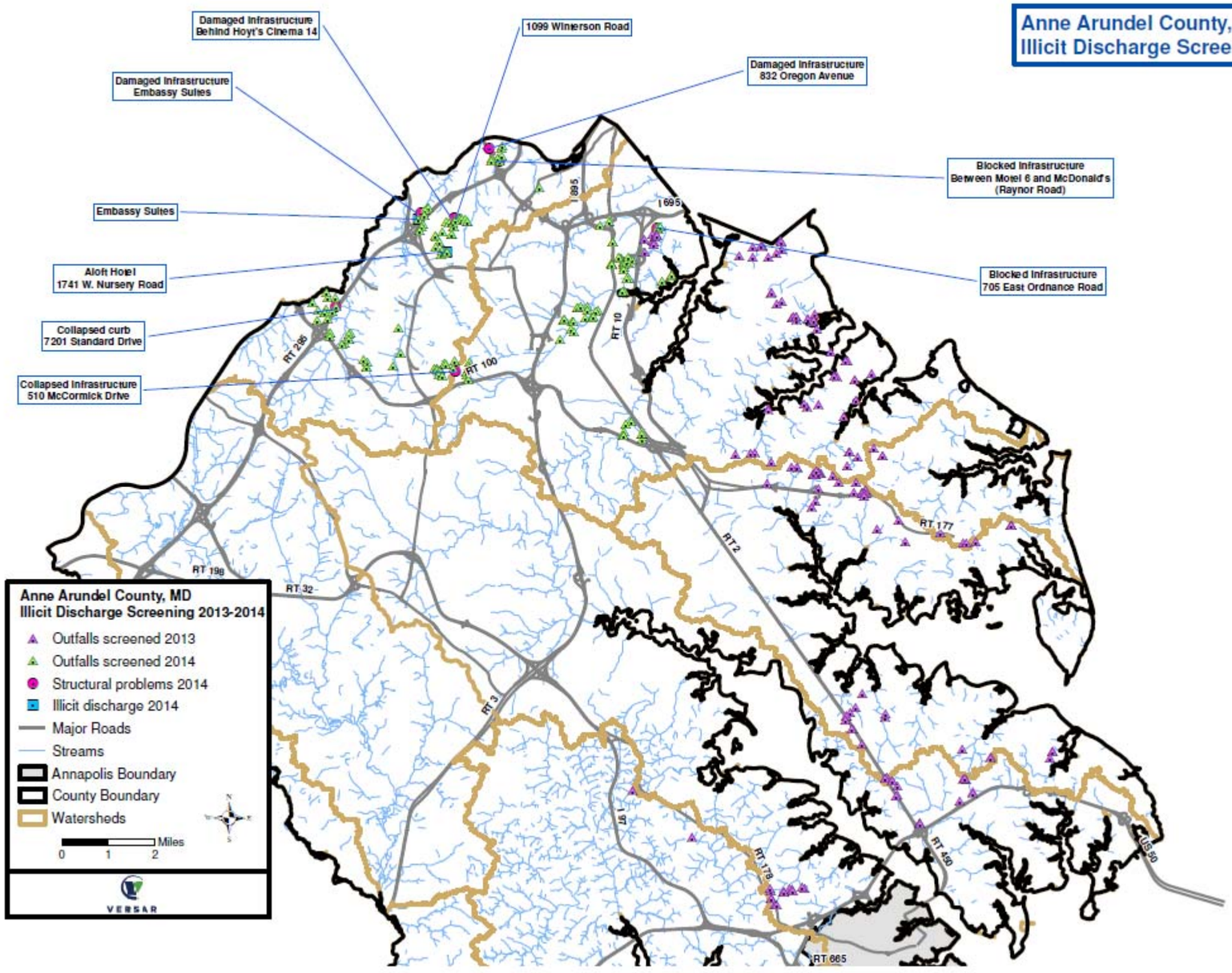


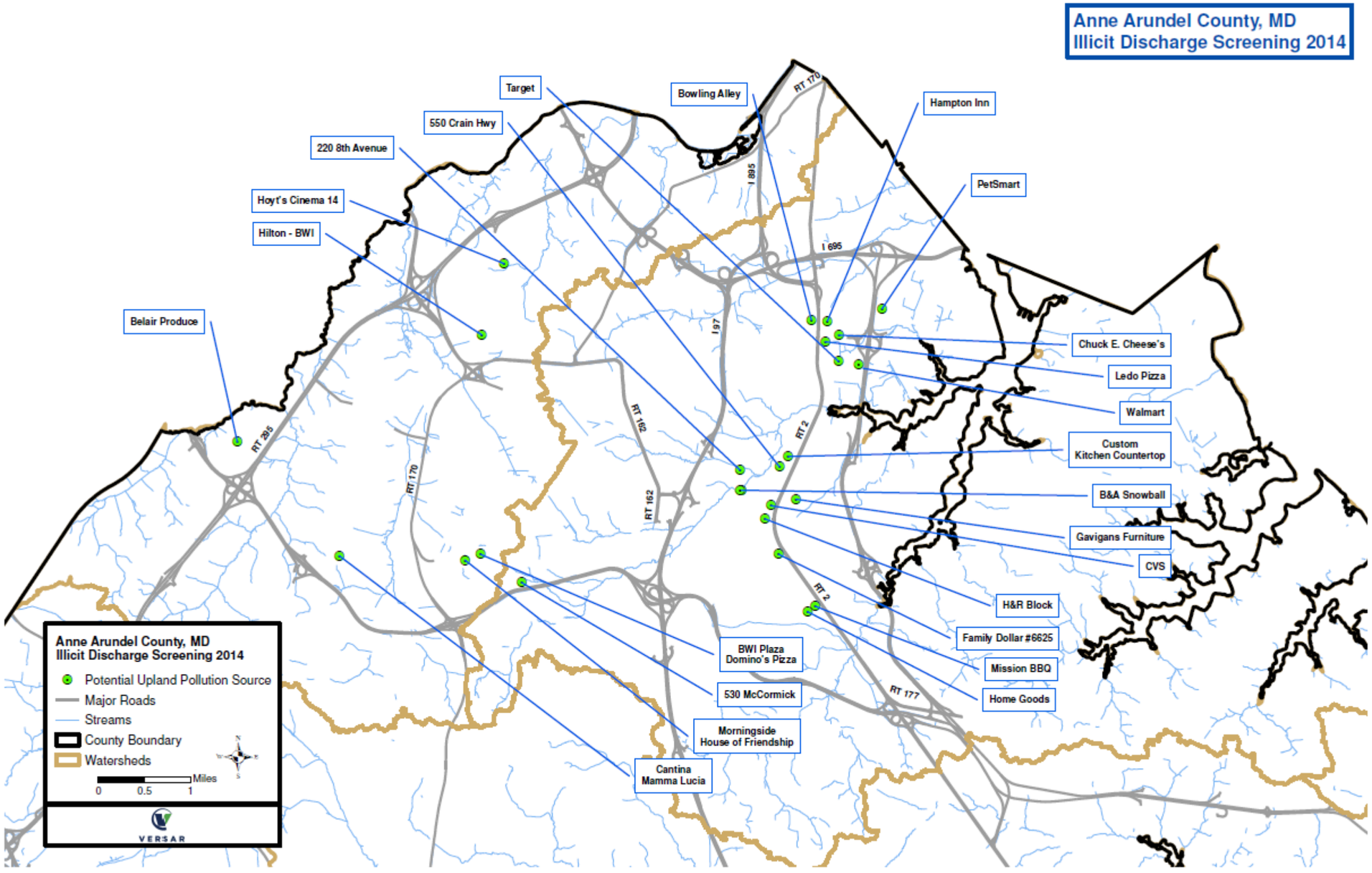
Figure 1. Debris found scattered around the dumpster



Figure 2. Area map

APPENDIX D
MAPS


Anne Arundel County, MD
Illicit Discharge Screening 2013 - 2014
Damaged Infrastructure Behind Hoyt's Cinema 14
1099 Winnerson Road
Damaged Infrastructure 832 Oregon Avenue
Damaged Infrastructure Embassy Suites
Blocked Infrastructure Between Motel 6 and McDonald's (Raynor Road)
Embassy Suites
Aloft Hotel 1741 W. Nursery Road
Blocked Infrastructure 705 East Ordnance Road
Collapsed curb 7201 Standard Drive
Collapsed Infrastructure 510 McCormick Drive
I 895
I 695
RT 10
RT 100
RT 198
RT 32
RT 3
RT 2
RT 177
RT 179
RT 450
RT 665
US 50
Anne Arundel County, MD
Illicit Discharge Screening 2013-2014
Outfalls screened 2013
Outfalls screened 2014
Structural problems 2014
Illicit discharge 2014
Major Roads
Streams
Annapolis Boundary
County Boundary
Watersheds
Miles
0 1 2
VERSAR


Anne Arundel County, MD
Illicit Discharge Screening 2014
Target
Bowling Alley
Hampton Inn
550 Crain Hwy
220 8th Avenue
PetSmart
Hoyt's Cinema 14
Hilton - BWI
Belair Produce
Chuck E. Cheese's
Ledo Pizza
Walmart
Custom Kitchen Countertop
B&A Snowball
Gavigans Furniture
CVS
H&R Block
Family Dollar #6625
Mission BBQ
Home Goods
BWI Plaza Domino's Pizza
530 McCormick
Morningside House of Friendship
Cantina Mamma Lucia
RT 170
I 895
I 695
I 97
RT 295
RT 162
RT 2
RT 177
Anne Arundel County, MD
Illicit Discharge Screening 2014
Potential Upland Pollution Source
Major Roads
Streams
County Boundary
Watersheds
Miles
0
0.5
1
VERSAR

APPENDIX E
ACCESS DATABASE FOR ILLICIT DISCHARGE DETECTION PROGRAM INSPECTIONS

APPENDIX F
COUNTY INSPECTION COMPLIANCE DATABASE REPORTS

Anne Arundel County
Compliance Cases

Case ID:	E - 2013 - 378	**Location:**	0 FLOOD PLAINS
Tax ID:	447290045690		MARYLAND CITY LAUREL 20724
Received:	7/2/2013	**Details:**	ERODED STORMDRAIN OUTFALL
Tickler:		**Completed:**	5/29/2014
	FLOODPLAIN COMPLAINT		

Receiver:		**Inspector:**		**Backup Inspector:**	
Date Assigned:	7/2/2013	**Permit Number:**		**Original ID:**	
ADC Map:		**Related Cases:**			
Water Front:	N	**Critical Area:**	N	**Violation:**	
Cty. Council Ind:	N	**Case Org:**			
Complainant:					

Owner Information	**Violator Information**
Owner 1:	**Violator 1:**
Owner 2:	**Violator 2:**
Address:	**Address:**
	Phone:

State Map:	19		24	0178	**County Map:**				
	Map No:	Suffix	Block	Parcel		Plat	Sect	Block	Lot No

Date	Event	Due Date	Request for Trial Date
7/2/2013	OPENED COMPLAINT CASE	7/7/2013	
	ERODED OUTFALL COMPLAINT FILED WITH DPW, WHO INDICATED STORMDRAIN IS OWNED AND MAINTAINED BY THE MARYLAND CITY CIVIC ASSOCIATION.		
11/27/2013	CLOSE COMPLAINT	1/31/2014	
4/21/2014	RE-OPEN CASE	4/21/2014	4/21/2014
	DATA ENTRY ERROR, CASE NOT CLOSED. WPRP SECTION WILL TAKE OVER INVESTIGATION FOR POSSIBLE ENFORCEMENT		
4/23/2014	CASE NOTE	4/23/2014	4/23/2014
	SCREENED WITH OFFICE OF LAW FOR ENFORCEMENT UNDER 16.5.101 FOR THE CREATION OF AN OFF-SITE SOURCE OF EROSION OR SEDIMENT DEPOSITION. CLEAR AND CONVINCING EVIDENCE OF EROSION OR SEDIMENT DEPOSITION ON THE ADJACENT PROPERTY DIRECTLY TRACED TO THE FAILED STORMDRAIN IS REQUIRED. SITE INSPECTION OF 4-23-14 WILL ATTEMPT TO COLLECT EVIDENCE TO SCREEN WITH THE OOL FOR POSSIBLE ENFORCEMENT		

5/29/2014 CLOSE COMPLAINT

SITE INSPECTION ON 4/23/14 REVEALED NO EVIDENCE OF OFF-SITE EROSION ON SEDIMENT DEPOSITION. NO VIOLATION OF ARTICLE 16 OF COUNTY CODE. STORMDRAIN IS PRIVATELY OWNED BUT NOT COVERED UNDER A RECORDED STORMWATER INSPECTION & MAINTENANCE AGREEMENT. UNABLE TO TAKE ANY ENFORCEMENT ACTION UNDER THE COUNTY ENVIRONMENTAL CODES. NO ZONING VIOLATIONS CONCERNING HEALTH AND SAFETY.

Anne Arundel County
Compliance Cases

Case ID:	E - 2013 - 405	**Location:**	7621 ENERGY PKY
Tax ID:	313790036031		BRANDON WOODS BUS PK SC1 BALTIMORE 21226
Received:	7/19/2013	**Details:**	POND SOUTHEAST OF BUILDING
Tickler:		**Completed:**	9/4/2013
	ILLEGAL DISCHARGES COMPLAINT		

Receiver:		**Inspector:**		**Backup Inspector:**	NONE
Date Assigned:	7/19/2013	**Permit Number:**		**Original ID:**	
ADC Map:		**Related Cases:**			
Water Front:	N	**Critical Area:**	N	**Violation:**	
Cty. Council Ind:	N	**Case Org:**			
Complainant:					

Owner Information	**Violator Information**
Owner 1:	**Violator 1:**
Owner 2:	**Violator 2:**
Address:	**Address:**
	Phone:

	Map No:	Suffix	Block	Parcel		Plat	Sect	Block	Lot No
State Map:	11		08	0019	**County Map:**				7R

Date	Event	Due Date	Request for Trial Date
7/19/2013	OPENED COMPLAINT CASE	7/24/2013	

VERSAR FIELD STAFF CONDUCTED A SITE VISIT TO SEVERAL TARGETED OUTFALLS AROUND A WET POND ADJACENT TO THE 7621 ENERGY PARKWAY PROPERTY (RELIABLE CHURCHILL, LLLP) ON JULY 17, 2013. AT 1:45 P.M., THE FIELD TEAM IDENTIFIED A NEW OUTFALL DISCHARGING TO THE NORTHEAST PERIPHERY OF THE POND. THE OUTFALL WAS FOUND TO BE PARTIALLY BLOCKED BY RIPRAP, CAUSING WATER TO BACK UP INSIDE OF THE OUTFALL. FIELD STAFF REMOVED THE BLOCKAGE AND THE STORED WATER FLOWED OUT. STAFF OBSERVED THAT THE WATER WAS ORANGE IN COLOR AND OPAQUE (FIGURE 1). THE WATER ALSO EMITTED A FOUL, RANCID-SOUR SMELL. BECAUSE THE WATER WAS OPAQUE, STAFF TESTED FOR SELECTED PARAMETERS WHOSE CONCENTRATIONS WERE NOT RELIANT ON STAFF INTERPRETATION OF COLOR CHANGE (CHLORINE, DETERGENTS, FLUORIDE). THE CHLORINE CONCENTRATION WAS ABOVE THE APPLICABLE ACTION LEVEL (0.82 MG/L) AND THE PH WAS SLIGHTLY BELOW THE ALLOWABLE RANGE (6.19; TABLE 1). FIELD STAFF RETURNED TO THE OUTFALL ON JULY 18, 2013 AT 11:30 A.M. STAFF NOTED THAT THE WATER WAS STILL FLOWING AND WAS ORANGE IN COLOR. FIELD STAFF TESTED FOR THE SAME, LIMITED NUMBER OF PARAMETERS. FOR THIS FIELD TESTING, DETERGENTS TESTED ABOVE THE APPLICABLE ACTION LEVEL (0.9 MG/L) AND THE PH OF THE FLOWING WATER WAS AGAIN LOWER THAN THE RECOMMENDED RANGE (6.24; TABLE 1). AFTER THE FIELD TESTING OF THE OUTFALL ON JULY 18, STAFF WALKED AND MAPPED THE UPSTREAM DRAINAGE TO DETERMINE THE SOURCE OF THE FLOWING WATER. THE PATH OF THE TRACKDOWN CROSSED A MAN-MADE FILL AREA THAT INCLUDED A WELL WITH AN MDE IDENTIFICATION TAG (FIGURE 2). THE FIELD TEAM IDENTIFIED AND OPENED TWO MANHOLES ALONG THE FLOW PATH THAT

CONTAINED FLOWING WATER SIMILAR TO THAT FOUND AT THE OUTFALL. STAFF TESTED THE WATER IN MANHOLE #1 FOR PH AND IT WAS FOUND TO BE BELOW 6.5. UPSTREAM OF THE TWO MANHOLES, STAFF FOUND THREE GRATED INLETS IN SERIES IN THE REAR LOT OF 7621 ENERGY PARKWAY. WATER WAS PRESENT IN ALL THREE, BUT APPEARED NOT TO BE FLOWING OR OPAQUE (FIGURE 3). NEAR THE NORTHERN-MOST INLET, THE FIELD TEAM NOTED STAINING ON THE ASPHALT (FIGURE 4) AND AN EXTERIOR HOSEBIB THAT APPEARED TO BE USED FOR WASHING. A SMALL PUDDLE WAS NOTED NEAR THE HOSEBIB (FIGURE 5). STAFF CONCLUDED THAT WASHDOWN ACTIVITIES IN THE REAR OF THE BUILDING MAY BE CONTRIBUTING TO THE ILLICIT DISCHARGE INDICATIONS FOUND AT THE OUTFALL DRAINING TO THE WET POND. THE FIELD TEAM REPORTED THE PROBLEM TO THE ENVIRONMENTAL HOTLINE AT 2 P.M. ON JULY 19, 2013. AN AREA MAP OF THE WET POND AND POSSIBLE RESPONSIBLE BUSINESS IS PROVIDED IN FIGURE 6.

8/1/2013 NOT IN COMPLIANCE 8/29/2013 8/1/2013

INSPECTION OF 7/23/13 BY DM INDICATES POORLY MAINTAINED DUMPSTER PAD AND LEAKING DUMPSTER DRAINING TO SWM POND. POSSIBLE DISCHARGES OF CLEANING FLUIDS TO SWM POND. CORRECTION NOTICE ISSUED FOR SHORT AND LONG TERM MAINTENANCE PLAN BY 8/29/13

9/4/2013 CLOSE COMPLAINT

MET WITH VP ON 8/30/13. INSPECTED SITE TO CONFIRM THAT FLOOR SCRUBBER WASTE WATER NOW HAS AN AREA FOR PROPER DISPOSAL. WATER OUTFALL HAS CLEARED UP, HOWEVER SOME RESIDUE LEFTOVER

Anne Arundel County

Compliance Cases

Main Menu > Print Logout

Case ID:	E - 2013 - 408	**Location:**	5881 LITTLE RD
Tax ID:	800000884400		MCDONALD PROP LOTHIAN 20711
Received:	7/22/2013	**Details:**	
Tickler:	8/27/2014	**Completed:**	
	STOCK PILE (GENERAL)		

Receiver:		**Inspector:**		**Backup Inspector:**	NONE
Date Assigned:	7/22/2013	**Permit Number:**		**Original ID:**	
ADC Map:		**Related Cases:**			
Water Front:	N	**Critical Area:**	N	**Violation:**	
Cty. Council Ind:	N	**Case Org:**			
Complainant:					

Owner Information	**Violator Information**
Owner 1:	**Violator 1:**
Owner 2:	**Violator 2:**
Address:	**Address:**
	Phone:

State Map:	72		23	0025	**County Map:**			
	Map No:	Suffix	Block	Parcel	Plat	Sect	Block	Lot No

Date	Event	Due Date	Request for Trial Date
7/22/2013	OPENED COMPLAINT CASE	7/27/2013	
7/23/2013	NOT IN COMPLIANCE	7/28/2013	7/23/2013

CONTACTED THE COMPLAINANT (VANESSA CAMPBELL, MDE) TO INQUIRE ABOUT THE HISTORY OF THE CASE. SHE ADVISED ME THAT THE MARYLAND DEPARTMENT OF THE ENVIRONMENT HAD RECEIVED INFORMATION ABOUT THE POSSIBILITY OF STOCKPILLING AND BURNING OF CONSTRUCTION DEBRIS AT THE LOCATION. DURING THE COURSE OF HER SITE VISIT SHE OBSERVED SIGNS OF GRADING THAT MAY POSSIBLY BE A RESULT OF BURYING THE STOCKPILLED MATERIALS. REVIEW OF AERIAL IMAGERY SHOWED SIGNS OF ACTIVITIES CONSISTENT WITH THE INFORMATION PROVIDED BY MDE. ADDITIONAL INFORMATION TO BE FORWARDED TO THE COUNTY FROM MDE. CAMPBELL INQUIRED ABOUT THE POSSIBILITY OF A JOINT AGENCY SITE VISIT.

8/27/2013	CASE NOTE	8/27/2013	8/27/2013

JOINT SITE VISIT WITH BRIAN LITTLEFIELD (MDE SOLID WASTE PROGRAM) AND PAUL VIGNOLA, JR. ON 8/22/13. OBSERVED SEVERAL AREAS OF STOCKPILING AND STORAGE. MATERIALS CONSISTED OF CONSTRUCTION DEBRIS FROM SEVERAL PUBLIC SCHOOLS, POWER POLES, UNDERGROUND CONDUIT, TOWER LIGHTS, CONCRETE PIPE, CORRUGATED PIPE AND VARIOUS OTHER NON-AGRICULTURAL ITEMS.THREE VEHICLES

WERE FOUND AT THE BACK OF THE PROPERTY (2 W/EXPIRED REG, 1 W/NO PLATES). THREE TRAILERS ON SITE (2 STANDARD BOX TRAILERS AND 1 TANKER TRAILER). CONCRETE, ASPHALT MILLINGS AND OTHER STONE DEBRIS FOUND DUMPED INTO A STREAM. PICTURES TAKEN.

12/13/2013 NO VIOLATION FOUND 12/18/2013 12/13/2013

LETTER REGARDING BOE DEBRIS DUMPED AT 5881 LITTLE RD, LOTHAIN SENT TO AACO BOARD OF EDUCATION SUPERINTENDENT MAMIE PERKINS. VIOLATION OF STATE AND COUNTY CODE. REQUESTS THE BOE TO ADDRESS THE MATTER ALONG WITH THEIR CONSTRUCTION MANAGEMENT STAFF AND ANY CONTRACTORS WORKING FOR THE BOE.

2/20/2014 CASE NOTE 3/14/2014 2/20/2014

LETTER FROM AACO OFFICE OF LAW SENT TO MR. PAUL VIGNOLA ON 1/14/2014 VIA FIRST CLASS MAIL. LETTER REQUIRED MR. VIGNOLA TO CLEAR THE PROPERTY OF THE FOLLOWING VIOLATIONS: REMOVAL OF NON-AG MATERIALS/MACHINERY, ALL JUNK AND DEBRIS AND ALL FILL MATERIAL DEPOSITED INTO THE WETLANDS ON THE PROPERTY. PROPERTY TO BE REINSPECTED AFTER MARCH 1, 2014 FOR COMPLIANCE. IF FOUND NOT IN COMPLIANCE, AN INJUNCTION WILL BE FILED. ---------- PLEASE UPDATE TICKLER DATE FOR: 03/14/2014

7/17/2014 CASE NOTE 8/15/2014 7/17/2014

SWO/VIOLATION NOTICE FOR DUMPING OF MATERIAL IN A WATERCOURSE (16-3-201 & 16-5-101) SENT TO PAUL VIGNOLA ON 7/17/2014 VIA FIRST CLASS MAIL. COUNTY REQUIRES A STANDARD GRADING PLAN APPLICATION BE SUBMITTED BY NO LATER THAN 30 DAYS FROM THE DATE OF THE NOTICE. MR. VIGNOLA IS ALSO REQUIRED TO OBTAIN ANY APPLICABLE STATE AND FEDERAL PERMITS FOR THE RESTORATION INVOLVED IN ABATING THE DUMPING OF MATERIALS IN A WATERCOURSE. NOTICE SENT TO LAST KNOWN HOME ADDRESS FOR MR. VIGNOLA AND LAST KNOWN WORK ADDRESS FOR H&D CONSTRUCTION, LLC (OWNED/OPERATED BY MR. VIGNOLA). ---------- PLEASE UPDATE TICKLER DATE FOR: 08/15/2014

7/17/2014 GENERAL LETTER 7/17/2014 8/1/2014

JULY 17, 2014 FIRST CLASS MAIL PAUL J. VIGNOLA JR. PAUL J. VIGNOLA JR. 146 POLLING HOUSE RD C/O H&D CONSTRUCTION LLC HARWOOD, MD 20776 1358 MARLBORO ROAD & LOTHIAN, MD 20711 RE: 5881 LITTLE ROAD, LOTHIAN, MD 20711 (TAX MAP 72, BLOCK 23, PARCEL 0025) STOP WORK ORDER AND VIOLATION NOTICE (FN# E-2013-408) (TAX ID: 800000884400) DEAR MR. VIGNOLA: ON OCTOBER 10, 2013, THE REFERENCED PROPERTY WAS INSPECTED BY REPRESENTATIVES OF THIS DEPARTMENT AND FOUND TO BE IN VIOLATION OF THE ANNE ARUNDEL COUNTY GRADING ORDINANCE (ALL CODE CITATIONS ARE FROM THE ANNE ARUNDEL COUNTY CODE). SPECIFICALLY, UNAUTHORIZED GRADING, I.E. DUMPING OF MATERIAL IN A WATERCOURSE, WITHOUT PRIOR APPROVAL IN VIOLATION OF ARTICLE 16, SECTION 3-201 AND 5-101, RESPECTIVELY. CONSEQUENTLY, A STOP WORK ORDER HAS BEEN ISSUED FOR THE SUBJECT PROPERTY PREVENTING ALL FURTHER SITE ACTIVITY IN ACCORDANCE WITH ARTICLE 16, SECTIONS 5-103. ACCORDINGLY, YOU MUST SUBMIT A STANDARD GRADING PLAN APPLICATION FOR ABATEMENT OF THIS VIOLATION, INCLUSIVE OF APPLICABLE ZONING AND ENVIRONMENTAL AUTHORIZATIONS, AS WELL AS, STATE AND FEDERAL ENVIRONMENTAL AUTHORIZATIONS, AND DILIGENTLY PURSUE ISSUANCE OF SAME, BY NO LATER THAN 30 DAYS FROM THE DATE OF THIS NOTICE. IN ACCORDANCE WITH ARTICLE 16, SECTION 1-109, THE DEPARTMENT SHALL DENY THE ISSUANCE OF ADDITIONAL PERMITS UNTIL THIS VIOLATION IS CORRECTED. FAILURE TO SUBMIT THE ABOVE REFERENCED MATERIALS MAY RESULT IN THE ISSUANCE OF FINES AND IMMEDIATE REFERRAL TO THE COUNTY OFFICE OF LAW FOR CIVIL ENFORCEMENT OR PENALTIES AS OUTLINED IN ARTICLE 16, TITLE 5. THE LEGAL ACTION FOR THE VIOLATION AS DESCRIBED IS A CLASS "C" VIOLATION AND MAY INCLUDE THE ISSUANCE OF CIVIL CITATIONS, WHICH CARRY FINES OF $500.00 FOR THE FIRST VIOLATION AND $1,000 FOR THE SECOND OR ANY SUBSEQUENT VIOLATION. IN ADDITION THE COUNTY MAY INSTITUTE ANY OTHER APPROPRIATE LEGAL PROCEEDINGS AS ALLOWED BY LAW IN RESPONSE TO THE VIOLATIONS AT THE ABOVE PROPERTY. (CONTINUED) SHOULD YOU HAVE ANY QUESTIONS RELATIVE TO PERMITTING REQUIREMENTS, YOU MAY ACCESS THE COUNTY'S WEBSITE AT WWW.AACOUNTY.ORG OR YOU MAY CONTACT MR. JAY LESHINSKIE, PERMIT COORDINATOR OF THE PERMIT APPLICATION CENTER AT (410) 222-7730. IF YOU HAVE ANY OTHER QUESTIONS REGARDING THIS CORRESPONDENCE, PLEASE CONTACT ME AT IPSMIT77@AACOUNTY.ORG OR BY CALLING (410) 222-7799. (A COPY OF THIS NOTICE MUST BE INCLUDED WITH ALL REQUIRED APPLICATIONS.) SINCERELY, STEVEN SMITH CODE COMPLIANCE INSPECTOR

7/29/2014 CASE NOTE 8/27/2014 7/29/2014

REVISED SWO & VIOLATION NOTICE SENT TO MR. VIGNOLA VIA A DIFFERENT ADDRESS (1358 MARLBORO RD., LOTHIAN, MD 20711) ON 7/29/2014. ---------- PLEASE UPDATE

TICKLER DATE FOR: 08/27/2014

7/29/2014	CASE NOTE	7/29/2014	7/29/2014

SWO/VIOLATION NOTICE SENT TO MR. VIGNOLA VIA FIRST CLASS MAIL ON 7/17/14 WAS RETURNED TO THE COUNTY ON 7/29/14 DUE TO A USPS ISSUE STATED: "RETURN TO SENDER. NO SUCH STREET. UNABLE TO FORWARD." ADDRESS ISSUE TO BE RESEARCHED AND NOTICE WILL BE FORWARDED TO THAT ADDRESS.

8/14/2014	NOT IN COMPLIANCE	8/19/2014	8/14/2014

SITE VISIT ON 8/13/14. ATTENDEES: VANESSA CAMPBELL (MDE REGIONAL INSPECTOR - SOLID WASTE), BRIAN LITTLEFIELD (MDE LICENSED ENVIRONMENTAL HEALTH SPECIALIST - SOLID WASTE), STEVE SMITH (AACO CODE COMPLIANCE INSPECTOR), STEPHANIE PAYNE, PAUL VIGNOLA JR. OBSERVATIONS: LARGE DEBRIS FIELD CONSISTING OF ITEMS FROM DEMOLISHED PORTABLE CLASSROOMS WAS NO LONGER PRESENT. MR. VIGNOLA STATED DISPOSAL RECEIPTS ARE AVAILABLE AND WILL BE SENT TO MDE (TO BE FORWARDED TO AACO). SMALL AMOUNT OF WOOD DEBRIS STACKED AT BACK OF PROPERTY WITH INTENT TO USE FOR PLAY SET AND VARIOUS ONSITE REPAIRS. THREE TRAILERS (2 BOX & 1 LIQUID STORAGE) STILL PARKED AT BACK OF PROPERTY ADJACENT TO STACKED WOOD DEBRIS. ALL BUT 1 ABANDONED VEHICLE HAS BEEN REMOVED FROM THE SITE. REMAINING VEHICLE TO BE REMOVED IN NEAR FUTURE. CONCRETE FOUNDATION BLOCKS/FORMS PREVIOUSLY STORED ONSITE HAD BEEN DUMPED INTO A STREAM AT THE BACK OF THE PROPERTY. PREVIOUS DUMPING IN SAME STREAM NOTED DURING 8/22/2013 SITE VISIT AND ADDRESSED IN VIOLATION NOTICE SENT TO MR. VIGNOLA ON 7/29/2014. ADVISED MR. VIGNOLA THAT SGP MUST BE SUBMITTED AND REQUIRED STATE APPROVALS RECEIVED PRIOR TO REMOVING ALL DEBRIS. APPROPRIATE STABILIZATION MUST BE AUTHORIZED. MDE INSPECTORS ADVISED MR. VIGNOLA TO CONTACT THE MDE WATER DIVISION FOR INFORMATION. PICTURES TAKEN.

Anne Arundel County
Compliance Cases

Case ID:	E - 2013 - 410	**Location:**	698 HOLLY DR
Tax ID:	302515615076		AMBERLEY ANNAPOLIS 21409
Received:	7/22/2013	**Details:**	
Tickler:		**Completed:**	8/6/2013
	ILLEGAL FILLING COMPLAINT		

Receiver:		**Inspector:**		**Backup Inspector:**	NONE
Date Assigned:	7/22/2013	**Permit Number:**		**Original ID:**	
ADC Map:		**Related Cases:**			
Water Front:	Y	**Critical Area:**	Y	**Violation:**	
Cty. Council Ind:	N	**Case Org:**			
Complainant:					

Owner Information	**Violator Information**
Owner 1:	**Violator 1:**
Owner 2:	**Violator 2:**
Address:	**Address:**
	Phone:

	Map No:	Suffix	Block	Parcel		Plat	Sect	Block	Lot No
State Map:	40		23	0362	**County Map:**	5			13

Date	Event	Due Date	Request for Trial Date
7/22/2013	OPENED COMPLAINT CASE	7/27/2013	
7/23/2013	NOT IN COMPLIANCE	7/29/2013	7/23/2013

COMPLAINT RECEIVED VIA E-MAIL FROM MDE ON 7/17/2013 FOR POSSIBLE ILLEGAL FILLING IN THE WETLANDS VIOLATION. I MET ANDREA BUIE-BRANAM, MDE, ON SITE SAME DAY FOR INSPECTION. THIS COMPLAINT WAS OPENED 7/22/2013. THIS PROPERTY IS IN THE CRITICAL AREA,LDA, AND IS WATER FRONT. THERE ARE NO ACTIVE PERMITS. SITE INSPECTION WITH MS. BUIE-BRANAM, MDE, AND MS. POLANSKY, PROPERTY OWNER, REVEALS STRIPS OF UNUSED SOD, FALLEN LEAVES, AND MISC. LAWN DEBRIS HAS BEEN PLACED IN THE WETLANDS. THE WETLAND AREA INVOLVED IS AA CO. PROPERTY. THE DISTURBED AREA MEASURES 40'X35'. MS. POLANSKY WAS ADVISED TO REMOVE ALL DEBRIS IN THE WETLANDS BY HAND, NO MACHINERY, AND ALLOW THE AREA TO NATURALLY REGINERATE. WARNING NOTICE WILL BE SENT. RE-INSPECTION SCHEDULED FOR 7/26/2013. PLEASE EXTEND TO 7/29/2013.

7/23/2013	GENERAL LETTER	7/23/2013	8/7/2013

JULY 23, 2013 MR. BARRY A. POLANSKY 698 HOLLY DR. ANNAPOLIS, MD 214090 SUBJECT: 698 HOLLY DR. ANNAPOLIS, MD 21409, TAX MAP 40, PARCEL 362 FN: E-2013-410 DEAR MR. POLANSKY; ON JULY 17, 2013, THE REFERENCED PROPERTY WAS INSPECTED BY REPRESENTATIVES OF THIS DEPARTMENT AND FOUND TO BE

IN VIOLATION OF ANNE ARUNDEL COUNTY CRITICAL AREA LEGISLATION (ALL ARTICLE/SECTION REFERENCES HEREIN ARE FROM THE ANNE ARUNDEL COUNTY CODE). SPECIFICALLY, PLACEMENT OF FILL MATERIALS TO INCLUDE, UNUSED SOD, LEAVES, AND MISC. LAWN DEBRIS HAS BEEN UNDERTAKEN IN THE CRITICAL AREA BUFFER WITHOUT REQUIRED PERMIT(S) AND APPROVALS IN VIOLATION OF ARTICLE 16, SECTION 3-201. CONSEQUENTLY, A STOP WORK ORDER HAS BEEN POSTED ON THE PROPERTY PREVENTING ANY ADDITIONAL WORK WITHOUT THE REQUIRED COUNTY PERMITS. THIS LETTER SHALL SERVE AS WRITTEN NOTICE THAT A VIOLATION EXISTS ON YOUR PROPERTY AND THAT A STOP WORK ORDER HAS BEEN POSTED IN ACCORDANCE WITH ARTICLE 16, SECTION 5-103. ADDITIONALLY, TO PERFORM WORK IN VIOLATION OF THIS ARTICLE OR A STOP WORK ORDER, OTHER THAN AS DIRECTED TO ABATE THIS VIOLATION, IS A VIOLATION OF ARTICLE 16, SECTION 5-103(B). THE LEGAL ACTION FOR THE VIOLATION AS DESCRIBED IS A CLASS "A" CIVIL OFFENSE AND MAY INCLUDE THE ISSUANCE OF CIVIL CITATIONS, WHICH CARRY FINES OF UP TO $10,000.00 FOR THE FIRST VIOLATION AND ANY SUBSEQUENT VIOLATION. ONCE A CITATION IS ISSUED, THE FINE MAY NOT BE REDUCED OR WITHDRAWN BY THE DEPARTMENT OF INSPECTIONS AND PERMITS. THE DEPARTMENT OF INSPECTIONS AND PERMITS SHALL CONSIDER THIS CASE CLOSED AND TAKE NO FURTHER ACTION PROVIDED THE ILLEGALLY PLACED MATERIALS ARE REMOVED BY HAND AND THE AFFECTED AREA IS ALLOWED TO NATURALLY REGENERATE, AND NO FURTHER PLACING OF MATERIALS OCCURS WITHOUT PROPER PERMITS AND APPROVALS. THANK YOU FOR YOUR COOPERATION. WE WOULD MUCH RATHER ACHIEVE VOLUNTARY COMPLIANCE WITH COUNTY LAWS THAN IMPOSE AND COLLECT FINES. PLEASE CALL ME AT 410-222-7782 IF YOU HAVE ANY QUESTIONS. SINCERELY, THOMAS M. CAULK CODE COMPLIANCE INSPECTOR

8/6/2013 CLOSE COMPLAINT

COMPLIANCE INSPECTION 8/2/2013 REVEALS PROPERTY OWNERS HAVE REMOVED ALL DEBRIS IN THE WETLANDS BY HAND AND HAULED AWAY. PLEASE CLOSE THIS COMPLAINT.

8/22/2014 Anne Arundel County Department of Inspections and Permits

Anne Arundel County

Compliance Cases

Main Menu > Print Logout

Case ID:	E - 2013 - 425	**Location:**	2800 MOUNTAIN RD
Tax ID:	353490058213		MANSION HOUSE MANOR PASADENA 21122
Received:	7/24/2013	**Details:**	
Tickler:		**Completed:**	8/1/2013
	ILLEGAL DISCHARGES COMPLAINT		

Receiver:		**Inspector:**		**Backup Inspector:**	NONE
Date Assigned:	7/24/2013	**Permit Number:**		**Original ID:**	
ADC Map:		**Related Cases:**			
Water Front:	N	**Critical Area:**	N	**Violation:**	
Cty. Council Ind:	N	**Case Org:**			
Complainant:					

Owner Information	**Violator Information**
Owner 1:	**Violator 1:**
Owner 2:	**Violator 2:**
Address:	**Address:**
	Phone:

State Map:	17		14	0072	**County Map:**			
	Map No:	**Suffix**	**Block**	**Parcel**	**Plat**	**Sect**	**Block**	**Lot No**

Date	**Event**	**Due Date**	**Request for Trial Date**
7/24/2013	OPENED COMPLAINT CASE	7/29/2013	

WHILE CONDUCTING DRY WEATHER SCREENING ON MAY 6, 2013, A VERSAR FIELD TEAM IDENTIFIED A CATCH BASIN IN THE PARKING LOT OF A 7-11 CONVENIENCE STORE THAT WAS FILLED WITH SEDIMENT AND HAD BEEN DAMAGED. THE PROBLEM CATCH BASIN IS IN THE NEAR VICINITY OF TARGETED OUTFALL R09A6O009. THE FIELD STAFF NOTED THAT THE CATCH BASIN WAS FILLED WITH SEDIMENT AND TRASH (FIGURE 1). FURTHER, THE TOP SLAB OF THE CATCH BASIN HAD BEEN KNOCKED OUT OF ALIGNMENT THEREBY POSING A SAFETY RISK (FIGURE 2). BECAUSE OF THE POTENTIAL TO DISCHARGE POLLUTION AND THE INCREASED SAFETY RISK DUE TO POSSIBLE PONDING IN THE VICINITY OF THE BLOCKED OUTFALL AND FALLING HAZARD, WE ARE BRINGING THIS PROBLEM TO THE COUNTY'S ATTENTION. AN AREA MAP IS PROVIDED IN FIGURE 3.

8/1/2013	CLOSE COMPLAINT		

INSPECTOR DM OBSERVED NO EVIDENCE OF ANY ILLICIT DISCHARGES BUT NOTIFIED PROPERTY OWNERS OF THE NEED TO REPAIR THE STORMDRAIN SYSTEM AND CLEAN OUT THE CATCH BASINS.

8/1/2013	CASE NOTE	8/1/2013	8/1/2013

NO PERMITS OR STORMWATER INSPECTION AND MAINTENANCE AGRRMENT ON PROPERTY. DEPARTMENT HAS NO STATUTORY ENFORCEMENT AUTHORITY OVER THE PRIVATE STORMDRAIN SYSTEM

Anne Arundel County
Compliance Cases

Case ID:	E - 2013 - 426	**Location:**	0 OUTING AVE
Tax ID:	338800814505		GREEN HAVEN PASADENA 21122
Received:	7/24/2013	**Details:**	
Tickler:		**Completed:**	8/1/2013
	ILLEGAL DISCHARGES COMPLAINT		

Receiver:		**Inspector:**		**Backup Inspector:**	NONE
Date Assigned:	7/24/2013	**Permit Number:**		**Original ID:**	
ADC Map:		**Related Cases:**			
Water Front:	Y	**Critical Area:**	Y	**Violation:**	
Cty. Council Ind:	N	**Case Org:**			
Complainant:					

Owner Information	**Violator Information**
Owner 1:	**Violator 1:**
Owner 2:	**Violator 2:**
Address:	**Address:**
	Phone:

State Map:	17		01	0184	**County Map:**		72		4
	Map No:	Suffix	Block	Parcel		Plat	Sect	Block	Lot No

Date	Event	Due Date	Request for Trial Date
7/24/2013	OPENED COMPLAINT CASE	7/29/2013	
	THE THREE FILES STARTING "NORTH END OF OUTING AVE..." THESE THREE SITES ARE ALL LOCATED IN THE SAME PLACE, NORTH OF THE INTERSECTION OF OUTING AVENUE AND SHORE ROAD (ADC MAP COORD 5058-B7). SEE THE PHOTOS FOR DETAILS. TWO ARE SEDIMENT-CHOKED YARD DRAINS LOCATED NEAR NUMBERED OUTFALLS (SEE PHOTOS). THE OTHER, MORE SERIOUS (IN MY OPINION) PROBLEM CONCERNS THE OUTFALL Q08D3O009, WHICH DRAINS DIRECTLY TO STONY CREEK AND APPEARS COMPLETELY COVERED WITH SEDIMENT.		
8/1/2013	NO VIOLATION FOUND	8/6/2013	8/1/2013
	INSPECTION BY DM FINDS ALL OUTFALLS HAVE BEEN CLEANED. THERE IS NO PRIVATE STORMWATER MAINTENANCE AGREEMENT COVERING ANY OF THE STORMDRAIN OUTFALLS.		
8/1/2013	CLOSE COMPLAINT		

8/22/2014 Anne Arundel County Department of Inspections and Permits

Anne Arundel County
Compliance Cases

Main Menu > Print Logout

Case ID:	E - 2013 - 436	**Location:**	7014 CRESTHAVEN DR
Tax ID:	568213264000		RIPPLING RIDGE GLEN BURNIE 21061
Received:	7/29/2013	**Details:**	
Tickler:		**Completed:**	11/27/2013
	ILLEGAL DISCHARGES COMPLAINT		

Receiver:		**Inspector:**		**Backup Inspector:**	
Date Assigned:	7/29/2013	**Permit Number:**		**Original ID:**	
ADC Map:		**Related Cases:**			
Water Front:	N	**Critical Area:**	N	**Violation:**	
Cty. Council Ind:	N	**Case Org:**			
Complainant:					

Owner Information	**Violator Information**
Owner 1:	**Violator 1:**
Owner 2:	**Violator 2:**
Address:	**Address:**
	Phone:

State Map:	09		06	0190	**County Map:**			J	8
	Map No:	**Suffix**	**Block**	**Parcel**		**Plat**	**Sect**	**Block**	**Lot No**

Date	Event	Due Date	Request for Trial Date
7/29/2013	OPENED COMPLAINT CASE	8/3/2013	
	REFERRAL TO DPW-WERC VIA EPA. OUR NEIGHBOR HAS BEEN DUMPING HER HUMAN WASTE OVER HER BACK FENCE. THE BACK OF OUR HOUSES BACK TO AN ANNE ARUNDEL COUNTY PUBLIC PARK THAT CONTAINS A SMALL STREAM. AFTER DUMPING THE WASTE SHE SQUIRTS IT DOWN WITH HER GARDEN HOSE. WE HAVE CONTACTED HEALTH DEPARTMENT BUT THEY WON'T HELP WITHOUT PROOF.WE ARE TRYING TO GET VIDEO EVIDENCE. HOWEVER THIS IS HARD TO OBTAIN DUE TO HER YARD BEING OVERGROWN WITH BUSHES/GRASS. WE HAVE BEEN TOLD BY OTHER NEIGHBORS SHE DUMPS WASTE DUE TO THE FACT HER INDOOR PLUMBING DOES NOT WORK DUE TO A TREE ROOT CRUSHING HER PIPE.		
8/1/2013	NO VIOLATION FOUND	9/30/2013	8/1/2013
	INSPECTION ON 7/31/13 BY DM. UNABLE TO ACCESS BACK YARD, BEWARE OF DOG SIGN POSTED, UNDBLE TO OBESRVE ANY VIOLATIONS FROM A NUTRAL LOCATION. WILL MONITOR FOR 30 DAYS		
11/27/2013	CLOSE COMPLAINT		

Anne Arundel County

Compliance Cases

Main Menu > Print Logout

Case ID:	E - 2013 - 455	**Location:**	389 NORTH SHORE RD
Tax ID:	359027196605		NORTH SHORE PASADENA 21122
Received:	8/6/2013	**Details:**	
Tickler:		**Completed:**	9/16/2013
	DRAINAGE COMPLAINT		

Receiver:		**Inspector:**		**Backup Inspector:**	NONE
Date Assigned:	8/6/2013	**Permit Number:**		**Original ID:**	
ADC Map:		**Related Cases:**			
Water Front:	N	**Critical Area:**	Y	**Violation:**	
Cty. Council Ind:	N	**Case Org:**			
Complainant:					

Owner Information	**Violator Information**
Owner 1:	**Violator 1:**
Owner 2:	**Violator 2:**
Address:	**Address:**
	Phone:

State Map:	25		20	0248	**County Map:**	D			47
	Map No:	**Suffix**	**Block**	**Parcel**		**Plat**	**Sect**	**Block**	**Lot No**

Date	Event	Due Date	Request for Trial Date
8/6/2013	OPENED COMPLAINT CASE	8/11/2013	
8/9/2013	NOT IN COMPLIANCE	8/14/2013	8/9/2013

DRAINAGE COMPLAINT RECEIVED ON 8/7/13. PROPERTY IS NOT WATERFRONT, BUT IS CRITICAL AREA LDA. RECORDS LIST THE PROPERTY SIZE AS 22,240 SQ FT AND THE ENCLOSED AREA AS 2,756. SITE VISIT CONDUCTED ON 8/8/13. SPOKE WITH MR. WORSHAM AT 405 PARK CREEK CT, PASADENA ABOUT THE COMPLAINT. HE INFORMED ME THAT 389 N SHORE RD HAD A DRAINAGE LINE (BLACK CORRUGATED PIPE) THAT RAN FROM THEIR FENCE, ACROSS 405 PARK CREEK CT PROPERTY, AND DISCHARGED AT THE CURB IN FRONT OF 405. PIPING WAS CONNECTED TO THE POOL AND ANOTHER UNKNOWN SOURCE AT 389 N SHORE RD. THE PIPING HAS DETERIORATED OVER TIME CAUSING EROSION AND KILLING PLANTS/TREES. DISCHARGE WATER IS CHLORINATED AND IS COLLECTED BY A NEARBY STORMWATER CATCH BASIN (INLET). PICTURES TAKEN OF PIPING. VISITED 389 N SHORE RD AT 1445. MR. POYNEER WAS NOT HOME. BUSINESS CARD LEFT ON FRONT DOOR.

8/19/2013 CASE NOTE 8/30/2013 8/19/2013

EMAIL SENT TO MR. POYNEER ON 8/16/13. ADVISED THAT DRAINAGE PIPES MUST BE REDIRECTED ON TO HIS PROPERTY. RECOMMENDED A DISCHARGE POINT OF APPROXIMATELY 10FT FROM ANY ADJACENT PROPERTY LINES. COMPLETED WORK MUST RECEIVE A FINAL INSPECTION BY 8/30/13.

9/16/2013 CLOSE COMPLAINT

COMPLIANCE INSPECTION PERFORMED ON 9/13/13. MET WITH THE HOMEOWNER TO PERFORM FINAL INSPECTION. MR. POYNEER HAD PROPERLY REDIRECTED THE DRAINAGE LINES TO DISCHARGE ON TO HIS PROPERTY. SITE IS IN COMPLIANCE. CASE CLOSED.

Anne Arundel County

Compliance Cases

Case ID:	E - 2013 - 456	**Location:**	1275 DEFENSE HWY
Tax ID:	200009498300		NR CHESTERFIELD GAMBRILLS 21054
Received:	8/8/2013	**Details:**	
Tickler:		**Completed:**	11/14/2013
	GRADING W/O PERMIT		

Receiver:		**Inspector:**		**Backup Inspector:**	NONE
Date Assigned:	8/8/2013	**Permit Number:**		**Original ID:**	
ADC Map:		**Related Cases:**			
Water Front:	N	**Critical Area:**	N	**Violation:**	
Cty. Council Ind:	N	**Case Org:**			
Complainant:					

Owner Information	**Violator Information**
Owner 1:	**Violator 1:**
Owner 2:	**Violator 2:**
Address:	**Address:**
	Phone:

State Map:	43		20	0090	**County Map:**				
	Map No:	Suffix	Block	Parcel		Plat	Sect	Block	Lot No

Date	Event	Due Date	Request for Trial Date
8/8/2013	OPENED COMPLAINT CASE	8/13/2013	
8/16/2013	NOT IN COMPLIANCE	10/15/2013	8/16/2013
	COMPLAINT RECEIVED 8/8/2013 FOR POSSIBLE GRADING W/O A PERMIT VIOLATION. THIS PROPERTY IS NOT LOCATED IN THE CRITICAL AREA. THERE ARE NO ACTIVE PERMITS. MR. PATTERSON MET WITH CONTRACT PURCHASER, (PATRICK O. DUNBAR) ON SITE AND CONDUCTED THE SITE INSPECTION. THE INSPECTION REVEALS LARGE AREAS OF BUSH-HOGGING, AND NUMEROUS TREES REMOVED. TREE AND BUSH- HOGGING SPOILS, (MULCH) WAS BEING DUMPED INTO A NEARBY RAVINE ON SITE. RAVINE DUMPING ALSO INCLUDED TREE TRUNKS, TRASH AND ABANDONED ELECTRICAL WIRES. MR PATTERSON POSTED SWO ORDER AND ADVISED MR. DUNBAR OF VIOLATION. VIOLATION NOTICE WILL BE SENT. PLEASE EXTEND TO 10/15/2013.		
8/21/2013	CASE NOTE	8/21/2013	8/21/2013
	CASE NOTE; TOM CAULK AND STEVE SMITH MET ON SITE TO CALCULATE AREA OF BUSH-HOGGING AND MULCH DUMP AREA. USING HAND HELD GARMIN GPS, BUSH-HOGGED PERIMETER WAS MEASURED AT 91,645 SQFT. MULCH DUMP AREA WAS MEASURED USING 100' RAG TAPE TO BE APROX 5,000 SQFT. LEAVE TICKLE DATE AS IS.		

8/21/2013 GENERAL LETTER 8/21/2013 9/5/2013

AUGUST 21, 2013 MS. DIANE E. MARTIN 1275 DEFENSE HWY. GAMBRILLS, MD 21054 MR. PATRICK O. DUNBAR 2100 CHAINBRIDGE CT. CROFTON, MD 21114 RE; SUBJECT PROPERTY: 1275 DEFENSE HWY. GAMBRILLS, MD 21054; TAX MAP 43; PARCEL 90 VIOLATION NOTICE, STOP WORK ORDER, FN; E-2013-456 DEAR MS. MARTIN/ MR. DUNBAR; ON AUGUST 8, 2013, THE REFERENCED PROPERTY WAS INSPECTED BY REPRESENTATIVES OF THIS DEPARTMENT AND FOUND TO BE IN VIOLATION OF ANNE ARUNDEL COUNTY LEGISLATION (ALL ARTICLE/SECTION REFERENCES HEREIN ARE FROM THE ANNE ARUNDEL COUNTY CODE). SPECIFICALLY, MULCHED TREE DEBRIS, APPROX. 5,000 SQ. FT., HAS BEEN DUMPED INTO A RAVINE THAT LEADS TO A NATURAL STREAM, HAS BEEN UNDERTAKEN WITHOUT REQUIRED PERMIT(S) AND APPROVALS IN VIOLATION OF ARTICLE 16, SECTION 3-201 AND SECTION 4-201 RESPECTIVELY. CONSEQUENTLY, A STOP WORK ORDER HAS BEEN ISSUED ON THE PROPERTY PREVENTING ANY ADDITIONAL WORK WITHOUT THE REQUIRED COUNTY PERMITS. THIS LETTER SHALL SERVE AS WRITTEN NOTICE THAT A VIOLATION EXISTS ON YOUR PROPERTY AND THAT A STOP WORK ORDER HAS BEEN ISSUED IN ACCORDANCE WITH ARTICLE 16, SECTION 5-102(D)(3). ADDITIONALLY, TO PERFORM FURTHER WORK IN VIOLATION OF THIS ARTICLE OR A STOP WORK ORDER IS A VIOLATION OF ARTICLE 16, SECTION 5-101(A)(4). THE LEGAL ACTION FOR THE VIOLATION AS DESCRIBED, IS A CLASS "C" VIOLATION, AND MAY INCLUDE THE ISSUANCE OF CIVIL CITATIONS, WHICH CARRY FINES OF $500.00 FOR THE FIRST VIOLATION; $1,000.00 FOR THE SECOND VIOLATION OR ANY SUBSEQUENT VIOLATION. ONCE A CITATION IS ISSUED, THE FINE MAY NOT BE REDUCED OR WITHDRAWN BY THE DEPARTMENT OF INSPECTIONS AND PERMITS. THE DEPARTMENT OF INSPECTIONS AND PERMITS SHALL CONSIDER THIS CASE CLOSED AND TAKE NO FURTHER ACTION PROVIDED THE MULCH PLACED IN THE RAVINE IS REMOVED AND THE AREA IS ALLOWED TO NATURALLY REGENERATE AND NO FURTHER DUMPING, OR FILLING OCCURS WITHOUT PROPER PERMITS AND APPROVALS. PLEASE CONTACT THIS INSPECTOR TO SCHEDULE AN ON SITE MEETING PRIOR TO ANY MULCH REMOVAL TO DISCUSS REMOVAL METHODS AND TIME SCHEDULE. THANK YOU FOR YOUR COOPERATION. WE WOULD MUCH RATHER ACHIEVE VOLUNTARY COMPLIANCE WITH COUNTY LAWS THAN IMPOSE AND COLLECT FINES. PLEASE CALL ME AT 410-222-7782 IF YOU HAVE ANY QUESTIONS. SINCERELY, THOMAS M. CAULK CODE COMPLIANCE INSPECTOR

11/14/2013 GENERAL LETTER 11/14/2013 11/29/2013

SEPTEMBER 3, 2013 MS. DIANE E. MARTIN 1275 DEFENSE HWY. GAMBRILLS, MD 21054 MR. PATRICK O. DUNBAR 2100 CHAINBRIDGE CT. CROFTON, MD. 21114 SUBJECT: 1275 DEFENSE HWY. GAMBRILLS, MD 21054, TAX MAP 43, PARCEL 90 FN: E-2013-456 DEAR MR. DUNBAR; SUBSEQUENT TO OUR MEETING ON SITE ON TUESDAY AUGUST 27, 2013, THE DEPARTMENT OF INSPECTIONS AND PERMITS SHALL CONSIDER THIS CASE CLOSED PROVIDED ALL MULCH IS LEFT IN PLACE AND NO FURTHER FILL IS ADDED WITH OUR PROPER APPROVALS, AND THE AREA IS ALLOWED TO NATURALLY REGENERATE. THANK YOU VERY MUCH FOR COMPLYING VOLUNTARILY WITH THE COUNTY LAW. SHOULD WE BE REQUIRED TO RETURN TO YOUR PROPERTY BECAUSE OF A SUBSEQUENT COMPLAINT, WE WILL HAVE TO TAKE FORMAL ENFORCEMENT ACTION WITHOUT ADDITIONAL NOTICE. THEREFORE, I URGE YOU TO CALL ME AT 410-222-7782 IF YOU HAVE ANY QUESTIONS ABOUT CONTINUING COMPLIANCE WITH THIS PROVISION OF THE COUNTY LAW. AGAIN, THANK YOU. SINCERELY, THOMAS M. CAULK CODE COMPLIANCE INSPECTOR

11/14/2013 CLOSE COMPLAINT

8/25/2014 Anne Arundel County Department of Inspections and Permits

Anne Arundel County
Compliance Cases

Main Menu > Print Logout

Case ID:	E - 2013 - 538	**Location:**	0 BALTIMORE-ANNAPOLIS BLV
Tax ID:	374822121000		SEVERNA PARK SEVERNA PARK 21146
Received:	9/19/2013	**Details:**	
Tickler:		**Completed:**	11/27/2013
	ILLEGAL DISCHARGES COMPLAINT		DUMPING BLEACH WATER INTO STORM DRAIN

Receiver:		**Inspector:**		**Backup Inspector:**	NONE
Date Assigned:	9/19/2013	**Permit Number:**		**Original ID:**	
ADC Map:		**Related Cases:**			
Water Front:	N	**Critical Area:**	N	**Violation:**	
Cty. Council Ind:	N	**Case Org:**			
Complainant:					

Owner Information	**Violator Information**
Owner 1:	**Violator 1:**
Owner 2:	**Violator 2:**
Address:	**Address:**
	Phone:

State Map:	Map No:	Suffix	Block	Parcel	**County Map:**	Plat	Sect	Block	Lot No
	32		07	0245					389

Date	Event	Due Date	Request for Trial Date
9/19/2013	OPENED COMPLAINT CASE	9/24/2013	
9/25/2013	NOT IN COMPLIANCE	10/1/2013	9/25/2013
	GREASE BARRELS AT THE BACK OF SQUISTO PIZZA ARE THE SOURCE OF AN ILLICIT DISCHARGE. CLEAN GREASE UP THAT IS ON CONCRETE AREA. GREASE BARRELS MUST BE SEALED AT ALL TIMES.		
11/27/2013	IN-COMPLIANCE	12/2/2013	11/27/2013
	REQUIRED REPAIRS COMPLETED, VIOLATION CORRECTED, CASE MAY BE CLOSED		
11/27/2013	CLOSE COMPLAINT		

http://was-http-intra.aacounty.org/ComplaintIntranet/allCaseSelect.do 1/1

8/25/2014 Anne Arundel County Department of Inspections and Permits

Anne Arundel County
Compliance Cases

Main Menu > Print Logout

Case ID:	E - 2013 - 541	**Location:**	1250 PATUXENT RD
Tax ID:	400001033600		BRAGERS STATION ODENTON 21113
Received:	9/19/2013	**Details:**	
Tickler:		**Completed:**	1/3/2014
	ILLEGAL DISCHARGES COMPLAINT		DUMPING

Receiver:		**Inspector:**		**Backup Inspector:**	NONE
Date Assigned:	9/19/2013	**Permit Number:**		**Original ID:**	
ADC Map:		**Related Cases:**			
Water Front:	N	**Critical Area:**	N	**Violation:**	
Cty. Council Ind:	N	**Case Org:**			
Complainant:					

Owner Information	**Violator Information**
Owner 1:	**Violator 1:**
Owner 2:	**Violator 2:**
Address:	**Address:**
	Phone:

State Map:	36		15	0033	**County Map:**				
	Map No:	Suffix	Block	Parcel		Plat	Sect	Block	Lot No

Date	Event	Due Date	Request for Trial Date
9/19/2013	OPENED COMPLAINT CASE	9/24/2013	
9/27/2013	NOT IN COMPLIANCE	11/20/2013	9/27/2013

COMPLAINT RECEIVED 9/19/2013 FOR POSSIBLE "ILLEGAL DISCHARGES" VIOLATION. THIS PROPERTY IS NOT LOCATED IN THE CRITICAL AREA. THERE ARE NO ACTIVE PERMITS. SITE INSPECTION REVEALS NUMEROUS DUMP LOADS OF EXCAVATION SPOILS. SOME LOADS HAVE BEEN GRADED, SOME HAVE NOT. THE GRADED AREAS HAS BEEN PUSHED INTO AN AREA OF BAMBOO, AND ADJACENT TO A NON-CRITICAL WETLANDS 25' BUFFER. THE DISTURBED AREA IS GREATER THAN 5,000 SQFT. LEFT CARD WITH FARM EMPLOYEE ASKING MR. PUMPHREY TO CONTACT ME. VIOLATION NOTICE WILL BE SENT. EXTEND TO 11/20/2013.

9/27/2013	CASE NOTE	9/27/2013	9/27/2013

MET WITH MR. PUMPHREY, PROPERTY OWNER, ON SITE. MR. PUMPHREY REVEALED THE SPOILS MOSTLY WERE EXCATIONS FROM THE LAUREL MALL CONSTRUCTION SITE. SOME OF THE SPOILS WERE FROM THE WATER LINE CONSTRUCTION ON CONWAY RD. ALSO REVEALED DELIVERY CONTRACTOR AS MOG (CLIFF) 443-942-6072. I INSTRUCTED MR. PUMPHREY TO INSTALL RSF ALONG THE AREA ADJACENT TO THE NON-CRITICAL WETLANDS 25' BUFFER, TO REMOVE THE UNGRADED DUMP SPOILS, AND TO CALL THIS INSPECTOR

UPON COMPLETION OF BOTH. I GAVE MR. PUMPHREY A HANDOUT LIST OF ENGINEERING COMPANIES AND EXPLAINED THE NEED FOR A GRADING PLAN. PLEASE LEAVE THE TICKLE DATE AS 11/20/2013.

12/5/2013	CASE NOTE	12/5/2013	12/5/2013

RSF INSTALLED AND ACCEPTABLE. PROPERTY OWNER IN PROCESS OF REMOVING DUMP SPOILS. LEAVE TICKLE DATE 11/20/2013.

12/30/2013	CASE NOTE	12/31/2013	12/30/2013

SITE INSPECTION REVEALS ALL SPOILS REMOVED, AREA GRADED SEEDED AND STABILIZED. PLEASE EXTEND TO 12/31/2013.

1/3/2014 CLOSE COMPLAINT

COMPLIANCE INSPECTION REVEALS CONTINUED GROWTH, RSF MAINTAINED, ALL SPOILS REMOVED OR MIXED WITH TOPSOIL SEEDED AND STABILIZED. PLEASE CLOSE THIS COMPLAINT.

Anne Arundel County
Compliance Cases

Main Menu > Print Logout

Case ID:	E - 2013 - 569	**Location:**	1674 CHINFORD TRL
Tax ID:	224090052163		EPPING FOREST ANNAPOLIS 21401
Received:	10/2/2013	**Details:**	
Tickler:		**Completed:**	4/30/2014
	GRADING W/O PERMIT		
	ILLEGAL FILLING COMPLAINT		FILLING IN STREAM BEHIND HOUSE WITH FILL MATERIAL

Receiver:		**Inspector:**		**Backup Inspector:**	NONE
Date Assigned:	10/2/2013	**Permit Number:**		**Original ID:**	
ADC Map:		**Related Cases:**			
Water Front:	N	**Critical Area:**	Y	**Violation:**	
Cty. Council Ind:	N	**Case Org:**			
Complainant:					

Owner Information	**Violator Information**
Owner 1:	**Violator 1:**
Owner 2:	**Violator 2:**
Address:	**Address:**
	Phone:

State Map:	45		03	0043	**County Map:**		C	76	6
	Map No:	Suffix	Block	Parcel		Plat	Sect	Block	Lot No

Date	Event	Due Date	Request for Trial Date
10/2/2013	OPENED COMPLAINT CASE	10/7/2013	
10/7/2013	NOT IN COMPLIANCE	10/12/2013	10/7/2013

COMPLAINT RECEIVED ON 10/2/2013 FOR GRADING W/OUT A PERMIT IN THE CRITICAL AREA AND ON A STEEP SLOPE. PROPERTY IS NOT WATERFRONT. PROPERTY IS CRITICAL AREA LDA. LOT SIZE IS 14,210 SQ FT. ENCLOSED AREA IS 1,409 SQ FT. SITE VISIT CONDUCTED 10/3/2013. OBSERVED NEW "U"-SHAPED GRAVEL DRIVEWAY ON NORTHERN SIDE OF RESIDENCE. AREA HAD BEEN CLEARED OF ALL VEGETATION EXCEPT 3 TREES ADJACENT TO THE ROADWAY. DRIVE WAS OUTLINED BY PRESSURE TREATED 4"X4" LUMBER THEN FILLED WITH #57 STONE. ADDITIONAL VEGETATIVE DEBRIS AND EARTHEN SPOILS OBSERVED STOCKPILED AT EDGE OF RAVINE BEHIND FENCED TRASH CAN AREA. APPEARED TO BE FROM THE AREA OF THE NEW DRIVEWAY. SPOKE WITH MR. JEFF TUCKER (CONTRACTOR) REGARDING THE WORK. INFORMED ME THAT HE DIDN'T KNOW APPROVAL WAS NEEDED OUTSIDE THE BUFFER. STATED THE STOCKPILED DEBRIS WAS PRESENT PRIOR TO BEGINNING HIS WORK. STOP WORK ORDER POSTED ON PROPERTY. HOMEOWNER NOT PRESENT DURING THE SITE VISIT. BUSINESS CARD LEFT ON FRONT DOOR REQUESTING A CALL. PICTURES AND GPS DATA COLLECTED.

10/7/2013	CASE NOTE	10/7/2013	10/7/2013

MET WITH MRS. POWELL AT I&P OFFICE. ASSISTED WITH COMPLETING SGP AND CA WORKSHEET FOR GRADING VIOLATION (DRIVEWAY AND STOCKPILED DEBRIS FROM DRIVEWAY). SGP SUBMITTED ON 10/7/13.

10/8/2013	STOP WORK ORDER	10/13/2013	10/8/2013

SWO AND VIOLATION NOTICE SENT TO KATHLEEN WHITAKER-POWELL ON 10/08/2013. REQUIRED SUBMISSION OF SGP TO ADDRESS VIOLATION. SGP SUBMITTED ON 10/7/13.

10/8/2013	GENERAL LETTER	10/8/2013	10/23/2013

OCTOBER 8, 2013 FIRST CLASS MAIL KATHLEEN WHITAKER-POWELL 1674 CHINFORD TRAIL ANNAPOLIS, MD 21401 RE: 1674 CHINFORD TRAIL, ANNAPOLIS, MD (TAX MAP 45, PARCEL 43, BLOCK 3, LOT 6) VIOLATION NOTICE AND STOP WORK ORDER (E-2013-569) DEAR MS. KATHLEEN WHITAKER-POWELL: ON OCTOBER 3, 2013, THE REFERENCED PROPERTY WAS INSPECTED BY REPRESENTATIVES OF THIS DEPARTMENT AND FOUND TO BE IN VIOLATION OF THE ANNE ARUNDEL COUNTY CRITICAL AREA AND GRADING ORDINANCES (ALL CODE CITATIONS ARE FROM THE ANNE ARUNDEL COUNTY CODE). SPECIFICALLY, GRADING (INSTALLATION OF COMPACTED GRAVEL DRIVEWAY, CLEARING OF VEGETATION, DUMPING OF VEGETATIVE DEBRIS ON A STEEP SLOPE IN A WATERWAY) OCCURRED IN THE CHESAPEAKE BAY CRITICAL AREA WITHOUT PRIOR APPROVAL IN VIOLATION OF ARTICLE 16, SECTION 3-201 AND ARTICLE 17, RESPECTIVELY. CONSEQUENTLY, A STOP WORK ORDER HAS BEEN POSTED ON THE SUBJECT PROPERTY IN ACCORDANCE WITH ARTICLE 16, SECTIONS 5-103. ACCORDINGLY, YOU WERE REQUIRED TO SUBMIT A STANDARD GRADING PLAN APPLICATION AND DILIGENTLY PURSUE ISSUANCE OF SAME, INCLUSIVE OF APPLICABLE ZONING AND ENVIRONMENTAL AUTHORIZATIONS. IN ACCORDANCE WITH ARTICLE 16, SECTION 1-109, THE DEPARTMENT SHALL DENY THE ISSUANCE OF ADDITIONAL PERMITS UNTIL THIS VIOLATION IS CORRECTED. FAILURE TO COMPLY WITH THIS NOTICE MAY RESULT IN THE ISSUANCE OF FINES AND IMMEDIATE REFERRAL TO THE COUNTY OFFICE OF LAW FOR CIVIL ENFORCEMENT OR PENALTIES AS OUTLINED IN ARTICLE 16, TITLE 5. IN ADDITION, THE COUNTY MAY INSTITUTE ANY OTHER APPROPRIATE LEGAL PROCEEDINGS AS ALLOWED BY LAW IN RESPONSE TO THE VIOLATIONS AT THE ABOVE PROPERTY. THANK YOU FOR YOUR COOPERATION. WE WOULD MUCH RATHER ACHIEVE VOLUNTARY COMPLIANCE WITH COUNTY LAWS THAN IMPOSE AND COLLECT FINES. IF YOU HAVE ANY QUESTIONS REGARDING THIS CORRESPONDENCE, OR ANY OTHER ISSUE, PLEASE CONTACT ME AT IPSMIT77@AACOUNTY.ORG OR BY CALLING (410) 222-7799. PLEASE NOTE, A COPY OF THIS NOTICE MUST BE INCLUDED WITH ALL REQUIRED APPLICATIONS. SINCERELY, STEVEN SMITH CODE COMPLIANCE INSPECTOR

10/14/2013	CASE NOTE	12/31/2013	10/14/2013

SGP 253 SUBMITTED AND CAN NOT BE APPROVED SUBJECT TO THE FOLLOWING OPZ CRITICAL AREA REVIEW COMMENTS: THE NEW 1,200 SF IMPERVIOUS DRIVEWAY IS SUBJECT TO VARIANCES TO DEVELOP WITHIN SLOPES OF 15% OR GREATER IN THE CRITICAL AREA AND EXPANDED BUFFER DISTURBANCE INCLUDING AREA WITHIN 50 FT OF THE TOP OF STEEP SLOPES. MITIGATION FOR THE 1,200 SF NEW IMPERVIOUS WILL BE THE CUMULATIVE OF THE REQUIRED 1:1 FOR STORM WATER MANAGEMENT, 2:1 FOR BUFFER DISTURBANCE, 3:1 FOR THE REQUIRED VARIANCES AND 4:1 FOR THE CRITICAL AREA VIOLATION. DENIAL LETTER SENT 10-13-2013 ADVISING OF THE NEED FOR ZONING VARIANCE APPROVAL

10/16/2013	CASE NOTE	10/16/2013	10/16/2013

LETTER SENT TO KATHLEEN POWELL-WHITAKER STATING SGP NOT APPROVED DUE TO VARIANCE REQUIREMENT AND MITIGATION REQUIREMENT. VARIANCE REQUIRED DUE TO 15% OR GREATER SLOPE IN C.A. AND EXPANDED BUFFER DISTURBANCE. MITIGATION FOR 1200 SQ FT AT 10:1 (1:1 SW, 2:1 BUFFER DISTURBANCE, 3:1 VARIANCES, 4:1 CRITICAL AREA VIOLATION).

10/18/2013	CASE NOTE	10/18/2013	10/18/2013

SPOKE WITH HOMEOWNER ABOUT NEED FOR VEGETATIVE STABILIZATION/SEDIMENT CONTROLS FOR AREA BETWEEN UNPERMITTED DRIVEWAY AND ROADWAY. ASKED THAT ALL MUD AND DIRT IN THE ROADWAY BE CLEANED UP. SPOKE WITH JEFF TUCKER (EXECUTIVE LANDSCAPE MANAGEMENT) REGARDING WORK PERFORMED ON DRIVEWAY FOUND DURING 10/17/13 SITE INSPECTION. MR. TUCKER STATED HE DID NOT DO ANY ADDITIONAL WORK AFTER THE SWO WAS POSTED AT THE SITE AND SUGGESTED THE HOMEOWNER DID THE WORK.

10/18/2013	CASE NOTE	10/18/2013	10/18/2013

STATUS INSPECTION PERFORMED ON 10/17/13. OBSERVED SIGNIFICANT AMOUNT OF MUD AND DIRT THAT HAD BEEN CARRIED FROM THE PROPERTY ONTO THE ROADWAY. INSPECTION OF THE GRAVEL DRIVEWAY REVEALED THAT ADDITIONAL WORK HAD BEEN COMPLETED SINCE THE SWO WAS POSTED ON 10/03/13. GRAVEL HAD BEEN SPREAD AND LEVELED TO ALLOW DRIVEWAY TO BE USED. PICTURES TAKEN.

11/25/2013	CASE NOTE	11/25/2013	11/25/2013

SPOKE WITH MS. POWELL ON 11/22/13 REGARDING THE REMOVAL OF DRIVEWAY AND RETURNING AREA TO ORIGINAL CONDITION. EMAIL SENT TO MS. POWELL ON 11/25/13 ADVISING HER TO SUBMIT A COMPLETED ABATEMENT PLAN FOR THE REMOVAL OF THE VIOLATION (1,200 SQ FT) AND THE PLANTING OF 4 TREES (1

TREE FOR EVERY 300 SQ FT DISTURBED). ABATEMENT PLAN TO BE SUBMITTED BY 12/20/13.

12/18/2013 CASE NOTE 4/16/2014 12/18/2013

ABATEMENT PLAN AND COPY OF CONTRACT WITH CHILDS LANDSCAPING RECEIVED ON 12/18/13. PLAN DETAILS REMOVAL OF DRIVEWAY, INSTALLATION OF SOIL/SOD AND THE PLANTING OF 12 SHRUBS. PLAN WAS REVIEWED AND APPROVED ON 12/18/2013. ALL WORK TO BE COMPLETED BY MAY 1, 2013. FINAL INSPECTION REQUIRED PRIOR TO CASE BEING CLOSED.

4/30/2014 CLOSE COMPLAINT

SITE VISIT ON 4/29/14. ABATEMENT PLAN APPROVED ON 12/18/13 DUE TO BE COMPLETED BY 5/1/14. INSPECTION OF SITE REVEALED ALL WORK COMPLETED PER THE APPROVED PLAN. PROPERTY IS IN COMPLIANCE. PICTURES TAKEN. STOP WORK ORDER LIFTED. CASE CLOSED.

Anne Arundel County
Compliance Cases

Main Menu > Print Logout

Case ID:	E - 2013 - 591	**Location:**	515 BURNS CROSSING RD
Tax ID:	400090214435		ADAMS PROPERTY GAMBRILLS 21054
Received:	10/11/2013	**Details:**	
Tickler:		**Completed:**	1/13/2014
	DRAINAGE COMPLAINT		

Receiver:		**Inspector:**		**Backup Inspector:**	NONE
Date Assigned:	10/11/2013	**Permit Number:**		**Original ID:**	
ADC Map:		**Related Cases:**			
Water Front:	N	**Critical Area:**	N	**Violation:**	
Cty. Council Ind:	N	**Case Org:**			
Complainant:					

Owner Information	**Violator Information**
Owner 1:	**Violator 1:**
Owner 2:	**Violator 2:**
Address:	**Address:**
	Phone:

State Map:	30		07	0048	**County Map:**					2
	Map No:	Suffix	Block	Parcel		Plat	Sect	Block	Lot No	

Date	Event	Due Date	Request for Trial Date
10/11/2013	OPENED COMPLAINT CASE	10/16/2013	
10/22/2013	NOT IN COMPLIANCE	10/27/2013	10/22/2013
	INSPECTION OF THE SITE SHOWS TURBID RUNOFF LEAVING THE CR6 SALES CETER ENTRANCE OFF SITE AT JOYCE LN NEXT TO THE SCE. THIS IS A TRIGGER EVENT WHICH WILL CAUSE THE FOLLOWING ACTION BY THE PERMITTEE/CONTRACTOR PER THE SITES NPDES PERMIT: THE MDE SELF MONITORING FORM MUST BE SUBMITTED TO THE COUNTY GRADING INSPECTOR WITHIN 2 DAYS OF THE EVENT OBSERVED ON THUR 10/10/13. PERMITTEE MUST REPAIR THE SALES CENTER ENTRANCE INA WAY THAT WILL NOT CAUSE THE DIS-COLORED/MUDDY SEDIMENT LADEN DISCHARGE FROM THE SITE IN VIOLATION OF THE PERMIT AND THE APPROVED PLAN FOR THE PROJECT. IF SITUATION CONTINUES THE SITE WILL BE ISSUED A SWO AND THE ENGINEER WILL HAVE TO ADDRESS THE PROBLEM WITH A REQUIRED PLAN REVISION.		
10/22/2013	CASE NOTE	10/22/2013	10/22/2013
	WILL RE-INSPECT 10/15/13 FOR COMPLIANCE		
1/13/2014	CLOSE COMPLAINT		
	DEVELOPER ABATED THE VIOLATION ON 10/16/13 AND SUBMTITED THE CHECK LIST FOR A 1ST TRIGGERING EVENT. PHOTOS SHOW CONTRACTOR TEMP STABILIZED ENTIRE PERMITTED AREA, ADDED PERIMETER SILT FENCE AT BURNS CROSSING RD TO HELP CONTROL STORM WATER SHEET FLOW		

Anne Arundel County
Compliance Cases

Main Menu > Print

Logout

Case ID:	E - 2013 - 658	**Location:**	307 BISHOP AVE
Tax ID:	535190235499		GRAYS PARK BALTIMORE 21225
Received:	12/13/2013	**Details:**	
Tickler:	1/9/2015	**Completed:**	
	STORMWATER MANAGEMENT ISSUES		

Receiver:		**Inspector:**		**Backup Inspector:**	NONE
Date Assigned:	12/13/2013	**Permit Number:**		**Original ID:**	
ADC Map:		**Related Cases:**			
Water Front:	N	**Critical Area:**	N	**Violation:**	
Cty. Council Ind:	Y	**Case Org:**			
Complainant:					

Owner Information	**Violator Information**
Owner 1:	**Violator 1:**
Owner 2:	**Violator 2:**
Address:	**Address:**
	Phone:

State Map:	01		22	0214	**County Map:**		2		57
	Map No:	Suffix	Block	Parcel		Plat	Sect	Block	Lot No

Date	Event	Due Date	Request for Trial Date
12/13/2013	OPENED COMPLAINT CASE	12/18/2013	
	PROPERTY FLOODING AT 306 AND 308 BISHOP AVE AS A RESULT OF NEW CONSTRUCTION UNDER G02014711		
12/13/2013	NOT IN COMPLIANCE	12/18/2013	12/13/2013
	REQUIRED SWM CONSISTING OF MULTIPLE RAINBARRELS AND PERVIOUS PAVEMENT DRIVEWAYS ON 2 LOTS NOT INSTALLED AS PER THE APPROVED PLANS		
1/8/2014	CASE NOTE	6/30/2014	1/8/2014
	BOND DEFAULT REFERRAL TO OOL. DEMAND LETTER BY OOL SENT 12/13.		
7/9/2014	CASE NOTE	1/9/2015	7/9/2014
	IN LITIGATION WITH OOL		

Anne Arundel County
Compliance Cases

Main Menu > Print Logout

Case ID:	E - 2013 - 633	**Location:**	128 PINEVIEW AVE
Tax ID:	374690232964		SABRINA PARK SEVERNA PARK 21146
Received:	11/18/2013	**Details:**	REMOVAL OF REQUIRED ESD PRATICE
Tickler:	8/2/2014	**Completed:**	
	STORMWATER MANAGEMENT ISSUES		

Receiver:		**Inspector:**		**Backup Inspector:**	
Date Assigned:	11/18/2013	**Permit Number:**		**Original ID:**	
ADC Map:		**Related Cases:**			
Water Front:	N	**Critical Area:**	N	**Violation:**	
Cty. Council Ind:	N	**Case Org:**			
Complainant:	JPP				

Owner Information	**Violator Information**
Owner 1:	**Violator 1:**
Owner 2:	**Violator 2:**
Address:	**Address:**
	Phone:

State Map:	23		23	0552	**County Map:**		P		12
	Map No:	Suffix	Block	Parcel		Plat	Sect	Block	Lot No

Date	Event	Due Date	Request for Trial Date
11/18/2013	OPENED COMPLAINT CASE	1/15/2014	
	ONE OF TWO REQUIRED LANDSCAPE INFILTRATION PRACTICES CONSTRUCTED BY DEVELOPER WAS REMOVED BY HOMEOWNER AFTER SETTLEMENT. INSPECTOR NORRIS MISED ENGINEER'S NOTE ON AS-BUILT PLANS PRACTICE WAS REMOVED.		
11/18/2013	CASE NOTE	12/18/2013	11/18/2013
	E-MAILS AND MEMO OF 11-18-13 FROM JPP TO OOL SEEKING ADVISE ON PROPER ENFORCEMENT ACTION.		
11/21/2013	STORMWATER MANAGEMENT VIOLATION	1/1/2014	12/6/2013
	AS PER OOL A VIOLATION NOTICE WAS SENT IN ACCORDANCE WITH CHAPTER 6 OD STORMW AGREEMENT. FAILURE TO COMPLY TO RESULT IN REFARRAL FOR INJUNCTIVE RELIEF		
12/5/2013	LAW OFFICE REFERRAL	8/2/2014	12/5/2013

Anne Arundel County
Compliance Cases

Main Menu > Print Logout

Case ID:	E - 2014 - 3	Location:	0 FLOOD PLAIN
Tax ID:	440790071543		HANOVER HILLS JESSUP 20794
Received:	1/6/2014	Details:	
Tickler:		Completed:	5/8/2014
	ILLEGAL DISCHARGES COMPLAINT		DUMPING IN A FLOOD PLAIN

Receiver:		Inspector:		Backup Inspector:	NONE
Date Assigned:	1/6/2014	Permit Number:		Original ID:	
ADC Map:		Related Cases:			
Water Front:	N	Critical Area:	N	Violation:	
Cty. Council Ind:	N	Case Org:			
Complainant:					

Owner Information	Violator Information
Owner 1:	Violator 1:
Owner 2:	Violator 2:
Address:	Address:
	Phone:

State Map:	Map No:	Suffix	Block	Parcel	County Map:	Plat	Sect	Block	Lot No
	07		17	0074					

Date	Event	Due Date	Request for Trial Date
1/6/2014	OPENED COMPLAINT CASE	1/11/2014	
1/7/2014	NOT IN COMPLIANCE	1/12/2014	1/7/2014

SITE INSPECTION ON 01/06/2014. STOP WORK ORDER SIGNS POSTED ON AACO PROPERTY (TAX ID: 440790071543) ADJACENT TO BRIDGES BUILT OVER DEEP RUN STREAM. INSPECTION OF SITE REVEALED PILES OF LEAVES, CUT BRUSH AND TREE LIMBS HAD BEEN DUMPED RECENTLY. PICTURES TAKEN. ATTEMPTED TO CONTACT MR. GARY WELLS AT 7301 FAMILY ACRES RD, HANOVER. PROPERTY WAS FENCED, NOT ALLOWING FOR ANY ENTRY. NO TRESPASSING SIGNS POSTED AT ALL GATES. BUSINESS CARD LEFT ON FAMILY ACRES RD ACCESS GATE. PICTURES TAKEN.

1/7/2014	CASE NOTE	1/7/2014	1/7/2014

COMPLAINT RECEIVED ON 1/2/2014 FOR ILLEGAL DUMPING IN A FLOODPLAIN. INITIAL COMPLAINT LISTED 7301 FAMILY ACRES RD, HANOVER AS THE LOCATION OF THE VIOLATION (E-2014-0001). CASE WAS CLOSED DUE TO INCORRECT ADDRESS ON 01/06/2014. PROPERTY IS OWNED BY ANNE ARUNDEL COUNTY AND IS SHOWN AS A FLOOD PLAIN ON PLAT 6677, PLAT BOOK 128, PG 3. LOT IS 1.9826 ACRES WITH NO BUILDINGS. IMAGES SUPPLIED WITH THE ORIGINAL COMPLAINT SHOWS TWO INDIVIDUALS, ONE OF WHOM WAS GARY WELLS, BUILDING THE WESTERN BRIDGE. ALSO PICTURED WAS A TRUCK BELONGING TO WELL CONSTRUCTED [SERVICES] (410-799-0892). SITE INSPECTION ON 01/03/2014. OBSERVED TWO WALKING BRIDGES THAT HAD BEEN BUILT ACROSS THE STREAM THAT MARKS THE NORTHERN BOUNDARY OF THE PROPERTY. STOCKPILES OF AN UNKNOWN DEBRIS (COVERED WITH SNOW) WERE OBSERVED ACROSS

FROM THE WESTERN MOST BRIDGE. BOTH BRIDGES EXTENDED FROM THE NORTHERN BANK OF THE STREAM TO THE SOUTHERN BANK. THE NORTHERN SIDE OF THE STREAM MARKS THE EDGE OF THE AACO PROPERTY. PICTURES AND GPS DATA COLLECTED.

1/8/2014 CASE NOTE 4/11/2014 1/8/2014

LEFT VOICEMAIL FOR GARY WELLS. CALL RETURNED SHORTLY AFTER. SPOKE WITH MR. WELLS ABOUT THE SMALL BRIDGE AND DUMPING THAT HAD OCCURRED ON ANNE ARUNDEL COUNTY FLOODPLAIN PROPERTY (SIMMS LN & FOREST AVE, HANOVER). ADVISED MR. WELLS THAT HE MUST REMOVE THE BRIDGE AND ALL DUMPED MATERIAL. HE STATED HE WAS IN FLORIDA UNTIL LATE MARCH. DUE DATE FOR ALL WORK TO BE COMPLETED SET FOR 4/11/2014. WILL CONTACT MR. WELLS EARLY APRIL TO DISCUSS STATUS OF WORK.

5/1/2014 CASE NOTE 5/12/2014 5/1/2014

SEVERAL VOICEMAILS LEFT FOR MR. WELLS REQUESTING A STATUS UPDATE TO THE REQUESTED DEBRIS CLEANUP AND BRIDGE REMOVAL DUE BY 4/11/2014. NO RESPONSE HAS BEEN RECEIVED AS OF 5/1/2014. NOTICE TO BE SENT TO MR. WELLS REQUESTING ALL WORK BE COMPLETED AND FINAL INSPECTION PERFORMED BY NO LATER THAN 5/12/2014. MR. WELLS MUST CONTACT THE INSPECTOR TO SCHEDULE THE FINAL INSPECTION. NO EXTENSION WILL BE PROVIDED PAST 5/12/14. FAILURE TO COMPLY WITH THE NOTICE WILL RESULT IN THE IMMEDIATE REFERRAL TO THE COUNTY OFFICE OF LAW FOR CIVIL ENFORCEMENT OR PENALTIES AS OUTLINED IN ARTICLE 16, TITLE 5. IN ADDITION, THE COUNTY MAY INSTITUTE ANY OTHER APPROPRIATE LEGAL PROCEEDINGS AS ALLOWED BY LAW IN RESPONSE TO THE VIOLATIONS THAT HAVE OCCURRED. NOTICE TO BE SENT ON 5/1/14 VIA FIRST CLASS MAIL. ---------- ---------- PLEASE UPDATE TICKLER DATE FOR: 05/12/2014

5/8/2014 CLOSE COMPLAINT

SITE INSPECTION ON 5/7/14. BRIDGE INSTALLED BY MR. GARY WELLS HAD BEEN REMOVED. VEGETATIVE DEBRIS STILL PRESENT. NEW DEBRIS ALSO OBSERVED. WILL CONTACT APPROPRIATE COUNTY DEPARTMENT REGARDING NO DUMPING SIGNS. PICTURES TAKEN. CASE CLOSED.

Anne Arundel County
Compliance Cases

Main Menu > Print Logout

Case ID:	E - 2014 - 65	**Location:**	828 A SWIFT RD
Tax ID:	300027666500		COCKEYS CREEK PASADENA 21122
Received:	3/7/2014	**Details:**	
Tickler:	12/1/2014	**Completed:**	
	STOCK PILE (GENERAL)		

Receiver:		**Inspector:**		**Backup Inspector:**	NONE
Date Assigned:	3/7/2014	**Permit Number:**	B02292474	**Original ID:**	
ADC Map:		**Related Cases:**			
Water Front:	N	**Critical Area:**	Y	**Violation:**	
Cty. Council Ind:	N	**Case Org:**			
Complainant:					

Owner Information	**Violator Information**
Owner 1:	**Violator 1:**
Owner 2:	**Violator 2:**
Address:	**Address:**
	Phone:

State Map:	24		11	0161	**County Map:**				
	Map No:	Suffix	Block	Parcel		Plat	Sect	Block	Lot No

Date	Event	Due Date	Request for Trial Date
3/7/2014	OPENED COMPLAINT CASE	3/12/2014	
	COMPLAINANT STATES THAT 50+ TRUCK LOADS OF DIRT/SOIL HAVE BEEN BROUGHT INTO THE PROPERTY. THERE IS AN ACTIVE BUILDING VIOLATION FROM 2006 CURRENTLY BEING MONITORED. PLEASE CALL THE COMPLAINANT PRIOR TO GOING OUT.		
3/13/2014	NOT IN COMPLIANCE	3/18/2014	3/13/2014
	COUNTY RECEIVED NOTICE THAT MR. MIKE FOY WAS OPERATING A BULLDOZER ONSITE AND GRADING/MOVING THE DIRT AT 823 HRS ON 3/11/14. ARRIVED ON SITE AT 920 HRS. OBSERVED THE EQUIPMENT DUMPING BUCKET LOADS OF DIRT INTO A DUMP TRUCK AS WELL AS LEVELING THE DIRT. WAS INFORMED THAT THE DUMP TRUCK WAS RELOCATING THE DIRT TO A LOCATION ON THE SAME PROPERTY, APPROXIMATELY 250' TO 300' EAST. OBSERVED THE LOCATION OF THE DUMPING VIA A NEIGHBORING PROPERTY. PICTURES AND VIDEO DATA COLLECTED. STOP WORK ORDER SIGN POSTED AT 1000 HRS ON 3/11/14. SIGN ATTACHED TO TREE AT FRONT OF PROPERTY (832A/828A SWIFT RD, PASADENA) ALL OBSERVATIONS AND DATA COLLECTION OCCURRED FROM ADJACENT PROPERTIES. ACCESS TO ADJACENT PROPERTIES GRANTED TO THE COUNTY BY THE HOMEOWNER.		
3/13/2014	STOP WORK ORDER	3/18/2014	3/13/2014
3/13/2014	CASE NOTE	3/13/2014	3/13/2014

MR. MIKE FOY CALLED TO DISCUSS THE STOP WORK ORDER SIGN POSTED AT THE PROPERTY ON 3/11/14. WHEN ASKED, MR. FOY STATED THAT THE DIRT WAS FROM THE COX CREEK WATER RECLAMATION FACILITY VIA KEY RECYCLING INC. MR. FOY STATED THAT HE WOULD NOT INSTALL SEDIMENT CONTROLS BETWEEN THE DIRT AND COCKEY CREEK SINCE HE DIDN'T DEMO THE HOUSE THERE. THE COUNTY TORE DOWN THE HOUSE SO THEY COULD INSTALL THE CONTROLS. WHEN ASKED WHY HE DIDN'T GET A PERMIT, MR. FOY STATED THAT THE DEFAULT JUDGMENT (SEPTEMBER 5, 2014) GAVE HIM THE RIGHT TO FILL IN THE PROPERTY, DUMP DIRT AND GRADE AS NEEDED. FURTHER STATEMENTS MADE BY MR. FOY WERE NOT RECORDED DUE TO HIS SPEECH BEING VERY ERRATIC, OCCASIONALLY SLURRED AND PARTIALLY INCOHERENT.

3/13/2014 CASE NOTE 3/13/2014 3/13/2014

COUNTY RECEIVED NOTICE THAT MR. MIKE FOY WAS OPERATING A BULLDOZER ONSITE AND GRADING/MOVING THE DIRT AT 758 HRS ON 3/12/14. ARRIVED ONSITE AT 1300 HRS. MR. FOY WAS NOT OBSERVED WORKING ON THE PROPERTY. CLOSER INSPECTION REVEALED ADDITIONAL GRADING HAD OCCURRED SINCE SITE VISIT ON 3/11/14. PICTURES TAKEN. ALL OBSERVATIONS AND DATA COLLECTION OCCURRED FROM ADJACENT PROPERTIES. ACCESS TO ADJACENT PROPERTIES GRANTED TO THE COUNTY BY THE HOMEOWNER.

3/13/2014 CASE NOTE 3/13/2014 3/13/2014

MET WITH CHRIS WHITE (PC CONSTRUCTION COMPANY), SUPERVISING INSPECTOR GENE PATTERSON AND COX CREEK WRF PERSONNEL ON 3/10/2014. MR. WHITE INFORMED THE COUNTY THAT THE EXCAVATION SITE HAD UNDERGONE A SUB-SURFACE SITE INSPECTION TO SEPARATE THE CLEAN AND CONTAMINATED SOILS. APEX ENVIRONMENTAL WAS MANAGING THE REMOVAL AND DISPOSAL OF ALL MATERIALS CLASSIFIED AS HAZARDOUS WASTE. ALL CLEAN MATERIAL WAS BEGIN RECYCLED BY KEY RECYCLING CENTER (BALTIMORE, MD) AT THEIR FORT ARMISTEAD RD AND BROMWELL (3950 MOUNTAIN RD, PASADENA) FACILITIES. MR. WHITE CONFIRMED THAT MR. JEFFERY FOY AND MR. MIKE FOY WERE HAULING THE MATERIALS FOR KEY RECYCLING CENTER. COLOR AND CONSISTENCY OF DIRT WAS CONSISTENT WITH THE DUMPED MATERIAL OBSERVED AT THE 832A/828A SWIFT RD PROPERTY.

3/13/2014 CASE NOTE 4/11/2014 3/13/2014

COMPLAINT RECEIVED ON 3/7/14 FOR STOCK PILE (GENERAL). ORIGINALLY ASSIGNED TO INSPECTOR 327, REASSIGNED ON 3/10/14. PHONE CALL FROM ANNE ARUNDEL COUNTY POLICE (OFFICER GERCZAK) ON 3/10/14 AT APPROXIMATELY 800 HRS. OFFICER GERCZAK DETAILED INCIDENT/COMPLAINT FROM VISIT TO PROPERTY ON 3/7/14. AACO POLICE REPORT PROVIDED TO THE COUNTY DETAILED "SMELLY" DIRT BEING BROUGHT ON SITE VIA DUMP TRUCKS OWNED BY MIKE FOY CONTRACTING. ONCE DUMPED, THE DIRT WAS BEING MOVED WITH HEAVY EQUIPMENT. ADDITIONAL DETAILS MAY BE FOUND IN OFFICER GERCZAK'S REPORT. SITE VISIT ON 3/10/14. OBSERVED A LARGE QUANTITY OF REDDISH DIRT (CLAY) THAT HAD BEEN SPREAD THROUGHOUT THE SITE. CLOSER OBSERVATION REVEALED THE CLAY/DIRT HAD BEEN PUSHED TO THE STOP OF A SLOPE THAT WAS WITHIN 100' OF COCKEY CREEK. GRADED DIRT WAS APPROXIMATELY 8' DEEP AT THIS LOCATION. NO EROSION & SEDIMENT CONTROLS PRESENT. NO ACTIVITY OBSERVED DURING SITE VISIT. PICTURES AND VIDEO TAKEN. ALL OBSERVATIONS AND DATA COLLECTION OCCURRED FROM ADJACENT PROPERTIES. ACCESS TO ADJACENT PROPERTIES GRANTED TO THE COUNTY BY THE HOMEOWNER. ----------
PLEASE UPDATE TICKLER DATE FOR: 04/11/2014

3/14/2014 CASE NOTE 3/14/2014 3/14/2014

RECEIVED CALL FROM MR. JOE MARKLEY (SPELLING?) OF SEVERN SAVINGS BANK. CALL WAS IN RESPONSE TO MESSAGE LEFT FOR CHRISTINA HAMBRUCH (V.P. OF LOSS MITIGATION AT SEVERN SAVINGS BANK) ON 3/10/14. INFORMED MR. MARKLEY OF AACO COMPLIANCE CASE E-2014-065 AND PENDING MARYLAND STATE CRIMINAL CASE AGAINST MR. FOY. MR. MARKLEY OFFERED TO INFORM THE COUNTY OF ANY CHANGES TO THE OWNERSHIP OF THE PROPERTIES IN QUESTION.

3/19/2014 CASE NOTE 3/19/2014 3/19/2014

SWO AND VIOLATION NOTICE SENT TO MICHAEL FOY ON 3/19/2014 VIA FIRST CLASS MAIL. GRADING WITHOUT A PERMIT IN THE CA BUFFER, CA LDA AND THE COCKEY'S CREEK BOG BUFFER IN EXCESS OF 5,000 SQ FT. REQUIRES MR. FOY TO SUBMIT A GRADING PERMIT APPLICATION FOR THE ABATEMENT OF THE VIOLATION BY NO LATER THAN 5/16/2014. CLASS "A" VIOLATION TO BE REFERRED TO THE OFFICE OF LAW. SENT TO 842 SWIFT RD, 832A SWIFT RD AND 828A SWIFT RD DUE TO UNKNOWN MAILING ADDRESS.

3/19/2014 GENERAL LETTER 3/19/2014 4/3/2014

MARCH 19, 2014 VIA FIRST CLASS MAIL MR. MICHAEL FOY 842 SWIFT RD. PASADENA, MD 21122 RE: 832A/828A SWIFT RD, PASADENA, MD 21122 (TAX MAP 24, BLOCK 11, PARCEL 161) VIOLATION NOTICE AND STOP WORK ORDER (E-2014-065) DEAR MR. FOY: ON MARCH 10TH, 11TH & 12TH, 2014, THE REFERENCED PROPERTY WAS INSPECTED BY REPRESENTATIVES OF THIS DEPARTMENT AND FOUND TO BE IN

VIOLATION OF THE ANNE ARUNDEL COUNTY CRITICAL AREA, GRADING, AND STORMWATER MANAGEMENT ORDINANCES (ALL CODE CITATIONS ARE FROM THE ANNE ARUNDEL COUNTY CODE). SPECIFICALLY, UNAUTHORIZED GRADING, DUMPING AND STOCKPILING HAS OCCURRED RESULTING IN A DISTURBANCE OF GREATER THAN 5,000 SQ FT IN THE CRITICAL AREA BUFFER, CRITICAL AREA LDA AND THE COCKEY'S CREEK BOG BUFFER WITHOUT PRIOR APPROVAL. THE UNDERTAKING OF THESE ACTIVITIES IS IN VIOLATION OF ARTICLE 16, SECTION 3-201, 4-201 AND ARTICLE 17, RESPECTIVELY. CONSEQUENTLY, A STOP WORK ORDER HAS BEEN POSTED ON THE SUBJECT PROPERTY PREVENTING ALL FURTHER SITE ACTIVITY IN ACCORDANCE WITH ARTICLE 16, SECTION 5-103. ACCORDINGLY, YOU ARE REQUIRED TO SUBMIT A GRADING PERMIT APPLICATION FOR THE ABATEMENT OF THE CURRENT VIOLATION BY NO LATER THAN MAY 16, 2014, AND DILIGENTLY PURSUE ISSUANCE OF SAME, INCLUSIVE OF APPLICABLE ZONING AND ENVIRONMENTAL AUTHORIZATIONS. ADDITIONALLY, GRADING IN EXCESS OF 5,000 SQ FT IN THE CRITICAL AREA BUFFER IS A CLASS "A" VIOLATION AND HAS THEREFORE BEEN REFERRED TO THE COUNTY OFFICE OF LAW FOR APPROPRIATE LEGAL PROCEEDINGS AS ALLOWED BY LAW. FAILURE TO COMPLY WITH THIS NOTICE MAY RESULT IN THE ISSUANCE OF FINES AND ADDITIONAL PENALTIES AS OUTLINED IN ARTICLE 16, SECTION 5. IN ACCORDANCE WITH ARTICLE 16, SECTION 1-109, THE DEPARTMENT SHALL DENY THE ISSUANCE OF ADDITIONAL PERMITS UNTIL THIS VIOLATION IS CORRECTED. SHOULD YOU HAVE ANY QUESTIONS RELATIVE TO PERMITTING REQUIREMENTS, YOU MAY ACCESS THE COUNTY'S WEBSITE AT HTTP://WWW.AACOUNTY.ORG OR YOU MAY CONTACT MR. JAY LESHINSKIE, PERMIT COORDINATOR OF THE PERMIT APPLICATION CENTER AT (410) 222-7730. IF YOU HAVE ANY OTHER QUESTIONS REGARDING THIS CORRESPONDENCE, PLEASE CONTACT ME AT (410) 222-7799 OR BY EMAIL AT IPSMIT77@AACOUNTY.ORG. (A COPY OF THIS NOTICE MUST BE INCLUDED WITH ALL REQUIRED APPLICATIONS.) SINCERELY, STEVEN SMITH CODE COMPLIANCE INSPECTOR

3/20/2014 CASE NOTE 3/20/2014 3/20/2014

SITE INSPECTION ON 3/19/13. OBSERVED THAT SEDIMENT CONTROLS (STANDARD SILT FENCE) HAD BEEN INSTALLED BETWEEN THE LARGE DIRT PILE AND COCKEY'S CREEK, PER THE SWO. CONTROLS WERE INSTALLED AT THE EDGE OF A PRE-EXISTING RETAINING WALL. PICTURES TAKEN. NEW SWO SIGN POSTED ON DIRT ROAD (NORTH OF SWIFT RD) LEADING TO THE FOY PROPERTIES. PICTURES TAKEN.

5/27/2014 CASE NOTE 12/1/2014 5/27/2014

CASE REFERRED TO THE ANNE ARUNDEL COUNTY OFFICE OF LAW. LEGAL ACTION TO BE UNDERTAKEN BY THE STATE OF MARYLAND AGAINST MR. FOY. ---------- ----- PLEASE UPDATE TICKLER DATE FOR: 12/01/2014

8/26/2014 CASE NOTE 8/26/2014 8/26/2014

SITE VISIT ON 8/22/14. REPORT OF POSSIBLE DUMPING OCCURRING ONSITE RECEIVED. OBSERVATIONS MADE FROM NEIGHBORING PROPERTIES. NO OBVIOUS SIGNS OF RECENT DUMPING FOUND. PICTURES TAKEN. FLY-OVER OF PROPERTY TO BE SCHEDULED.

Anne Arundel County
Compliance Cases

Main Menu > Print

Logout

Case ID:	E - 2014 - 98	**Location:**	0 SWIFT RD
Tax ID:	300010499705		LAKE SHORE PASADENA 21122
Received:	3/18/2014	**Details:**	
Tickler:	1/15/2015	**Completed:**	
	GRADING W/O PERMIT		

Receiver:		**Inspector:**		**Backup Inspector:**	NONE
Date Assigned:	3/18/2014	**Permit Number:**		**Original ID:**	
ADC Map:		**Related Cases:**			
Water Front:	N	**Critical Area:**	Y	**Violation:**	
Cty. Council Ind:	N	**Case Org:**			
Complainant:					

Owner Information	**Violator Information**
Owner 1:	**Violator 1:**
Owner 2:	**Violator 2:**
Address:	**Address:**
	Phone:

	Map No:	Suffix	Block	Parcel		Plat	Sect	Block	Lot No
State Map:	24		11	0157	**County Map:**				

Date	Event	Due Date	Request for Trial Date
3/18/2014	OPENED COMPLAINT CASE	3/23/2014	
3/20/2014	NOT IN COMPLIANCE	3/25/2014	3/20/2014
	AERIAL FLY-OVER OF ADJACENT PROPERTY (832A/828A SWIFT RD [E-2014-065]) REVEALED EXTENSIVE GRADING, DUMPING AND STOCKPILING HAD OCCURRED ONSITE WITHOUT AUTHORIZATION. PROPERTY IS LOCATED WITHIN THE CRITICAL AREA LDA, COCKEY'S CREEK BOG BUFFER AND THE COCKEY'S CREEK WETLAND OF SPECIAL STATE CONCERN (WSSC) BUFFER. PICTURES TAKEN. CASE FILE E-2014-098 OPENED ON 03/19/2014. GRADING WITHOUT A PERMIT.		
3/20/2014	CASE NOTE	5/16/2014	3/20/2014
	SWO AND VIOLATION NOTICE SENT TO JEFFREY FOY ON 3/20/2014 VIA FIRST CLASS MAIL. GRADING WITHOUT A PERMIT IN THE CA LDA AND THE COCKEY'S CREEK BOG BUFFER & WSSC BUFFER IN EXCESS OF 5,000 SQ FT. REQUIRES MR. JEFFREY FOY TO SUBMIT A GRADING PERMIT APPLICATION FOR THE ABATEMENT OF THE VIOLATION BY NO LATER THAN 5/16/2014. CLASS "A" VIOLATION TO BE REFERRED TO THE OFFICE OF LAW. ---------- PLEASE UPDATE TICKLER DATE FOR: 05/16/2014		
3/20/2014	GENERAL LETTER	3/20/2014	4/4/2014
	MARCH 20, 2014 VIA FIRST CLASS MAIL MR. JEFFERY FOY 834 SWIFT RD PASADENA, MD 21122 RE: 0 SWIFT RD (3.6640 ACRES), PASADENA, MD 21122 (TAX MAP 24, BLOCK 11, PARCEL 157) VIOLATION NOTICE AND STOP WORK ORDER (E-2014-098) DEAR MR. FOY: ON MARCH 14, 2014, THE REFERENCED PROPERTY WAS		

INSPECTED BY REPRESENTATIVES OF THIS DEPARTMENT AND FOUND TO BE IN VIOLATION OF THE ANNE ARUNDEL COUNTY CRITICAL AREA, GRADING, AND STORMWATER MANAGEMENT ORDINANCES (ALL CODE CITATIONS ARE FROM THE ANNE ARUNDEL COUNTY CODE). SPECIFICALLY, UNAUTHORIZED GRADING, DUMPING AND STOCKPILING HAS OCCURRED RESULTING IN A DISTURBANCE OF GREATER THAN 5,000 SQ FT IN THE CRITICAL AREA LDA AND THE COCKEY'S CREEK BOG BUFFER AND WSSC STREAM BUFFER, WITHOUT PRIOR APPROVAL. THE UNDERTAKING OF THESE ACTIVITIES IS IN VIOLATION OF ARTICLE 16, SECTION 3-201, 4-201 AND ARTICLE 17, RESPECTIVELY. CONSEQUENTLY, A STOP WORK ORDER HAS BEEN POSTED ON THE SUBJECT PROPERTY PREVENTING ALL FURTHER SITE ACTIVITY IN ACCORDANCE WITH ARTICLE 16, SECTION 5-103. ACCORDINGLY, YOU ARE REQUIRED TO SUBMIT A GRADING PERMIT APPLICATION FOR THE ABATEMENT OF THE CURRENT VIOLATION BY NO LATER THAN MAY 16, 2014, AND DILIGENTLY PURSUE ISSUANCE OF SAME, INCLUSIVE OF APPLICABLE ZONING AND ENVIRONMENTAL AUTHORIZATIONS. ADDITIONALLY, GRADING IN EXCESS OF 5,000 SQ FT IN THE CRITICAL AREA IS A CLASS "A" VIOLATION AND HAS THEREFORE BEEN REFERRED TO THE COUNTY OFFICE OF LAW FOR APPROPRIATE LEGAL PROCEEDINGS AS ALLOWED BY LAW. FAILURE TO COMPLY WITH THIS NOTICE MAY RESULT IN THE ISSUANCE OF FINES AND ADDITIONAL PENALTIES AS OUTLINED IN ARTICLE 16, SECTION 5. IN ACCORDANCE WITH ARTICLE 16, SECTION 1-109, THE DEPARTMENT SHALL DENY THE ISSUANCE OF ADDITIONAL PERMITS UNTIL THIS VIOLATION IS CORRECTED. SHOULD YOU HAVE ANY QUESTIONS RELATIVE TO PERMITTING REQUIREMENTS, YOU MAY ACCESS THE COUNTY'S WEBSITE AT HTTP://WWW.AACOUNTY.ORG OR YOU MAY CONTACT MR. JAY LESHINSKIE, PERMIT COORDINATOR OF THE PERMIT APPLICATION CENTER AT (410) 222-7730. IF YOU HAVE ANY OTHER QUESTIONS REGARDING THIS CORRESPONDENCE, PLEASE CONTACT ME AT (410) 222-7799 OR BY EMAIL AT IPSMIT77@AACOUNTY.ORG. (A COPY OF THIS NOTICE MUST BE INCLUDED WITH ALL REQUIRED APPLICATIONS.) SINCERELY, STEVEN SMITH CODE COMPLIANCE INSPECTOR

3/20/2014	CASE NOTE	3/20/2014	3/20/2014

SWO SIGN POSTED ON DIRT ROAD (NORTH OF SWIFT RD) LEADING TO THE FOY PROPERTIES ON 03/19/2014. PICTURES TAKEN.

5/20/2014	LAW OFFICE REFERRAL	1/15/2015	5/20/2014
7/14/2014	CASE NOTE	7/14/2014	7/14/2014

RECEIVED NOTIFICATION FROM BANK REPRESENTATIVE OF A MEETING ON 6/18/14 AT 1300 HRS AT ADJACENT PROPERTY (832A SWIFT RD) FOR CODE COMPLIANCE CASE E-2014-065. ATTENDEES INCLUDED ANNE ARUNDEL COUNTY SHERIFFS, MD OFFICE OF THE ATTORNEY GENERAL, MD OAG ENVIRONMENTAL CRIMES UNIT, MDE WATER DIVISION, MDE LAND DIVISION AND SEVERN SAVINGS BANK. AACO SHERIFF ESCORTED ALL ATTENDEES ON TO PROPERTY TO PERFORM A SITE INSPECTION. OBSERVED EXTENSIVE DUMPING OF WOOD CHIPS AND CONSTRUCTION DEBRIS, GRADING, NUMEROUS ABOVEGROUND STORAGE TANKS (2 STILL CONTAINING HEATING OIL) AND AUTOMOTIVE GAS TANKS (PARTIALLY FILLED), STOCKPILING OF TIRES, ABANDONED VEHICLES/HEAVY EQUIPMENT AND AN ABANDONED HOME. DUMPING, GRADING AND STOCKPILING EXTENDED ON TO "0" SWIFT RD AND 834 SWIFT RD. PICTURES TAKEN. FURTHER INSPECTION REVEALED THAT THE STOP WORK ORDERS POSTED ON 3/19/14 HAD BEEN REMOVED FROM THE PROPERTY.

Anne Arundel County
Compliance Cases

Main Menu > Print Logout

Case ID:	E - 2014 - 120	**Location:**	2589 GOLFERS RIDGE RD
Tax ID:	289290025454		HERITAGE HARBOUR ANNAPOLIS 21401
Received:	3/27/2014	**Details:**	
Tickler:		**Completed:**	4/8/2014
	STOCK PILE (GENERAL)		

Receiver:		**Inspector:**		**Backup Inspector:**	NONE
Date Assigned:	3/27/2014	**Permit Number:**	B02300315	**Original ID:**	
ADC Map:		**Related Cases:**			
Water Front:	N	**Critical Area:**	N	**Violation:**	
Cty. Council Ind:	N	**Case Org:**			
Complainant:					

Owner Information	**Violator Information**
Owner 1:	**Violator 1:**
Owner 2:	**Violator 2:**
Address:	**Address:**
	Phone:

	Map No:	Suffix	Block	Parcel		Plat	Sect	Block	Lot No
State Map:	50		04	0344	**County Map:**	3	422		35

Date	Event	Due Date	Request for Trial Date
3/27/2014	OPENED COMPLAINT CASE	4/1/2014	
4/8/2014	CORRECTION NOTICE ISSUED	4/13/2014	4/8/2014
	4/3/14: INSPECTOR ARRIVED ON SITE ON 3/27/14 TO INVESTIGATE COMPLAINT. UPON ARRIVAL THE FOLLOWING WAS OBSERVED. THE CONTRACTOR HAS PLACED A LARGE STOCKPILE OF SOIL ON A COUNTY ROAD. DUE TO THIS, SEDIMENT IS BEING TRACKED UP AND DOWN GOLFERS RIDGE RD. THERE IS EXISTING CURB AND GUTTER IN PLACE THAT SEDIMENT FROM THE STOCKPILE WILL MAKE IT'S WAY INTO. NO SEDIMENT CONTROLS ARE IN PLACE NEAR STOCKPILE.		
4/8/2014	STOP WORK ORDER	4/13/2014	4/8/2014
	A STOP WORK ORDER HAS BEEN ISSUED. A REPORT WAS GIVEN TO THE FOREMAN PRESIDENT. HE SIGNED THE REPORT AND A STOP WORK ORDER WAS POSTED ON A TREE NEAR THE WORK AREA. THE ONLY WORK ALLOWED IS THAT IN WHICH TO ABATE THE STOP WORK ORDER.		
4/8/2014	CLOSE COMPLAINT		
	RELMS LANDSCAPING (CNTRACTOR) HAS FOLLOWED THE CORRECTION NOTICE ISSUED ON 3/27/14. THE STOCKPILE HAS BEEN REMOVED AND THE COUNTY ROAD IN WHICH THE STOCKPILE WAS PLACE HAS BEEN CLEANED. SINCE THE VIOLATION HAS BEEN ABATED, THIS COMPLAINT CAN BE CLOSED		

Anne Arundel County
Compliance Cases

Main Menu > Print

Logout

Case ID:	E - 2014 - 133	**Location:**	105 CLARENCE AVE
Tax ID:	374615747000		SABRINA PARK SEVERNA PARK 21146
Received:	4/3/2014	**Details:**	
Tickler:		**Completed:**	4/25/2014
	DRAINAGE COMPLAINT		NPDES TRIGGERING EVENT

Receiver:		**Inspector:**		**Backup Inspector:**	NONE
Date Assigned:	4/3/2014	**Permit Number:**	G02011800	**Original ID:**	
ADC Map:		**Related Cases:**			
Water Front:	N	**Critical Area:**	N	**Violation:**	
Cty. Council Ind:	N	**Case Org:**			
Complainant:					

Owner Information	**Violator Information**
Owner 1:	**Violator 1:**
Owner 2:	**Violator 2:**
Address:	**Address:**
	Phone:

State Map:	Map No:	Suffix	Block	Parcel	**County Map:**	Plat	Sect	Block	Lot No
	23		23	0269		F			57

Date	Event	Due Date	Request for Trial Date
4/3/2014	OPENED COMPLAINT CASE	4/8/2014	
4/25/2014	NOT IN COMPLIANCE	4/30/2014	4/25/2014

4/4/14: THIS INSPECTOR MET ON THIS SITE WITH GRADING SUPERVISOR VERNON MURRAY WITH DEVELOPER TODD UTZ RELATIVE TO A COMPLAINT OF A STORMWATER DRAINAGE NPDES TRIGGERING EVEN T DUE TO A RECENT RAIN EVENT. THE SITE WALK THRU REVEALED SEVERAL ISSUES WHICH NEEDED TO BE REPAIRED TO ACHIEVE COMPLIANCE. A HANDWRITTEN LIST WAS PREPARED AND IS INCLUDED IN THE GRADING FILE. FINDINGS AT THE TIME OF INSPECTION REVEALED THAT SECTIONS OF ROADSIDE SWALES HAD BEEN DAMAGED DUE TO CONSTRUCTION ACTIVITIES WHICH CREATED TURBID DRAINAGE WATER. THIS TURBID WATER HOWEVER, WAS BEING FILTERED THROUGH APPROVED GEOTEXTILE -E FABRIC AT INLETS #1 AND #2. DUE TO THE AGE OF THE FABRIC AND SEDIMENT FOULING, THE FILTERING RATE WAS SLOW, THUS CREATING A PONDING CONDITION ON THE SITE. THIS FABRIC IS TO BE REPLACED. A VISIT WAS MADE TO THE SITE OUTFALL IN THE ADJOINING COMMUNITY OF CHART RIDGE AND FOUND CLEAR WATER CONDITIONS AND NO EVIDENCE OF SEDIMENT DEPOSITION. THE WORK BEING DONE UNDER THE ISSUED CORRECTION NOTICE SHOULD ALLEVIATE A REPEAT OF THIS DRAINAGE PROBLEM DURING FUTURE RAIN EVENTS. THE DEVELOPER MUST COMPLETE ALL REPAIRS BY 4/9/14. FOLLOW UP INSPECTION TO TAKE PLACE TO ENSURE COMPLIANCE.

4/25/2014 CLOSE COMPLAINT

A SITE WALK THROUGH WITH THE DEVELOPER ON 4/10/14 REVEALS THAT ALL ITEMS IN THE CORRECTION NOTICE HAVE BEEN COMPLETED AS WELL AS A MODIFICATION OF INLET #1 NO REDUCE THE POSSIBILITY OF PONDING IN THE ROADWAY. THIS COMPLAINT CAN BE CLOSED

Anne Arundel County
Compliance Cases

Main Menu > Print

Logout

Case ID:	E - 2014 - 141	**Location:**	1127 RIVER BAY RD
Tax ID:	316507166728		CAPE ST CLAIRE ANNAPOLIS 21409
Received:	4/9/2014	**Details:**	
Tickler:		**Completed:**	4/25/2014
	DRAINAGE COMPLAINT		

Receiver:		**Inspector:**		**Backup Inspector:**	NONE
Date Assigned:	4/9/2014	**Permit Number:**	B02293204	**Original ID:**	
ADC Map:		**Related Cases:**			
Water Front:	N	**Critical Area:**	Y	**Violation:**	
Cty. Council Ind:	N	**Case Org:**			
Complainant:					

Owner Information	**Violator Information**
Owner 1:	**Violator 1:**
Owner 2:	**Violator 2:**
Address:	**Address:**
	Phone:

State Map:	33		24	0059	**County Map:**	B			132R
	Map No:	Suffix	Block	Parcel		Plat	Sect	Block	Lot No

Date	Event	Due Date	Request for Trial Date
4/9/2014	OPENED COMPLAINT CASE	4/14/2014	

4/25/2014 CLOSE COMPLAINT

COMPLAINT ABOUT PUMPED WATER TAKING SEDIMENT INTO THE COUNTY OWNED DITCH/SWALE. TALKED TO THE HOMEOWNER AND HAD THE PUMP TURNED OFF AND SPOKE TO THE POOL COMPANY TO HAVE THE DITCH/SWALE CLEANED OUT. WORK HAS BEEN DONE 4/11/14

Anne Arundel County
Compliance Cases

Main Menu > Print Logout

Case ID:	E - 2014 - 208	**Location:**	8141 TELEGRAPH RD
Tax ID:	400000548925		SEVERN SEVERN 21144
Received:	5/6/2014	**Details:**	
Tickler:		**Completed:**	5/8/2014
	ILLEGAL DISCHARGES COMPLAINT		STORMWATER MANAGEMENT ISSUES

Receiver:		**Inspector:**		**Backup Inspector:**	
Date Assigned:	5/6/2014	**Permit Number:**		**Original ID:**	
ADC Map:		**Related Cases:**			
Water Front:	N	**Critical Area:**	N	**Violation:**	
Cty. Council Ind:	N	**Case Org:**			
Complainant:					

Owner Information	**Violator Information**
Owner 1:	**Violator 1:**
Owner 2:	**Violator 2:**
Address:	**Address:**
	Phone:

State Map:	21		06	0478	**County Map:**				
	Map No:	Suffix	Block	Parcel		Plat	Sect	Block	Lot No

Date	Event	Due Date	Request for Trial Date
5/6/2014	OPENED COMPLAINT CASE	5/11/2014	

5/8/2014 CLOSE COMPLAINT

RT. 170 IS A STATE HIGHWAY. THERE IS A CURB INLET CLOGGED AND A PIPE CONNECTED TO THE INLET DESIGNED TO OUTFALL ON THE OTHER SIDE OF TELEGRAPH RD. INTO A DRAINAGE SWALE. THE DRAINAGE SWALE IS ALSO CLOGGED WITH SEDIMENT. AGAIN THIS IS A STATE HIGHWAY ISSUE. NO RESPONSIBILITY FOR AA COUNTY. INSPECTOR - RON WALTERS.

Anne Arundel County
Compliance Cases

Main Menu > Print

Logout

Case ID:	E - 2014 - 228	**Location:**	0 DORSEY RD
Tax ID:	500090050796		GLEN BURNIE GLEN BURNIE 21061
Received:	5/12/2014	**Details:**	IDDE REFERRAL
Tickler:		**Completed:**	5/29/2014
	FLOODPLAIN COMPLAINT		

Receiver:		**Inspector:**		**Backup Inspector:**	
Date Assigned:	5/12/2014	**Permit Number:**		**Original ID:**	
ADC Map:		**Related Cases:**			
Water Front:	N	**Critical Area:**	N	**Violation:**	
Cty. Council Ind:	N	**Case Org:**			
Complainant:					

Owner Information	**Violator Information**
Owner 1:	**Violator 1:**
Owner 2:	**Violator 2:**
Address:	**Address:**
	Phone:

State Map:	09		11	0283	**County Map:**				
	Map No:	Suffix	Block	Parcel		Plat	Sect	Block	Lot No

Date	Event	Due Date	Request for Trial Date
5/12/2014	OPENED COMPLAINT CASE	5/17/2014	

A VERSAR AND LIMNOTECH FIELD TEAM IDENTIFIED A DUMPSITE IN THE FLOODPLAIN OF SAWMILL BRANCH DURING THE JOINT FIELD CALIBRATION DAY. THE TEAM WAS ATTEMPTING TO LOCATE AN OUTFALL AT THE REAR OF THE PROPERTY AND DISCOVERED FRESHLY DUMPED SOIL AND MATERIAL ON THE NORTHERN PERIPHERY OF THE PARKING AREA (FIGURE 1 AND FIGURE 2). THE NAME AND ADDRESS OF THE PROPERTY COULD NOT BE IMMEDIATELY ASCERTAINED, HOWEVER IT APPEARED THAT THE BUILDING IN THE REAR IS AN OPERATING SNOWBALL STAND AND THE BUILDING ADJACENT TO THE ROAD HAD BEEN A BAIT AND TACKLE SHOP. ADDITIONALLY, AT THE REAR OF THE PREMISES WERE TWO AREAS OF STORED AND DISCARDED MATERIAL; HOWEVER, THE MATERIAL WAS ON PERVIOUS SURFACES LOCATED APPROXIMATELY 20 METERS FROM THE STREAM (FIGURE 3). THE MATERIAL CONSISTED OF FIVE-GALLON BUCKETS AND OTHER ARTICLES OF PLASTIC. AN AREA MAP APPEARS IN FIGURE 4 WITH THE LOCATION OF THE PROBLEMS INDICATED.

5/13/2014	CASE NOTE	5/13/2014	5/13/2014

EXISTING SITE CONDITIONS DO NOT REFLECT AN ILLICIT STORMDRAIN DISCHARGE OR A VIOLATION OF THE COUNTY FLOODPLAIN, GRADING OR STORMWATER MANAGEMENT CODES.

5/13/2014	CASE NOTE	5/13/2014	5/13/2014

ZONING VIOLATION CASE NUMBERS Z-2014-0087 AND Z-2014-0416 OPEN FOR TRASH AND DEBRIS VIOLATIONS. NOTICE SENT

5/29/2014 CLOSE COMPLAINT

AFTER TALKING WITH TWO INDIVIDUALS WHO RENT LAND ON THE PROPERTY IT WAS REVEALED THAT JOHN DUNKER IS BELIEVED TO BE THE LAND OWNER. LEFT A VOICE MAIL MESSAGE FOR MR. DUNKER ON 5/13/14 @ 410-218-4886 NOTIFYING HIM THAT THERE WAS A COMPLAINT RECIEVED ABOUT HIS PROPERTY AND THAT HE NEEDED TO TAKED ACTION TO CLEAN UP THE ILLEGAL DUMPSITE LOCATED ON STATED PROPERTY. THE FRESHLY DUMPLED SOIL DISCOVERED WAS IN FACT NOT FRESHLY DUMPLED, BUT HAD BEEN THERE FOR SOME TIME. THE RENTER ON THE PROPERTY USES THE SOIL TO POT PLANTS DAILY, MAKING THE PILE OF DIRT APPEAR TO BE FRESHLY DUMPED. THE TWO RENTERS HAVE ALREADY REMOVED SOME OF THE TRASH. COMPLAINT HAS BEEN REFERRED TO ZONING ENFORCEMENT.

Anne Arundel County
Compliance Cases

Main Menu > Print Logout

Case ID:	E - 2014 - 229	**Location:**	510 MCCORMICK DR
Tax ID:	541490058866		INTERNATIONAL TRADE CNTR GLEN BURNIE 21061
Received:	5/12/2014	**Details:**	IDDE REFERRAL
Tickler:	8/12/2014	**Completed:**	
	STORMWATER MANAGEMENT ISSUES		

Receiver:		**Inspector:**		**Backup Inspector:**	NONE
Date Assigned:	5/12/2014	**Permit Number:**		**Original ID:**	
ADC Map:		**Related Cases:**			
Water Front:	N	**Critical Area:**	N	**Violation:**	
Cty. Council Ind:	N	**Case Org:**			
Complainant:					

Owner Information	**Violator Information**
Owner 1:	**Violator 1:**
Owner 2:	**Violator 2:**
Address:	**Address:**
	Phone:

State Map:	09		19	0070	**County Map:**				9R
	Map No:	Suffix	Block	Parcel		Plat	Sect	Block	Lot No

Date	Event	Due Date	Request for Trial Date
5/12/2014	OPENED COMPLAINT CASE	5/17/2014	

WHILE CONDUCTING OUTFALL SCREENING IN THE TARGET AREA, A VERSAR FIELD TEAM NOTED A HOLE IN THE ASPHALT NEAR A STORM DRAIN INLET (FIGURE 1 AND FIGURE 2) IN THE SOUTH PARKING AREA AT THE ABOVE ADDRESS. UPON CLOSER INSPECTION, THE INTERIOR OF THE CATCH BASIN COULD BE CLEARLY SEEN THROUGH THE OPEN HOLE (FIGURE 3). NO VEHICLES WERE PARKED IN THIS AREA, HOWEVER THE WEAKENED ASPHALT COULD CREATE A FALLING HAZARD FOR PASSERS-BY OR CAUSE DAMAGE TO VEHICLES. IF THERE IS AN EROSION PROBLEM, THE CONDITION COULD WORSEN.

5/29/2014	CASE NOTE	7/2/2014	5/29/2014

THE SITE INSPECTION REVEALED THE FOLLOWING: A HOLE IN THE ASPHALT WAS OBSERVED BY THE STORM DRAIN INLET IN THE SOUTH PARKING AREA AT 510 MCCORMICK DR., GLEN BURNIE, MD 21061 (PERMIT G00202963). UPON CLOSER INSPECTION, THE CATCH BASIN COULD BE CLEARLY SEEN THROUGH THE HOLE IN THE ASPHALT. THIS CATCH BASIN DRAINS INTO THE SMALL POND (NUMBER 431) DIRECTLY ADJACENT TO THE PARKING LOT. THIS POND HAS A STORM WATER MANAGEMENT AGREEMENT (NUMBER 445) WITH ANNE ARUNDEL COUNTY AND MUST MAINTAIN COMPLIANCE WITH THE TERMS OF THAT AGREEMENT. THE HOLE IN THE ASPHALT MUST BE REPAIRED SO THAT THE INTEGRITY OF THE PAVEMENT, CATCH BASIN, AND STORM WATER MANAGEMENT POND ARE UPHELD WITH RESPECT TO ANNE ARUNDEL COUNTY CODE. FOLLOW UP INSPECTION HAS BEEN SCHEDULED FOR 7/1/14.

8/5/2014	CASE NOTE	8/12/2014	8/5/2014

SITE MEETING WITH PROPERTY MANAGER, VICKY FROM ST. JOHNS PROPERTIES. VICKY INFORMED THE INSPECTOR, JOE MAXWELL, THAT THE HOLE IN THE ASPHALT IS OF HIGH PRIORITY AND SHE HAS A CONTRACTOR ADDRESSING THE ISSUE AS SOON AS POSSIBLE. INSPECTOR WILL BE CONTACTED AS SOON AS THE ISSUE HAS BEEN SOLVED. IF THE INSPECTOR IS NOT CONTACTED IN THE NEXT WEEK, THE INSPECTOR WILL CONTACT THE PROPERTY MANAGER.

Anne Arundel County
Compliance Cases

Main Menu > Print

Logout

Case ID:	E - 2014 - 252	**Location:**	1300 CONCOURSE DR
Tax ID:	500090038211		GATEWAY INTERNATIONAL LINTHICUM 21090
Received:	5/23/2014	**Details:**	
Tickler:	7/31/2014	**Completed:**	
	ILLEGAL DISCHARGES COMPLAINT		

Receiver:		**Inspector:**		**Backup Inspector:**	
Date Assigned:	5/23/2014	**Permit Number:**		**Original ID:**	
ADC Map:		**Related Cases:**			
Water Front:	N	**Critical Area:**	N	**Violation:**	
Cty. Council Ind:	N	**Case Org:**			
Complainant:					

Owner Information	**Violator Information**
Owner 1:	**Violator 1:**
Owner 2:	**Violator 2:**
Address:	**Address:**
	Phone:

State Map:	03		12	0255	**County Map:**				1R
	Map No:	Suffix	Block	Parcel		Plat	Sect	Block	Lot No

Date	Event	Due Date	Request for Trial Date
5/23/2014	OPENED COMPLAINT CASE	5/28/2014	

VERSAR FIELD STAFF CONDUCTED SITE VISITS TO SEVERAL TARGETED OUTFALLS IN THE VICINITY OF CONCOURSE DRIVE ON MAY 14TH. AT 1:45 P.M., THE FIELD TEAM SCREENED OUTFALL I03E8O003, WHICH DISCHARGES TO A WET POND AND WAS PARTIALLY SUBMERGED (FIGURE 1). A VISUAL INSPECTION OF THE 1ST MANHOLE UP FROM THE OUTFALL IN THE MIDDLE OF CONCOURSE DR. SHOWED FLOWING WATER. A FAINT RANCID ODOR WAS NOTED WHEN THE WATER SAMPLE WAS COLLECTED AT THE OUTFALL. THE SCREENING RESULTS WERE ABOVE ACTION LEVELS (8.6 MG/L1) FOR FLUORIDE, BUT ELEVATED FOR DETERGENTS (0.15MG/L) AND AMMONIA (0.10MG/L; TABLE 1). ON THE FOLLOWING DAY, THE FIELD TEAM RETESTED WATER OBTAINED FROM THE FLOWING PIPE, RATHER THAN THE STAGNANT WATER AT THE OUTFALL. THE RETEST YIELDED A LOWER FLUORIDE RESULT (0.3 MG/L). DETERGENT LEVELS WERE ABOVE THE ACTION LEVEL (0.50 MG/L) WHILE AMMONIA WAS ELEVATED (0.10 MG/L). BECAUSE OF THE ELEVATED DETERGENT RESULT, FIELD STAFF TRACED THE SOURCE OF THE FLOW. DURING TRACKDOWN, THE FIELD TEAM TESTED FLOWING WATER IN A MANHOLE LOCATED IN THE SOUTHEAST ENTRANCE DRIVEWAY OF 1302 CONCOURSE DRIVE. THE RESULTS WERE HIGH FOR DETERGENTS (0.75 MG/L) AND AMMONIA (0.20 MG/L). FIELD STAFF ALSO NOTED WHITE RESIDUE ON THE INTERIOR SURFACE OF THE STORM DRAIN PIPE AND A STRONGER ODOR. THE FIELD TEAM FOLLOWED THE ODOR, WHITISH RESIDUE, AND FLOWING WATER THROUGH THE CURB INLETS ON THE NORTHERN EDGE OF 1300 CONCOURSE DR. (EMBASSY SUITES) TO THE END OF THE SYSTEM, WHICH TERMINATED IN

A CURB INLET LOCATED DOWN-GRADIENT FROM THE HOTEL LOADING DOCK (FIGURE 2). WITHIN THIS CURB INLET, THE FIELD TEAM FOUND SOME STANDING GRAY WATER WITH A STRONG FOUL ODOR (FIGURE 4). TESTING OF THE WATER AGAIN YIELDED ELEVATED DETERGENTS (0.75 MG/L) AND ELEVATED AMMONIA (0.2 MG/L). A GENERAL INSPECTION OF THE AREA AROUND THE CURB INLET AND OF THE LOADING DOCK AREA SHOWED NO SIGNS OF ACTIVE ILLICIT DISCHARGE ACTIVITIES. T

5/23/2014 CASE NOTE 5/23/2014 5/23/2014

CONTINUED HE FIELD CREW NOTED AND PHOTO-DOCUMENTED CONDITIONS OF THE DOCK AREA AS THE CURB INLET GRATE WAS GENERALLY GRUNGY AND SOME STAINING OF THE PAVEMENT FROM THE DIRECTION OF THE LOADING DOCK TOWARDS THE CURB INLETS WAS READILY APPARENT (FIGURE 3). SOME RESIDUAL PUDDLED GREY WATER WAS FOUND IN THE AREA AS WELL BUT STAFF COULDN'T DISCERN THE SOURCE. FIELD CREW NOTED THE CONDITION OF THE LOADING DOCK TO BE MESSY, WITH ONE LARGE ROLLAWAY DUMPSTER WITH SOME RESIDUAL DUMPSTER JUICE ON THE GROUND ADJACENT AND A STAIN LINE TOWARD THE DRAIN. TWO STANDARD-SIZED DUMPSTERS WERE ALSO PLACED BESIDE THE DOCK; THEY WERE OVER-FLOWING WITH CARDBOARD AND SOME TRASH WAS NOTED AROUND THEM (FIGURE 5). A WASTE COOKING OIL VAT WAS ALSO NOTED BESIDE THE DOCK BUT APPEARED TO BE IN GOOD CONDITION. A MOP PAIL WAS ALSO PRESENT ON THE LOADING DOCK, SUGGESTING THAT HOTEL STAFF MAY BE DISPOSING OF WASH WATER ONTO THE PARKING LOT (FIGURE 6). FIELD CREW NOTED THESE CONDITIONS ON AN THE FIELD TEAM LATER DETERMINED THAT THE FLUORIDE METER WAS MIS-CALIBRATED AND THE ACTUAL CONCENTRATION WAS LIKELY MUCH LOWER. HOTSPOT DATA SHEET, BUT ARE INCLUDED WITH THIS CONFIRMED ILLICIT DISCHARGE REPORT.

5/29/2014 CLOSE COMPLAINT

THE INSPECTION REVEALED THE ILLICIT DISCHARGE CAN BE TRACED BACK TO A DOCKING AREA THAT HAS A LEAKING DUMPSTER. THE HOTEL HAS ALREADY BEEN INVESTIGATED BY THE HEALTH DEPARTMENT, WHO ADVISED THEM TO HAVE THE DUMPSTER(S) PROPERLY SEALED TO PREVENT FURTHER LEAKS. THE HOTEL IS ALREADY IN THE PROCESS OF HAVING THIS WORK DONE. THE INVESTIGATION CONFIRMS THE SAME SOURCE AS DETERMINED BY VERSAR. THE COLORATION OF THE WATER DISCHARGING INTO THE CONCOURSE DRIVE SWM POND IS THE SAME AS THE COLORATION OF THE LEAKAGE COMING FROM THE LARGE DUMPSTER AND LOADING DOCK AREA. THIS AREA DRAINS INTO THE FURTHEREST UPSTREAM BASIN OF THE SYSTEM THAT IS DRAINING INTO THE POND. THE HOTEL WAS NOTIFIED ON HOW TO DISPOSE OF MOP WATER THROUGH THE COUNTY SEWER SYSTEM AND NOT THROUGH THE OPEN PARKING LOT OR STORM DRAIN SYSTEM. HOTEL CHIEF ENGINEER HAS CONFIRMED THAT STAFF HAVE BEEN INSTRUCTED TO DO THIS INSIDE AND DRAIN IT TO FLOOR DRAINS CONNECTED TO SANITARY SYSTEM. AS OF 5/30/14 HOTEL STAFF AND MANAGEMENT HAVE BEEN ADVISED TO MAKE SURE NO ONE DUMPS OR RINSES ANY CLEANING SUPPLIES AND/OR EQUIPMENT OUTSIDE ON THE LOADING DOCK. THEY'VE ALSO BEEN ASKED TO CALL THE INSPECTOR ONCE THE DUMPSTER HAS BEEN SEALED OR REPLACED AND THE REMAINING DUMPSTER JUICE CLEANED UP. INSPECTOR WILL COME OUT TO TEST WATER AT OUTFALL A FEW DAYS LATER TO OFFICIALLY RULE OUT ANY OTHER POSSIBLE SOURCES OF DISCHARGE. THIS COMPLAINT WILL BE CLOSED IN RELATION TO STORMWATER MANAGMENT AND WILL BE HANDLED BY THE HEALTH DEPARTMENT SINCE THE SOURCE OF THE DISCHARGE IS A LEAKING DUMPSTER.

7/8/2014 CASE NOTE 7/31/2014 7/8/2014

INSPECTOR BURNHAM FOLLOWED UP WITH THE HOTEL'S CHIEF ENGINEER ON THE STATUS OF RECEIVING AND INSTALLING A NEW COMPACTOR DUMPSTER. THERE WAS NO DUMPSTER JUICE FINDING ITS WAY INTO THE BASIN UPON ARRIVAL AND BASIN WAS FULL OF WATER. THERE WAS TRASH ON THE GROUND, WHICH CHIEF ENGINEER ANTHONY WAS INFORMED TO HAVE CLEANED UP AS SOON AS POSSIBLE. ANTHONY INFORMED INSPECTOR BURNHAM THAT THE DUMPSTER WILL BE REPLACED BY THE END OF JULY. INSPECTOR BURNHAM WILL FOLLOW UP AGAIN ONCE THE NEW DUMPSTER IS INSTALLED.

Anne Arundel County
Compliance Cases

Main Menu > Print

Logout

Case ID:	E - 2014 - 271	**Location:**	940 INTERNATIONAL DR
Tax ID:	501790045129		AIRPORT SQ TECH PARK LINTHICUM HTS 21090
Received:	6/2/2014	**Details:**	
Tickler:	9/2/2014	**Completed:**	
	ILLEGAL DISCHARGES COMPLAINT		

Receiver:		**Inspector:**		**Backup Inspector:**	NONE
Date Assigned:	6/2/2014	**Permit Number:**		**Original ID:**	
ADC Map:		**Related Cases:**			
Water Front:	N	**Critical Area:**	N	**Violation:**	
Cty. Council Ind:	N	**Case Org:**			
Complainant:					

Owner Information	**Violator Information**
Owner 1:	**Violator 1:**
Owner 2:	**Violator 2:**
Address:	**Address:**
	Phone:

State Map:	04		07	0270	**County Map:**	1			5B
	Map No:	Suffix	Block	Parcel		Plat	Sect	Block	Lot No

Date	Event	Due Date	Request for Trial Date
6/2/2014	OPENED COMPLAINT CASE	6/7/2014	

INSPECTOR BRAD BURNHAM AND SUPERVISOR STEVE TRUMPLER MET WITH VERSAR FIELD CREW ABOUT ILLICIT DISCHARGE OCCURING AT AN OUTFALL BY 1099 WINTERSON ROAD. AFTER OPENING MULTIPLE MANHOLES ALONG WINTERSON RD AND INTERNATIONAL DR(SAMPLING 1 OF THEM), THE INVESTIGATION FOUND A MANHOLE ALONG AERO DR THAT APPEARED TO BE RECEIVING FLOW FROM STORM DRAINS IN THE PARKING LOT OF THE HYATT PLACE HOTEL, LOCATED AT 940 INTERNATIONAL DR. THERE WAS ALSO A STRONG ODOR COMING FROM THE MANHOLE. THE VERSAR FIELD CREW SAMPLED FROM THE MANHOLE, AND FOUND HIGH LEVELS OF AMMONIA AND DETERGENTS. THE INVESTIGATION THEN REVEALED THAT THERE IS A PARKING LOT INLET (CONNECTED TO A JUNCTION BOX THAT THEN CONNECTS TO THE AFOREMENTIONED MANHOLE) THAT IS RECEIVING FLOW FROM AN UNIDENTIFIED BLUE-GREEN PVC PIPE. THIS PIPE IS CONNECTED TO A SMALL VALVE NEXT TO THE HOTEL BUILDING, AND IT APPEARS THAT IT MUST BE RECEIVING FLOW SOMEWHERE FROM THE HOTEL. INSIDE OF THIS BASIN WAS AN EVEN STRONGER FOUL ODOR, AND THERE APPEARED TO BE PIECES OF DISSOLVED TOILET PAPER IN THE WATER. AGAIN A SAMPLE WAS TAKEN, AND THE WATER TESTED HIGH FOR AMMONIA AND DETERGENTS. AFTER CONCLUDING THAT THIS WAS THE SOUCE OF ILLICIT DISCHARGE, BRAD AND STEVE SPOKE WITH HOTEL MANAGER, JESS. JESS WAS MADE AWARE THAT IT APPEARS THERE IS AN ILLEGAL TIE INTO THE STORM DRAIN SYSTEM FROM THEIR HOTEL. HE WAS INSTRUCTED TO HIRE A PLUMBER TO COME DETERMINE WHAT THIS PVC PIPE IS DRAINING, AND IF IT'S ANYTHING THAT CATCHES DETERGENTS OR OTHER THINGS THAT SHOULD GO INTO SANITARY SEWER, TO HAVE THE PROBLEM FIXED IMMEDIATELY. A FOLLOW-UP INVESTIGATION WILL COMMENCE ON 6/2/14 TO SEE IF THE SOURCE OF THIS PVC PIPE WAS DETERMINED. IF IT'S AN ILLEGAL CONNECTION, THAN EITHER WORK SHOULD HAVE BEEN

COMPLETED TO RECTIFY THE ISSUE OR IS UNDER WAY. THIS IS AN ONGOING COMPLAINT INVESTIGATION UNTIL FURTHER NOTICE.

6/4/2014	CASE NOTE	6/4/2014	6/4/2014

UPON ARRIVAL, IT WAS OBSERVED THAT THERE WAS DIRTY TOILET PAPER AND DEBRIS INSIDE OF THE BASIN IN QUESTION. AS OF 5/30/14 AND 6/2/14, MR. HERBERT HAS HAD A PLUMBER, JONAS SPANGLER (FROM AMERICAN COMBUSTION INDUSTRIES, INC.) COME AND DETERMINE THE PROBLEM. MR. SPANGLER WAS ABLE TO DETERMINE THAT THE LAUNDRY ROOM WAS NOT THE SOURCE OF ILLICIT DISCHARGE , AND IT IS IN FACT FLOWING INTO THE SANITARY SEWER AS REQUIRED. MR. SPANGLER WAS ALSO ABLE TO TRACK THE SOURCE TO THE TOILET AND/OR GREY-WATER LINE COMING FROM ROOM 318. USING A CAMERA SYSTEM SET UP IN THE OUTSIDE STORM-DRAIN VALVE, MR. SPANGLER WAS ABLE TO SEE WATER RUSHING THROUGH THE PIPE ONLY WHEN THIS ROOM'S TOILET WAS FLUSHED. IT IS MR. SPANGLERS SUSPICION THAT SOMEONE MUST HAVE ACCIDENTALLY TIED THE SANITARY LINE FOR THIS ROOM INTO THE DOWN-SPOUT LINE FOR THE ROOF WHEN THE HOTEL WENT UNDER SOME RE-DESIGNS IN THE PAST. MR. HERBERT HAS BEEN INSTRUCTED TO INFORM INSPECTOR BRAD BURNHAM EVERY 2 DAYS OF THE PROGRESS OF THE WORK. IT HAS BEEN ESTIMATED THAT THE WORK MAY BE FINISHED WITHIN THE NEXT WEEK. MR. HERBERT HAS ALSO BEEN ASKED TO EITHER HAVE A MEMBER OF HIS STAFF OR TO ASK MR. SPANGLER TO REMOVE THE TOILET PAPER AND ANY OTHER SANITARY DEBRIS FROM THE BASIN. MR. HERBERT HAS MR. SPANGLER ACTIVELY WORKING TO RESOLVE THIS ISSUE AS SOON AS POSSIBLE, AND ARE COOPERATING WITH ANNE ARUNDEL COUNTY'S INVESTIGATION.

6/10/2014	CASE NOTE	6/11/2014	6/10/2014

INSPECTOR BURNHAM ARRIVED ON SITE ON MONDAY, 6/9/2014, AT 2:30 PM. UPON ARRIVAL, PVC PIPE HAD ACTIVE FLOW. UPON MEETING WITH MANAGER JESS HERBERT, IT WAS REVEALED THAT JONAS SPANGLER IS NOW WORKING WITH THE PROPERTY MANAGER FOR THE OWNER OF THE PROPERTY (HYATT PLACE LEASES THE BUILDING). THEY ARE COORDINATING THE NECESSARY WORK, WHICH WILL INCLUDE TRENCHING FROM THE LOBBY TO THE OUTSIDE OF THE BUILDING, REPLACING TILE, HIRING CONTRACTORS, OBTAINING NECESSARY PERMITS, ETC. MR. HERBERT HAS BEEN ADVISED THAT HE MUST IMMEDIATELY PUT ROOM 318, THE BELIEVED SOURCE OF ILLICIT DISCHARGE, UNDER OUT OF ORDER AND MOVE ANY OCCUPANTS OUT OF THE ROOM AND SHUT THE ROOM'S GRAY WATER LINE OFF. THIS ROOM MUST REMAIN OUT OF USE UNTIL THE PROBLEM HAS BEEN RESOLVED.

6/18/2014	CASE NOTE	6/24/2014	6/18/2014

INSPECTOR BURNHAM ARRIVED ON SITE ON TUESDAY, 6/17/14. UPON ARRIVAL, RESIDUAL FLOW AND TOILET WASTE WAS OBSERVED IN BASIN. MR. HERBERT INFORMED THE INSPECTOR THAT ROOM 318 , THE BELIEVED SOURCE, HAS BEEN PLACED OUT OF ORDER. HE HAS BEEN INSTRUCTED TO NOW SHUT THE GRAY-WATER LINE OFF TO THAT ROOM COMPLETELY AND TO HAVE THE BASIN CLEANED OF TOILET WASTE IMMEDIATELY. IN ADDITION, MR. HERBERT PLANS TO MAKE A REQUEST TO JONAS SPANGLER, THE HIRED PLUMBER, TO CHECK EVERY HOTEL ROOM'S BATHROOM TO MAKE ABSOLUTELY SURE THAT ROOM 318 WAS THE ONLY ONE THAT APPEARS CONNCECTED INTO THE DOWNSPOUT(S) FROM THE ROOF.

7/7/2014	CASE NOTE	7/7/2014	7/7/2014

INSPECTOR BURNHAM AND SUPERVISOR STEVE TRUMPLER ARRIVED ON SITE ON 6/27/2014. UPON ARRIVAL, ACTIVE FLOW WAS OBSERVED FROM THE PIPE AND NEW TOILET PAPER WASTE AND HUMAN FECES WAS OBSERVED IN THE BASIN. INSPECTORS MET WITH HOTEL MANAGER JESS HERBERT TO DISCUSS WHY IT IS THAT THE PIPE IS STILL FLOWING IN SPITE OF HAVING PLACED ROOM 318 OUT OF ORDER. MR. HERBERT SHOWED THE INSPECTORS THE INSIDE OF THE ROOM, WHICH NOW IN FACT HAS THE LINE FOR THE TOILET COMPLETELY DISCONNECTED. IT WAS THUS BELIEVED THAT THERE MUST BE ANOTHER TIE.IN SOMEWHERE THAT WAS MISSED. INSPECTOR BURNHAM LATER DISCOVERED DURING A PHONE CONVERSATION WITH THE CONTRACTED PLUMBER, JONAS SPANGLER, THAT IT IS IN FACT THE ENTIRE STACK OF ROOMS (316-318, 416-418, 516-518 AND 616-618) THAT ARE ALL TIED INTO A SANITARY LINE THAT HAS BEEN TIED INTO THE ROOF DRAIN SYSTEM. THE REASON ROOM 318'S FLOW WAS THE ONLY FLOW DETECTED WAS BECAUSE ALL THE OTHER ROOMS' FLOWS HAVE FURTHER TO TRAVEL AND MORE TURNS TO PASS THROUGH BEFORE CONNECTING IN THE MAIN SANITARY LINE FOR THIS WHOLE STACK. MR. SPANGLER CONCLUDED THAT ALL 6 OF THESE ROOMS ARE THE CAUSE AFTER REVIEWING THE PLUMBING SCHEMATICS FOR THE HOTEL. MR. HERBERT HAS BEEN INSTRUCTED TO CLEAN THE BASIN AGAIN AS SOON AS POSSIBLE, AND TO PLACE ALL THE ROOMS IN QUESTION OUT OF ORDER IMMEDIATELY. IN ADDITION, AS WITH ROOM 318, ALL ROOMS NEED TO HAVE THEIR TOILET LINES REMOVED TO PREVENT ANY USE UNTIL THE PROBLEM IS RESOLVED. THE HOTEL CORPORATE OFFICES AND PROPERTY MANAGERS/OWNERS (THAT THE HYATT PLACE RENTS THE BUILDING FROM) ARE STILL IN THE PROCESS OF APPROVING ACI'S (THE PLUMBING COMPANY) PROPOSED WORK TO RESOLVE THE ISSUE.

7/7/2014	CASE NOTE	7/14/2014	7/7/2014

INSPECTOR BURNHAM ARRIVED ON SITE ON 6/30/2014. THERE WAS FLOW COMING INTO THE BASIN BOTH FROM THE PIPE-IN-QUESTION AND THE PIPE FROM THE MAIN STORM DRAINAGE SYSTEM. A STRONG, PUNGENT SMELL OF WASTE WATER WAS COMING FROM THE BASIN. THERE WAS NO TOILET PAPER IN THE BASIN, BUT WHAT THERE WAS A CLUMP OF WHAT COULD'VE POSSIBLY BEEN HUMAN FECAL MATTER NEAR THE END OF THE PIPE COMING FROM THE HOTEL. THERE ALSO APPEARED TO POSSIBLY BE A FILM ON THE TOP OF THE WATER. UPON TALKING WITH MR. HERBERT, IT HAS BEEN FOUND THAT ROOMS 316-318, 416-418, 516-518, AND 616-618 HAVE ALL BEEN PLACED OUT OF ORDER UNTIL THE PROBLEM IS CORRECTED. ROOM 516 HAD AN OCCUPANT WHO HAD CHECKED-IN JUST AS INSPECTOR BURNHAM ARRIVED, BUT WAS BEING MOVED TO A DIFFERENT ROOM AS INSPECTOR BURNHAM WAS LEAVING. ALL 8 ROOMS HAVE ALSO HAD THEIR TOILET LINES DISCONNECTED/REMOVED AS ALL OF THEM ARE CONTRIBUTING TO THE PROBLEM. INSPECTOR BURNHAM WILL CONTINUE TO FOLLOW-UP AT LEAST ONCE A WEEK WITH MANAGER JESS HERBERT TO CHECK THE PROGRESS OF RESOLVING THE ILLICIT DISCHARGE.

7/14/2014	CASE NOTE	7/21/2014	7/14/2014

INSPECTOR BURNHAM ARRIVED ON SITE ON 7/10/2014. THERE WAS FLOW COMING INTO THE BASIN, NOT FROM THE PIPE-IN-QUESTION (AT LEAST NOT NOTICEABLE), BUT FROM THE PIPE FROM THE MAIN STORM DRAINAGE SYSTEM. HOWEVER, AFTER 5 MINUTES OF OBSERVING THE BASIN, A STRONG RUSH OF WATER CAME FLOWING OUT OF THE PIPE-IN-QUESTION. INSPECTOR MET WITH HOTEL MANAGER JESS HERBERT. MR. HERBERT VERIFIED THAT ALL 8 ROOMS IN QUESTION WERE OUT OF ORDER. MR. HERBERT SHOWED THE INSPECTOR TO ALL 8 ROOMS TO MAKE SURE ALL TOILETS WERE DISCONNECTED. ALL 8 TOILETS WERE DISCONNECTED, BUT ROOM 418 HAD EVIDENCE OF SOMEONE, PROBABLY AN EMPLOYEE, USING IT FOR WASHING UP IN THE SINK AND SHOWER. MR. HERBERT WAS INSTRUCTED TO MAKE STAFF AWARE THAT THE WATER IN THESE ROOMS WAS NOT TO BE USED UNDER ANY CIRCUMSTANCES. UPON TALKING WITH HOTEL'S HEAD ENGINEER, IT WAS DETERMINED THAT THE INSPECTOR WAS INSPECTING THE BASIN AT THE SAME TIME THAT HE WAS BACKWASHING THE HOTEL POOL. AFTER FURTHER INVESTIGATION, IT WAS DETERMINED THAT THE POOL'S BACKWASH DRAIN WAS TIED ILLEGALLY INTO THE OPEN STORM DRAIN. MR. HERBERT WAS INSTRUCTED THAT THE POOL HAD TO BE PLACED OUT OF ORDER AND COULD NOT BE BACKWASHED. POOL MUST REMAIN OUT OF ORDER UNTIL THESE PLUMBING CONNECTION ISSUES ARE REPAIRED.

7/18/2014	CASE NOTE	7/25/2014	7/18/2014

INSPECTORS BRAD BURNHAM AND DENNIS GILLS ARRIVED ON SITE ON THURSDAY, 7/17/2014, AT 1:15 PM. UPON ARRIVAL, A PERSONAL VEHICLE WAS PARKED OVER TOP OF THE PARKING LOT INLET, WHICH COULD NOT BE ASSESSED FOR CONDITION OR CHECKED FOR EVIDENCE OF SEWAGE WATER. INSPECTORS MET WITH HOTEL MANAGER JESS HERBERT. MR. HERBERT INFORMED THE INSPECTORS THAT ALL ROOMS WERE STILL PUT OUT OF ORDER, WHICH UPON INDIVIDUALLY CHECKING EACH OF THE 8 ROOMS, WAS CONFIRMED. MR. HERBERT WAS ASKED TO HAVE HEAD ENGINEER PHYSICALLY REMOVE THE TOILET LINES FROM THE BATHROOMS SO THAT THEY MAY NOT BE RECONNECTED. IN ADDITION, ROOM THAT WAS PREVIOUSLY BEING USED BY STAFF AS A BREAK/WASH ROOM DOES NOT APPEAR TO BE IN USE. HOWEVER, ROOM HAD NOT BEEN CLEARED OF TOWELS AND SOAP BARS FROM SHOWER ROD AND SINK COUNTER. TO SOLVE THE ISSUE OF THE POOL BACKWASH BEING TIED INTO THE ROOF DRAINS THAT TIE INTO THE PARKING LOT INLET, PLUMBER JONAS SPANGLER CAPPED OFF THE LARGE PVC DRAIN IN THE DOG HOUSE FOR THE POOL PUMP. HE THEN EXTENDED THE SMALLER PVC LINE COMING FROM THE PUMP AND ADDED A HOSE TO THE END. WHEN BACKWASH FOR THE POOL NEEDS TO BE DONE, THEY LEAD THE HOSE OUT TO THE NEAREST SANITARY SEWER CLEANOUT. THIS IS STILL A CODE VIOLATION AND A PERMANENT FIX NEEDS TO BE COMPLETED IMMEDIATELY TO CONTINUE POOL OPERATIONS. POOL MAY REMAIN IN USE FOR THE TIME BEING, BUT PENDING HOW LONG IT TAKES TO FIX THIS PLUMBING ISSUE, POOL IS SUBJECT TO BE SHUT DOWN AGAIN SOON. MR. HERBERT HAS BEEN ADVISED TO HAVE THE HOTEL CORPORATION APPLY FOR A PLUMBING PERMIT AND SUBMIT PLANS TO FIX THIS ISSUE ASAP.

7/29/2014	CASE NOTE	8/14/2014	7/29/2014

INSPECTOR BRAD BURNHAM ARRIVED ON SITE ON FRIDAY, 7/25/2014, AT 2:35 PM. UPON ARRIVAL, BASIN HAD NO TOILET PAPER DEBRIS AND THERE WAS FAR LESS WATER COMING FROM THE PIPE IN QUESTION. ALL ROOMS IN QUESTION ARE STILL OUT OF ORDER, AND POOL BACKWASH PUMP HAS REMAINED DISCONNECTED FROM THE STORM DRAIN SYSTEM. HOTEL MANAGEMENT HAS BEEN REMINDED THAT DUMPING BACKWASH INTO THE SANITARY LINE THROUGH A CLEANOUT-ACCESS IS STILL A VIOLATION, AND THAT THEY SHOULD NOT BACKWASH THE POOL UNTIL THE PROBLEM IS PERMANENTLY RESOLVED. HOTEL MANAGEMENT INFORMED INSPECTOR THAT A NEW CONTRACTOR HAS BEEN HIRED TO COMPLETE

THE WORK AND THAT THEY HAVE OBTAINED ALL THE PROPER PERMITS. THEY HAVE SCHEDULED TO DO THE WORK FROM 8/4/2014 TO 8/13/2014.

8/5/2014 CASE NOTE 8/12/2014 8/5/2014

INSPECTOR BRAD BURNHAM ARRIVED ON SITE ON 8/1/2014 AT 3:00 PM. UPON ARRIVAL, THERE WAS STORM DEBRIS OBSERVED IN THE BASIN (LEAVES, SEDIMENT, ETC.). NO TOILET/GRAY WATER DEBRIS WAS OBSERVED IN THE BASIN. HOWEVER, THERE WAS RESIDUAL FLOW COMING FROM THE PIPE IN QUESTION, AS WELL AS A STRONG, PUNGENT ODOR OF SANITARY SEWER COMING FROM THE BASIN IN QUESTION. IT WAS OBSERVED THAT WATER BACKED UP IN THE CONCRETE PIPE (THE ONE DRAINING THE BASIN) HAD SOMEWHAT OF A MILKY-WHITE COLORATION TO IT. INSPECTOR SUSPECTS THAT THE DOWNSPOUT PIPES ARE STILL BEING CLEARED OF SMALL, UNNOTICABLE AMOUNTS OF SANITARY DEBRIS, WHICH IS PRODUCING THE ODOR AND THE SOMEWHAT MILKY COLORATION. PLUMBING WORK ON RE-ROUTING THE SANITARY LINE STACK FOR THE 8 ROOMS IN QUESTION IS TO BEGIN TAKING PLACE ON MONDAY, 8/4/2014. INSPECTOR IS STILL AWAITING TO HEAR HOW PLUMBER PLANS TO RE-ROUTE POOL BACKWASH TO BRING INTO TOTAL COMPLIANCE. INSPECTOR IS TO CONTINUE PERFORMING ROUTINE SITE VISITS TO ASSESS PROGRESS OF WORK.

8/6/2014 CASE NOTE 8/13/2014 8/6/2014

INSPECTOR BRAD BURNHAM ARRIVED ON SITE ON 8/4/2014 AT 2:15 PM. UPON ARRIVAL, THERE WAS NO DEBRIS IN BASIN OR ANY KIND OF COLORATION TO STAGNANT WATER. IN ADDITION, NO STRONG SMELL WAS IMMEDIATELY NOTICEABLE. THERE IS STILL A RESIDUAL AMOUNT OF FLOWING WATER COMING OUT OF PIPE IN QUESTION, BELIEVED AT THIS TIME TO BE FROM RESIDUAL STORMFLOW OR GROUNDWATER INFILTRATION. INSPECTOR SPOKE WITH GENERAL MANAGER AND PLUMBING SUBCONTRACTOR ABOUT PROGRESS OF WORK. PLUMBER HAS BEGUN WORK ON RE-ROUTING THE LINE THE STACK OF 8 ROOMS STACKS. PLUMBER SHOWED INSPECTOR WHERE LINE IS BEING RE-ROUTED TO. HE ALSO INFORMED INSPECTOR THAT SCOPE OF WORK FOR RE-ROUTING THE POOL BACKWASH SYSTEM HAS NOT BEEN DONE YET. INSPECTOR ADVISED PLUMBER (AND WILL ALSO ADVISE HEAD CONTRACTOR) TO BEGIN THIS WORK AS SOON AS POSSIBLE.HOTEL STAFF ARE COMPLYING WITH THE REQUIREMENTS OF THE COUNTY AT THIS TIME. INSPECTOR IS TO CONTINUE PERFORMING ROUTINE SITE VISITS TO ASSESS PROGRESS OF WORK.

8/8/2014 CASE NOTE 8/18/2014 8/8/2014

INSPECTOR BRAD BURNHAM ARRIVED ON SITE ON WEDNESDAY 8/6/2014 AT 2:00 PM. UPON ARRIVAL, THERE WAS NO DEBRIS IN BASIN OR ANY KIND OF COLORATION TO STAGNANT WATER. IN ADDITION, NO STRONG SMELL WAS IMMEDIATELY NOTICEABLE. THERE IS STILL A RESIDUAL AMOUNT OF FLOWING WATER COMING OUT OF PIPE IN QUESTION, BELIEVED AT THIS TIME TO BE FROM RESIDUAL STORMFLOW OR GROUNDWATER INFILTRATION. INSPECTOR SPOKE WITH PLUMBERS AND HEAD CONTRACTOR. WORK ON RE-ROUTING THE STACK FOR THE 8 ROOMS HAS BEEN FINALED BY A PLUMBING INSPECTOR, AND IS IN THE PROCESS OF CLEAN-UP. WORK WILL BE COMPLETED BY FRIDAY, 8/8/2014. INSPECTOR ADVISED CONTRACTORS THAT WORK NEEDS TO BE DONE ON RE-ROUTING THE POOL BACKWASH SYSTEM. A SCOPE OF WORK IS EXPECTED TO BE COMPLETED BY THE END OF NEXT WEEK, FRIDAY, 8/15/2014. CONTRACTORS HOPE TO HAVE APPROVAL FROM HYATT PLACE CORPORATE OFFICES TO BEGIN WORK BY THAT TIME.HOTEL STAFF ARE COMPLYING WITH THE REQUIREMENTS OF THE COUNTY AT THIS TIME. INSPECTOR IS TO CONTINUE PERFORMING ROUTINE SITE VISITS TO ASSESS PROGRESS OF WORK.

8/19/2014 CASE NOTE 8/26/2014 8/19/2014

INSPECTOR BRAD BURNHAM ARRIVED ON SITE ON FRIDAY, 8/15/2014 AT 3:00 PM. UPON ARRIVAL, THERE WAS NO OBVIOUS TOILET DEBRIS IN BASIN-IN-QUESTION. HOWEVER, UPON FURTHER OBSERVATION, THERE APPEARED TO BE WHAT MAY HAVE BEEN SMALL BITS OF TOILET PAPER IN THE WATER. INSPECTOR SUSPECTS THIS IS RESIDUAL DEBRIS THAT IS BEING PUSHED OUT OF THE PIPES DURING RAIN EVENTS. BUT, NO HUMAN WASTE (URINE, FECES, ETC.) WAS IN THE BASIN UPON INVESTIGATION. HOTEL IS STILL WORKING TO RE-ROUTE THE POOL BACKWASH SYSTEM. A SCOPE OF WORK WAS SUPPOSED TO BE COMPLETED BY 8/15/2014, BUT INSPECTOR HAS NOT YET BEEN CONTACTED. CONTRACTORS ARE EXPECTED TO HAVE APPROVAL FROM HYATT PLACE CORPORATE OFFICES SOON. HOTEL STAFF ARE COMPLYING WITH THE REQUIREMENTS OF THE COUNTY AT THIS TIME. INSPECTOR IS TO CONTINUE PERFORMING ROUTINE SITE VISITS TO ASSESS PROGRESS OF WORK.

8/25/2014 CASE NOTE 9/2/2014 8/25/2014

INSPECTOR BRAD BURNHAM ARRIVED ON SITE ON FRIDAY, 8/22/2014 AT 2:30 PM. UPON ARRIVAL, A STRONG ODOR OF SEWAGE WAS COMING FROM THE INLET. IN ADDITION, WHILE NO NOTICEABLE HUMAN FECES COULD BE SEEN, WATER THAT HAD SETTLED INTO THE CENTER OF THE INLET HAD A BROWN COLORATION AND APPEARED TO HAVE STRIPS OF DISSOLVED TOILET PAPER IN IT. IT IS SUSPECTED AT THIS TIME THAT THE PROBLEM OF THE 8 ROOMS HAS EITHER NOT BEEN CORRECTED, OR THERE'S

ANOTHER OUTSTANDING PROBLEM THAT HAS YET BEEN DISCOVERED, OR A COMBINATION OF THE 2. INSPECTOR IS TO RETURN TO SITE AS SOON AS IS FEASIBLE, AND IF UPON ARRIVAL NO IMPROVEMENT IS SEEN, THE 8 ROOMS THAT WERE INITIALLY SHUT DOWN WILL BE PLACED OUT OF ORDER ONCE AGAIN UNTIL THE ISSUE IS RESOLVED. HOTEL IS STILL WORKING TO RE-ROUTE THE POOL BACKWASH SYSTEM. A SCOPE OF WORK WAS SUPPOSED TO BE COMPLETED BY 8/15/2014, BUT INSPECTOR HAS NOT YET BEEN CONTACTED. CONTRACTORS ARE EXPECTED TO HAVE APPROVAL FROM HYATT PLACE CORPORATE OFFICES SOON. HOTEL STAFF ARE COMPLYING WITH THE REQUIREMENTS OF THE COUNTY AT THIS TIME. INSPECTOR IS TO CONTINUE PERFORMING ROUTINE SITE VISITS TO ASSESS PROGRESS OF WORK.

8/26/2014 CASE NOTE 9/2/2014 8/26/2014

INSPECTOR BURNHAM ARRIVED ON-SITE ON MONDAY, 8/25/2014, AT 2:40 PM. UPON ARRIVAL, INSPECTOR OPENED THE STORM INLET TO FIND MORE DIRTY WATER AND AN ODOR OF SEWAGE COMING FROM INSIDE. BECAUSE INCREASE IN DIRTY WATER HAS OCCURRED SINCE PLACING THE 8 HOTEL ROOMS BACK IN ORDER, INSPECTOR INFORMED HEAD ENGINEER WILLIAM THAT THE ROOMS HAD TO BE PLACED BACK OUT OF ORDER IMMEDIATELY UNTIL THE ISSUE COULD BE RESOLVED. HOTEL AND CONTRACTORS PLAN TO MEET TO DETERMINE WHY THE REPAIRS DID NOT WORK. ACTING HOTEL MANAGER DION HUBBARD WAS NOT AVAILABLE DURING TIME OF VISIT. INSPECTOR IS TO FOLLOW-UP ON TUESDAY, 8/26/2014, WITH HOTEL STAFF AND CORPORATE MANAGER(S).

8/27/2014 CASE NOTE 9/2/2014 8/27/2014

INSPECTOR BURNHAM ARRIVED ON-SITE ON TUESDAY, 8/26/2014, AT 2:15 PM. UPON ARRIVAL, INSPECTOR OPENED THE STORM INLET TO FIND DIRTY WATER, SHREDS/SMALL AMOUNTS OF DISSOLVED TOILET PAPER AND THE SMELL OF SEWAGE. NO SOLID FECAL MATTER WAS OBSERVABLE. INSPECTOR BURNHAM WAS SHOWN THAT THE 8 ROOMS ORIGINALLY IN QUESTION WERE PLACED OUT OF ORDER ONCE AGAIN. AT LEAST ONE ROOM STILL HAD A GUEST BUT THEY WERE IN THE PROCESS OF BEING MOVED. INSPECTOR BURNHAM MET WITH ACTING MANAGER, DION HUBBARD, AND REGIONAL DIRECTOR OF OPERATIONS FOR PILLAR HOTELS, DAVE GARB. INSPECTOR SHOWED THEM WHERE PLUMBING WORK HAD BEEN COMPLETED FOR THE STACK OF 8 ROOMS, IN ADDITION TO WHY INSPECTOR SUSPECTED PERHAPS THERE WAS STILL AN ISSUE. IN ADDITION, HE SHOWED THEM WHERE THE POOL BACKWASH WAS CURRENTLY BEING DIRECTED. THEY INFORMED INSPECTOR THAT THEY HOPE TO BEGIN WORK ON PERMANENTLY RE-ROUTING THE BACKWASH SYSTEM NEXT WEEK. HOTEL CUSTODIANS RAN THE SHOWERS/SINKS/TOILETS (WITH NO DEBRIS/FECES IN THEM) OF THE 8 SHUT DOWN ROOMS FOR AT LEAST 10 MINUTES. NO EXTRA FLOW WAS OBSERVED COMING OUT OF THE PIPE. AS SUCH, AND WITH CORRESPONDENCE FROM THE CONTRACTORS EXPLAINING THAT THEY TESTED THE LINES AND EVERYTHING SHOULD'VE BEEN REPAIRED, THE MANAGERS WERE GIVEN PERMISSION TO REOPEN THE 8 ROOMS AT THIS TIME. AFTER DISCUSSIONS WITH HOTEL AND CORPORATE MANAGER, THE QUESTION HAS BEEN BROUGHT UP AS TO WHETHER OR NOT THE RESIDENT OF A LICENSED RV (PARKED ON AERO DRIVE ON THE OTHER SIDE OF THE SIDEWALK FROM THE STORM-INLET) COULD BE DUMPING THEIR SEWAGE INTO THE INLET. INSPECTOR WILL LOOK INTO THIS FURTHER. HOTEL STAFF AND MANAGERS ARE COMPLYING WITH THE COUNTY AND BEING COOPERATIVE AT THIS TIME. INSPECTOR IS TO FOLLOW-UP ON WEDNESDAY, 8/27/2014, AT 12:00 PM.

Anne Arundel County
Compliance Cases

Main Menu > Print

Logout

Case ID:	E - 2014 - 284	Location:	1741 NURSERY RD
Tax ID:	541290224734		HOMELAND PARK-WHITE FARM LINTHICUM 21090
Received:	6/9/2014	Details:	
Tickler:	8/13/2014	Completed:	
	ILLEGAL DISCHARGES COMPLAINT		

Receiver:		Inspector:		Backup Inspector:	
Date Assigned:	6/9/2014	Permit Number:		Original ID:	
ADC Map:		Related Cases:			
Water Front:	N	Critical Area:	N	Violation:	
Cty. Council Ind:	N	Case Org:			
Complainant:					

Owner Information	Violator Information
Owner 1:	Violator 1:
Owner 2:	Violator 2:
Address:	Address:
	Phone:

State Map:	04		13	0111	County Map:			
	Map No:	Suffix	Block	Parcel	Plat	Sect	Block	Lot No

Date	Event	Due Date	Request for Trial Date
6/9/2014	OPENED COMPLAINT CASE	6/14/2014	

WHILE INSPECTING OUTFALLS IN THE VICINITY OF 1741 W. NURSERY RD., FIELD STAFF DISCOVERED A NEW OUTFALL (FIGURE 1) AT APPROXIMATELY 12:30 P.M. THE PH OF THE DISCHARGING WATER WAS 10.20.A WHITISH FILM COULD BE SEEN ON THE SURFACE OF THE WATER BACKING UP INTO THE OUTFALL. NOTHING ELSE UNUSUAL WAS NOTED. THE FOLLOWING AFTERNOON, THE FIELD CREW RETURNED AT APPROXIMATELY 2:30 P.M. THE PH OF THE FLOWING WATER AT THE OUTFALL WAS 10.60 AND THE WHITISH FILM ON THE WATER SURFACE AT THE OUTFALL WAS AGAIN NOTED (FIGURE 2). FIELD STAFF THEN INITIATED TRACKDOWN PROCEDURES TO DETERMINE THE SOURCE OF THE FLOW. THE HOTEL (ALOFT HOTELS) AT 1741 W. NURSERY RD. IS NEWLY BUILT AND THEREFORE THE BUILDING AND STORMWATER INFRASTRUCTURE IS NOT ON THE MAPS OR IN GIS COVERAGE. THE TEAM INVESTIGATED THE STORMWATER INFRASTRUCTURE USING LINE-OF-SIGHT TO DETERMINE CONNECTIONS. THE FIELD CREW OPENED THE 1ST MANHOLE UPSTREAM OF THE OUTFALL AND FOUND IT TO BE A JUNCTION OF TWO PIPES THAT WERE BOTH PARTIALLY SUBMERGED (FIGURE 3). THE PIPE COMING IN FROM THE LEFT SIDE (WHENFACING UP-NETWORK) WAS FLOWING SLIGHTLY AND THE FIELD CREW OBTAINED A PH OF 10.90. THIS PIPE ALSO SHOWED SIGNS OF A MINERAL DEPOSIT AT ITS END. THE FIELD CREW PROCEEDED TO THE FIRST INLET UP THE NETWORK FROM THE FIRST MANHOLE. WITHIN THE FIRST CURB INLET, THE FIELD TEAM FOUND MINIMAL WATER IN IT, WHICH WAS INSUFFICIENT TO TEST. THE FIELD CREW ALSO NOTED WHITISH RESIDUE AND DEPOSITION IN THE PIPE (FIGURE 4). UP-NETWORK OF THE FIRST CURB INLET WAS A SECOND CURB INLET LOCATED ON THE OTHER SIDE OF THE HOTEL ENTRANCE. THE SECOND CURB INLET WAS DRY BUT SEEPING STAINS COULD BE SEEN RUNNING DOWN THE INSIDE WALL FROM A GAP IN THE CONCRETE AND INTO THE PIPE (FIGURE 5).

8/6/2014 CASE NOTE 8/13/2014 8/6/2014

AFTER FIELD INSPECTIONS, THE WHITISH FILM SEEN IN THE WATER BACKING UP INTO THE OUTFALL SEEMS TO BE COMING FROM GROUND WATER. THIS SITE HAS A HISTORY OF HIGH GROUND WATER. MINERAL DEPOSITS HAVE BEEN SEEN ON THE PARKING LOT WHERE THE GROUND WATER HAS PERCULATED THROUGH THE AREAS OF LEAST RESISTANCE. THE HIGH PH OF THE WATER BACKING UP INTO THE OUTFALL CAN BE ATTRIBUTED TO THE GROUND WATER THAT HAS MADE ITS WAY ONTO THE PARKING LOT AND INTO STORM BASINS. THE HIGH WATER TABLE IS NATURALLY OCCURING AT THIS SITE AND THE MINERAL DEPOSITS (CAUSING HIGH PH) ARE A RESULT OF THE GROUND WATER. THIS COMPLAINT CAN BE CLOSED AS A STORMWATER MANAGEMENT ISSUE BECAUSE THERE ARE NO ENFORCEMENT ACTIONS TO BE TAKEN. A FOLLOW-UP PH TEST WILL BE CONDUCTED ONCE TEST EQUIPMENT IS AVAILABLE TO ENSURE THAT THERE IS NATURALLY OCCURING HIGH PH IN THE GROUND WATER.

Anne Arundel County
Compliance Cases

Main Menu > Print Logout

Case ID:	E - 2014 - 326	**Location:**	604 BURLEY RD
Tax ID:	309390033507		BEECHWOOD ON THE BURLEY ANNAPOLIS 21409
Received:	6/24/2014	**Details:**	
Tickler:		**Completed:**	8/19/2014
	ILLEGAL DISCHARGES COMPLAINT		

Receiver:		**Inspector:**		**Backup Inspector:**	
Date Assigned:	6/24/2014	**Permit Number:**		**Original ID:**	
ADC Map:		**Related Cases:**			
Water Front:	N	**Critical Area:**	N	**Violation:**	
Cty. Council Ind:	N	**Case Org:**			
Complainant:					

Owner Information	**Violator Information**
Owner 1:	**Violator 1:**
Owner 2:	**Violator 2:**
Address:	**Address:**
	Phone:

State Map:	46		11	0198	**County Map:**	2			133
	Map No:	Suffix	Block	Parcel		Plat	Sect	Block	Lot No

Date	Event	Due Date	Request for Trial Date
6/24/2014	OPENED COMPLAINT CASE	6/29/2014	
	PROPERTY OWNER WAS DIGGING A TRENCH FROM THE HOUSE TO THE STORM DRAIN - POSSIBLE ILLICIT DISCHARGE.		
6/25/2014	CASE NOTE	7/3/2014	6/25/2014
	A FRESHLY DUG TRENCH STARTS AT THE HOUSE AT WHAT APPEARS TO BE THE SUMP PIPE. THE TRENCH TRAVELS ALONG THE CHAIN LINK YARD FENCE TO THE WOOD PROPERTY FENCE AND TURNS 90 DEGREES AND RUNS ALONG THE PROPERTY FENCE TO THE PUBLIC STORM DRAIN GRATE ON BURLEY RD. THERE IS PVC PIPE INSERTED INTO THE TRENCH BEGINNING AT THE HOUSE AND ENDING APPROXIMATELY 20' FROM THE END OF THE TRENCH. THERE IS A HOLE CORE-DRILLED INTO THE STORM DRAIN BELOW GRADE WITH NO PIPE INSERTED YET.THE OWNER/ RESIDENT SPOKE TO ME, EXPLAINING THAT THE TRENCH WAS TO DIVERT WATER FROM THE HOUSE DOWNSPOUT TO THE STORM DRAIN TO PREVENT POOLING IN THE YARD. UPON FURTHER INSPECTION, I OBSERVED A DOWNSPOUT ON THE OPPOSITE SIDE OF THE HOUSE WITH A FLEXIBLE DRAINAGE PIPE RUNNING ALONG THE CHAIN LINK FENCE ON THE SAME SIDE OF THE YARD. THIS PIPE WAS DRAINING INTO THE YARD AND INTO ANOTHER TRENCH.IT IS ILLEGAL TO DRILL INTO AN ANNE ARUNDEL COUNTY STORM DRAIN AND THE OWNER/ RESIDENT MUST STOP WORK. THE OWNER/ RESIDENT IS RESPONSIBLE FOR REPAIRING THE HOLE IN THE STORM DRAIN.		
8/19/2014	CLOSE COMPLAINT		
	DPW REMOVED PIPE AND PATCHED BASIN ON 7/10/14 AS PER GLENN GOINS, RIGHT OF WAY MANAGEMENT, DPW, AACO.		

Anne Arundel County
Compliance Cases

Main Menu > Print

Logout

Case ID:	E - 2014 - 328	**Location:**	7170 STANDARD DR
Tax ID:	562012348040		PARKWAY INDUSTRIAL CNTR HANOVER 21076
Received:	6/25/2014	**Details:**	
Tickler:	8/24/2014	**Completed:**	
	STORMWATER MANAGEMENT ISSUES		

Receiver:		**Inspector:**		**Backup Inspector:**	
Date Assigned:	6/25/2014	**Permit Number:**		**Original ID:**	
ADC Map:		**Related Cases:**			
Water Front:	N	**Critical Area:**	N	**Violation:**	
Cty. Council Ind:	N	**Case Org:**			
Complainant:					

Owner Information	**Violator Information**
Owner 1:	**Violator 1:**
Owner 2:	**Violator 2:**
Address:	**Address:**
	Phone:

State Map:	08		02	0538	**County Map:**				16A
	Map No:	Suffix	Block	Parcel		Plat	Sect	Block	Lot No

Date	Event	Due Date	Request for Trial Date
6/25/2014	OPENED COMPLAINT CASE	7/3/2014	

AT THE NORTH END OF THE PARKING LOT BEHIND BUILDING #7170, STORMWATER SHEET FLOW HAS CAUSED THE GROUND AROUND THE EXISTING STORM DRAIN, 1-D, TO ERODE COMPLETELY AWAY, RESULTING IN A SINKHOLE. THE SURROUNDING PAVEMENT HAS COLLAPSED INTO THE SINKHOLE AND IS CAUSING A DANGEROUS CONDITION. UPON FURTHER INVESTIGATION, DOWNHILL EROSION WAS EVIDENT, STEMMING FROM THE SINKHOLE AT THE STORM GRATE.THE OWNER(S) SHOULD INVOLVE A LICENSED ENGINEER TO DESIGN THE APPROPRIATE REPAIRS. THE OWNER(S) WILL BE RESPONSIBLE FOR REPAIRING THE SINKHOLE AND REINFORCING THE SURROUNDING AREA AND REPAIRING THE PARKING LOT, AS WELL AS REPAIRING THE SOIL EROSION AND REMOVING THE SEDIMENT DEPOSITS.

Anne Arundel County
Compliance Cases

Main Menu > Print Logout

Case ID:	E - 2014 - 330	**Location:**	545 BAY HILLS DR
Tax ID:	300090005029		DEEP CREEK ARNOLD 21012
Received:	6/26/2014	**Details:**	JUNK DEBRIS AND WOOD WASTE STORAGE
Tickler:		**Completed:**	7/7/2014
	ILLEGAL DISCHARGES COMPLAINT		
	STOCK PILE (GENERAL)		JUNK DEBRIS AND WOOD WASTE STORAGE

Receiver:		**Inspector:**		**Backup Inspector:**	NONE
Date Assigned:	6/26/2014	**Permit Number:**	B02292469	**Original ID:**	
ADC Map:		**Related Cases:**			
Water Front:	N	**Critical Area:**	N	**Violation:**	
Cty. Council Ind:	N	**Case Org:**			
Complainant:					

Owner Information	**Violator Information**
Owner 1:	**Violator 1:**
Owner 2:	**Violator 2:**
Address:	**Address:**
	Phone:

State Map:	40		02	0351	**County Map:**				
	Map No:	Suffix	Block	Parcel		Plat	Sect	Block	Lot No

Date	Event	Due Date	Request for Trial Date
6/26/2014	OPENED COMPLAINT CASE	7/1/2014	
	REFERRAL FROM WPRP INSPECTOR		
7/7/2014	CASE NOTE	7/7/2014	7/7/2014
	INSPECTION SHOWS JUNK, DEBRIS AND WOOD WASTE BEING STORED ON THE PROPERTY IN CLOSE PROXIMITY TO A STREAM BED. REFERRED TO ZONING ENFORCEMENT. OK TO CLOSE		
7/7/2014	CLOSE COMPLAINT		

Anne Arundel County
Compliance Cases

Main Menu > Print Logout

Case ID:	E - 2014 - 397	**Location:**	706 CRAIN HWY
Tax ID:	532600624831		GLEN BURNIE GLEN BURNIE 21061
Received:	8/7/2014	**Details:**	
Tickler:		**Completed:**	8/19/2014
	ILLEGAL DISCHARGES COMPLAINT		

Receiver:		**Inspector:**		**Backup Inspector:**	
Date Assigned:	8/7/2014	**Permit Number:**		**Original ID:**	
ADC Map:		**Related Cases:**			
Water Front:	N	**Critical Area:**	N	**Violation:**	
Cty. Council Ind:	N	**Case Org:**			
Complainant:					

Owner Information	**Violator Information**
Owner 1:	**Violator 1:**
Owner 2:	**Violator 2:**
Address:	**Address:**
	Phone:

State Map:	09		12	0081	**County Map:**				
	Map No:	Suffix	Block	Parcel		Plat	Sect	Block	Lot No

Date	Event	Due Date	Request for Trial Date
8/7/2014	OPENED COMPLAINT CASE	8/12/2014	

WHILE CONDUCTING OUTFALL SCREENING IN THE TARGET AREA, A LIMNOTECH FIELD TEAM DISCOVERED A WORK AREA IN THE PARKING LOT BEHIND THE CUSTOM KITCHEN COUNTERTOP BUSINESS. THE APPARATUS AND MATERIALS INDICATED A COUNTERTOP-CUTTING FACILITY (TILE, STONE, ETC.; FIGURE 1). THE FIELD TEAM DOCUMENTED THE CONDITION WITH A PHOTOGRAPH. DUST, CUTTINGS, AND MATERIALS LEFT ON THE IMPERVIOUS SURFACE OF THE PARKING LOT, WITHOUT BENEFIT OF CANOPY COVER, HAVE THE POTENTIAL FOR WASHOFF INTO THE STORM DRAIN SYSTEM AND SUBSEQUENTLY POLLUTING SURFACE WATERS DOWNSTREAM.

8/7/2014	CASE NOTE	8/14/2014	8/7/2014

INSPECTOR BRAD BURNHAM ARRIVED ON SITE ON MONDAY, 8/4/2014, AT 3:00 PM. UPON ARRIVAL, NO DUST WAS NOTICEABLE ON THE PAVEMENT, AND THE CUTTING TABLE REPORTED BY LIMNOTECH HAD BEEN MOVED INSIDE OF THE WORKSHOP. THERE WERE MATERIALS OUTSIDE OF THE BUILDING, BUT NO EVIDENCE OF CUTTING OCCURRING OUTSIDE. INSPECTOR SPOKE WITH THE COMPANY OWNER, KATIE HINES, WHO INFORMED HIM THAT THE OTHER DAY WHEN PICTURES WERE TAKEN, THE CUTTING TABLE HAD JUST BEEN DELIVERED. IN ADDITION, SHE INFORMED HIM THAT WORKERS WERE NOT ALLOWED TO CUT MATERIALS OUTSIDE AS IT WOULD VIOLATE THEIR LEASE AGREEMENT, AS WELL AS OSHA STANDARDS. BECAUSE THIS IS A COUNTERTOP MATERIAL CUTTING FACILITY, THE COMPANY USES WATER TO COLLECT CUTTING DUST, WHICH IS THEN PUMPED FROM THE WORKSHOP FLOOR INTO A FILTERING/SETTLING DEVICE THAT EVENTUALLY DISCHARGES "CLEAN" WATER INTO THE STORM DRAINAGE. INSPECTOR PLANS TO REVISIT SITE WHEN ACTING FOREMAN IS AVAILABLE IN ORDER TO SEE THE DEVICE AND CHECK THE CONDITION. IN ADDITION, INSPECTOR PLANS TO CONTACT LIMNOTECH

FIELD CREW IN ORDER TO DISCERN: IF THIS WORK AREA WAS CITED IN RELATION TO AN OUTFALL SCREENING; OR IF THE CREW HAPPENED TO NOTICE THIS WORK AREA WHILE PERFORMING THEIR USUAL WORK. ONCE INSPECTOR HAS ALL NECESSARY DETAILS, A DECISION TO EITHER CLOSE COMPLAINT, OR TAKE ANY NECESSARY ENFORCEMENT ACTIONS, WILL BE MADE.

8/19/2014 CLOSE COMPLAINT

INSPECTOR BRAD BURNHAM ARRIVED ON SITE ON FRIDAY, 8/8/2014, AT 2:00 PM. UPON ARRIVAL, THERE WAS NO NOTICEABLE DUST OUTSIDE, NOR ANY EVIDENCE OF ANY MATERIAL CUTTING TAKING PLACE OUTSIDE. INSPECTOR SPOKE WITH COMPANY OWNER, WHO SHOWED HIM THE SYSTEM THAT THEY HAVE IN PLACE FOR FILTERING WATER USED TO CLEAN DUST FROM WORKSHOP FLOOR. DEVICE/SETUP BEING USED DISCHARGES "FILTERED" WATER INTO A SHOWER DRAIN, WHICH IS CONNECTED TO SANITARY SEWER LINES. AFTER SPEAKING WITH HEAD OF VERSAR/LIMNOTECH FIELD CREWS, IT WAS DISCOVERED THAT THE COUNTERTOP FACILITY WAS DISCOVERED UNRELATED TO ANY OUTFALL SCREENINGS. IT HAS BEEN CONCLUDED THAT THERE IS NO VIOLATION FOR ILLICIT/ILLEGAL DISCHARGE. COMPLAINT WILL BE CLOSED.

Anne Arundel County
Compliance Cases

Main Menu > Print Logout

Case ID:	E - 2014 - 468	**Location:**	1591 NURSERY RD
Tax ID:	501790050066		AIRPORT SQUARE TECH PK LINTHICUM 21090
Received:	8/25/2014	**Details:**	ROTTING ORGANIC DEBRIS IN CATCH BASIN
Tickler:	9/2/2014	**Completed:**	
	STORMWATER MANAGEMENT ISSUES		

Receiver:		**Inspector:**		**Backup Inspector:**	
Date Assigned:	8/25/2014	**Permit Number:**		**Original ID:**	
ADC Map:		**Related Cases:**			
Water Front:	N	**Critical Area:**	N	**Violation:**	
Cty. Council Ind:	N	**Case Org:**			
Complainant:					

Owner Information	**Violator Information**
Owner 1:	**Violator 1:**
Owner 2:	**Violator 2:**
Address:	**Address:**
	Phone:

State Map:	04		07	1040	**County Map:**					16RC
	Map No:	Suffix	Block	Parcel		Plat	Sect	Block	Lot No	

Date	Event	Due Date	Request for Trial Date
8/25/2014	OPENED COMPLAINT CASE	9/2/2014	

VERSAR FIELD CREW DISCOVERED A PARKING LOT STORM-INLET FULL OF TRASH AND ROTTING DEBRIS, WHICH WAS REFERRED FROM DPW TO I&P. ENVIRONMENTAL CONTROL INSPECTOR BRAD BURNHAM ARRIVED ON-SITE ON 8/22/2014. UPON ARRIVAL, INSPECTOR OBSERVED A LARGE AMOUNT OF TRASH AND DEBRIS INSIDE OF THE INLET. INSPECTOR IS TO FIND A SWMA FOR THE PROPERTY. IF ONE EXISTS, INSPECTOR WILL COMPEL PROPERTY OWNER(S)/MANAGER(S) TO HAVE THE INLET CLEANED OUT.

Anne Arundel County
Compliance Cases

Main Menu > Print

Logout

Case ID:	E - 2014 - 469	**Location:**	705 ORDNANCE RD
Tax ID:	515690087662		CURTIS COMMERCE CENTER BALTIMORE 21226
Received:	8/25/2014	**Details:**	
Tickler:	9/29/2014	**Completed:**	
	STORMWATER MANAGEMENT ISSUES		OUTFALL BLOCKED BY SEDIMENT

Receiver:		**Inspector:**		**Backup Inspector:**	
Date Assigned:	8/25/2014	**Permit Number:**		**Original ID:**	
ADC Map:		**Related Cases:**			
Water Front:	N	**Critical Area:**	N	**Violation:**	
Cty. Council Ind:	N	**Case Org:**			
Complainant:					

Owner Information	**Violator Information**
Owner 1:	**Violator 1:**
Owner 2:	**Violator 2:**
Address:	**Address:**
	Phone:

State Map:	05		09	0286	**County Map:**				6
	Map No:	Suffix	Block	Parcel		Plat	Sect	Block	Lot No

Date	Event	Due Date	Request for Trial Date
8/25/2014	OPENED COMPLAINT CASE	9/2/2014	

WHILE CONDUCTING OUTFALL SCREENING IN THE TARGET AREA, A LIMNOTECH AND VERSAR FIELD TEAM DISCOVERED AN OUTFALL (N04H2O015) ALMOST COMPLETELY BLOCKED BY HARD SEDIMENT.THE OUTFALL DRAINS A PARKING LOT TO A STORMWATER POND BEHIND THE BUILDING. A THIN, TOP LAYER OF ALGAE DOWNSTREAM OF THE PIPE OPENING SUGGESTS THAT WATER MAY CONTINUE TO TRICKLE THROUGH THE PIPE; THE FIELD CREW REPORTED THAT THE OUTLET WAS NOT DRAINING ON THE DAY OF THE FIELD VISIT. SLUGGISH DRAINAGE OF THE PARKING LOT IN THIS CORNER MAY POSE A HAZARD FOR MOTORISTS AND PEDESTRIANS WITH ACCUMULATING DEBRIS, LEAVES, STANDING WATER, AND ICE.

8/29/2014	CASE NOTE	9/29/2014	8/29/2014

THE SWM INSPECTION REVEALED THAT THE SWM POND IS NOT IN COMPLIANCE. PLEASE COMPLETE THE FOLLOWING CORRECTION ITEMS BY 9/28/2014: 1. REPAIR SINKHOLE FORMING BY THE INFLOW PIPE IN NORTHWESTERN CORNER OF POND. 2. REMOVE SEDIMENT FROM RIP-RAP APRON AT THE INFLOW LOCATED IN THE SOUTHEASTERN CORNER OF THE POND. 3. REMOVE SEDIMENT AND VEGETATION FROM RIP-RAP IN SOUTHWESTERN CORNER OF THE POND. 4. UNBLOCK/UNCOVER INFLOW LOCATED IN THE SOUTHWESTERN CORNER OF THE POND. 5. CUT GRASS TO A HEIGHT NO TALLER THAN 6 INCHES AND MOW AT LEAST TWICE A YEAR. 6. GATE MUST BE LOCKED WITH THE COUNTY REQUIRED LOCK. AMERICAN LOCK / AMA 51KA KEYED TO 53525 PRIVATE IS THE REQUIRED LOCK FOR ALL PRIVATELY OWNED STORMWATER MANAGEMENT BASINS. REINSPECTION IS CURRENTLY SCHEDULED FOR 9/29/2014.

Anne Arundel County, MD
Illicit Discharge Screening 2013 - 2014

1099 Winterson Road

Damaged infrastructure
Behind Hoyt's Cinema 14

Damaged infrastructure
832 Oregon Avenue

Damaged infrastructure
Embassy Suites

Blocked infrastructure
Between Motel 6 and McDonald's
(Raynor Road)

Embassy Suites

Blocked infrastructure
705 East Ordnance Road

Aloft Hotel
1741 W. Nursery Road

Collapsed curb
7201 Standard Drive

Collapsed infrastructure
510 McCormick Drive

RT 170
I 695
I 695
I 695
RT 10
RT 163
RT 162
RT 170
RT 295
RT 100
RT 2
RT 177
RT 177
RT 295
RT 32
RT 198
RT 32
RT 295
RT 175
RT 3
I 97
RT 32
RT 178
RT 178
RT 178
US 50
RT 450
RT 450

Anne Arundel County, MD
Illicit Discharge Screening 2013-2014

- Outfalls screened 2013
- Outfalls screened 2014
- Structural problems 2014
- Illicit discharge 2014
- Major Roads
- Streams
- Annapolis Boundary
- County Boundary
- Watersheds

W E

Miles
0 1 2

VERSAR

Anne Arundel County, MD
Illicit Discharge Screening 2014

Target

Bowling Alley

Hampton Inn

550 Crain Hwy

220 8th Avenue

PetSmart

Hoyt's Cinema 14

Hilton - BWI

Belair Produce

Chuck E. Cheese's

Ledo Pizza

Walmart

Custom
Kitchen Countertop

B&A Snowball

Gavigans Furniture

CVS

H&R Block

Family Dollar #6625

Mission BBQ

Home Goods

BWI Plaza
Domino's Pizza

530 McCormick

Morningside
House of Friendship

Cantina
Mamma Lucia

RT 170
I 895
RT 2
I 695
I 97
RT 261
RT 162
RT 10
RT 648
RT 295
RT 175
RT 177

Anne Arundel County, MD
Illicit Discharge Screening 2014

- Potential Upland Pollution Source
- Major Roads
- Streams
- County Boundary
- Watersheds

0 0.5 1 Miles

VERSAR

ANNE ARUNDEL COUNTY
Department of Public Works
Waste Management Services

Inter-Office Correspondence

DATE: December 13, 2013
For Inspections conducted on December 9, 2013

TO: File 434

FROM: Chandra Chithaluru

SUBJECT: Northern Recycling Center formerly known as Glen Burnie Convenience Center and Closed Landfill
Comprehensive Annual SWP3 Compliance Evaluation for Year 2013

Introduction

The following personnel conducted the Storm Water Pollution Prevention Plan (SWP3) compliance inspection for the Northern Recycling Center formerly known as Glen Burnie Convenience Center on December 9, 2013: Chandra Chithaluru, Timothy Cluney, Russell Gartside, Michael Gravatt.

The following personnel conducted the Storm Water Pollution Prevention Plan (SWP3) compliance inspection for the Glen Burnie closed landfill on November 7& 8, 2012: Chandra Chithaluru, Joel Saline and Michael Gravatt.

The last SWP3 inspection by the Pollution Prevention Team at this site was conducted in November 7 & 8, 2012.

The purpose of these evaluations was to determine the compliance status of the site with regards to the SWP3 and the General Storm Water Discharge Permit Number 02-SW.

The format for this evaluation is on the attached outline.

Northern Recycling Center & Closed Landfill
SWP3 Evaluation Report for Year 2013

December 13, 2013

Summary

The evaluations revealed that the best management practices (BMPs) implemented as specified in the SWP3 continue to minimize the risk of pollutant releases. All of the BMPs specified in the SWP3 have been implemented.

The facility inspection revealed no evidence of pollutants in drainage and outfall areas. No significant and reportable spills or leaks have occurred during this evaluation period. It was the consensus of the Evaluation Team that the existing BMPs will effectively continue to eliminate storm water pollution at the facility. No BMP changes or modifications are planned or anticipated as the result of this evaluation. SPCC supplies were available in inventory and proper housekeeping was evident. Minor maintenance issues were identified.

Evaluation Findings

1) Convenience Center: ***The inspection logs for each pollutant source were available. They are up to date, kept in a three ring binders and are dated and signed.***

2) Convenience Center: ***Spill kits and spill control material is well stocked.***

3) Convenience Center: ***The evaluation team discussed the precious years' installation of two bollards to protect the above ground waste oil tank by the maintenance shop, restoring the drive way by bulk area and replacing the pipe that conveys storm water.***

4) Landfill: ***Two leachate collection sumps (sump #10 and sump #14) are monitored weekly. Leachate is pumped out using a tanker truck and discharged to the County sewer system on an as-needed basis. The leachate discharge information is recorded and submitted to AA County Utilities Department each month pursuant to the Discharge Permit to County Sewer System.***

5) Landfill: ***The Evaluation Team discussed and recommended repairs to the road system on the closed landfill on both north and south mounds. Work is to be completed in 2014.***

6) Landfill: ***The Evaluation Team discussed and recommended continuing removal of woody vegetation from the storm water ditches every year during the growing season to prevent clogging of the ditches. This is an ongoing maintenance task that usually takes place in Spring/Summer of each year.***

December 13, 2013

cc: Rhody Holthaus
Steve Krajcsik
Joel Saline
Molly Cannon
Tim Cluney
Russel Gartside
Mike Gravatt
GBL SWP3 File OR-O-434

December 13, 2013

Glen Burnie Convenience Center and Landfill
Outline of Evaluation on December 9, 2013.

Verify descriptions of potential pollutant sources as listed below and update as necessary:

A. VERIFY DESCRIPTION OF POTENTIAL POLLUTION SOURCES

1) Maintenance Yard and Surrounding Area
   Inspection: daily, semi-annually
   OK

2) Waste Oil, Antifreeze and Used Battery Collection Facility
   Inspection: daily, semi-annually
   OK

3) Convenience Center Yard Area and Recycling Area
   Inspection: daily, semi-annually
   OK

4) Convenience Center Lower Area
   Inspection: daily, semi-annually
   OK

5) Maintenance Building
   Inspection: daily, semi-annually
   OK

6) Record keeping
   OK

B) Identify changes to drainage maps/systems, if any.

Note: Any and all changes will be included in the SWP3 which is being updated. The updated SWP3 is being updated and is expected to be completed by Spring 2014 and will be included in the new NOI per MDE's issuance of 12-SW general permit.

C) Review team roster and change, if necessary.
   NONE

D) Update list of significant leaks or spills, if any.
   NONE

E) Inspect SPCC materials and equipment; update report with changes, if any.

No updates required

F) Identify any modifications to SWP3, compliance violations or deficiencies, and changes to BMPs, if any.

Note: ***The SWP3 is being updated and is expected to be completed by Spring 2014 to be included in the new NOI per MDE's issuance of 12-SW general permit.***

G) Plan training and update schedule for SWP3.

Annual employee training is scheduled for Fall 2014 after the 12-SW NOI and based on the new SWPPP.

Pollution Prevention Team Members

Leader:

Chandra Chithaluru

Title:	Environmental Monitoring Manager, Waste Management Services Department of Public Works
Office Phone:	(410) 222-6108
Responsibilities:	Visual inspections, evaluations, preparation of compliance reports, assistance with employee training, preparation of SWP3 updates, implementation, oversight and directives for SWP3 compliance assurance.

Members:

Molly Cannon

Title:	Community Services Manager
Office Phone:	(410) 222-6108
Responsibilities:	Visual inspections, evaluations and provision of resources for specific tasks as necessary for compliance with the SWP3 for the Convenience Center areas.

Timothy Cluney

Title:	Community Collections Supervisor
Office Phone:	(410) 222-6108 x3108
Responsibilities:	Supervisor for Convenience Center operation, community service operation and bulk item pick up; conduct employee training; direction of personnel to the ensure Convenience Center is operated and maintained in compliance with the SWP3.

Stephen Krajcsik

Title:	Disposal and Maintenance Manager
Office Phone:	(410) 222-6108
Responsibilities:	Visual inspections, evaluations and provision of resources for specific tasks as necessary for compliance with the SWP3 for the closed landfill.

December 13, 2013

Russell Gartside

Title:	Glen Burnie Convenience Center Crew Supervisor
Office Phone:	(410) 760-8237
Responsibilities:	Visual inspections and recordkeeping, assist in employee training, responsible for ensuring that maintenance requirements for the Convenience Center are completed and in compliance with the SWP3.

Mike Gravatt

Title:	Environmental Technician
Office Phone:	(410) 222-6177 ext. 3015
Responsibilities:	Visual inspections, evaluations, recordation, preventative and operational maintenance, and general housekeeping for SWP3 compliance at the closed landfill. Responsibilities include the operation of the sumps.

Joel Saline

Title:	Landfill Manager
Office Phone:	(410) 222-6108 ext. 3113
Responsibilities:	Visual inspections, evaluations and provision of resources and implementation assistance for specific maintenance requirements in compliance with the SWP3 closed landfill.

December 13, 2013

EMPLOYEE TRAINING FOR 2013/2014

GLEN BURNIE CONVENIENCE CENTER

TYPE	TOPIC	TRAINING DATE for 2012	PROPOSED TRAINING DATE(S) FOR 2013/2014
Hazardous Waste Operations (Response)	* Review handling of hazardous materials, reporting and response spill prevention and response procedures.	March 2012	FALL 2014
Good Housekeeping and Spill Prevention	* Review the use of absorbent materials. * Review good housekeeping practices.	March 2012	FALL 2014
Preventive Maintenance for Sediment and Erosion Control (stabilized areas)	* Discuss and review preventive maintenance, measures, case reviews and practices and procedures.	March 2012	FALL 2014
Runoff Control	* Discuss maintenance of existing controls and review pollution prevention measures.	March 2012	FALL 2014
Other Topics	* Review and discuss components and goals of SWPP plan. * Review and discuss record keeping and reporting, tracking and follow-up program.	March 2012	FALL 2014

ATTENDEES: Pollution Prevention Team Members, Operators and/or Maintenance Workers (as appropriate)

Storm Water Pollution Prevention Plan (SWP3) Training Topics Detail

I. Provided an overview and discussion pursuant to the components and goals of the SWP3 required to be developed and implemented for the MDE General Storm Water Discharge Permit.
   A. Identify and describe potential pollutant sources which may be reasonably expected to add significant amounts of pollutants to storm water discharges.
   B. Describe and implement storm water management control devices known as Best Management Practices (BMP's) at the facility. The control devices (BMP's) shall address the following minimum components:
      1. A preventive maintenance program that involves timely inspection and maintenance of storm water management devices (BMP's).
      2. Good housekeeping program that requires the maintenance of a clean and orderly facility.
      3. Spill prevention and response program identifying the necessary procedures and equipment available to clean up spills. This program also includes the requirement for the Spill Prevention Control and Counter Measure (SPCC) Plan required under Section 311 of the Clean Water Act.
      4. Sediment and erosion control program to prevent the discharge of sediment and minimization of erosion of soil.
      5. Storm water management practices used to divert, infiltrate, reuse or otherwise manage storm water runoff in a manner that reduces pollutants in storm water discharges. Practices shall be reasonable, appropriate and maintained.
      6. Visual inspection program to ensure the controls to reduce pollutant sources identified in the SWP3 plan are being implemented and are adequate and maintained. Also, to determine if the description of pollutant sources is accurate or has to be updated. A comprehensive annual inspection shall be performed by the SWP3 pollution prevention team.
      7. Facility Recordation Program that maintains records for a minimum of three (3) years at the facility that provides information on spills and other pollutant discharge incidents, and information describing the quality and quantity of storm water discharges. Also, visual inspection, preventive maintenance and good housekeeping activities shall be documented and recorded.
      8. Requirements for facilities subject to SARA Title III, Section 313 by implementing devices (BMP's) used to control, contain, divert or prevent storm water from coming in contact with Section 313 water priority chemicals. Devices used include trays, drip pans, curbing, containment dikes, swales, sewers, gutters, roofs, covers, liners, etc.
      9. Employee Training Program that informs personnel of the components and goals of the SWP's.

Northern Recycling Center & Closed Landfill
SWP3 Evaluation Report for Year 2013

December 13, 2013

Recycle. More Often.

*Telephone 410-222-6108 * Mail Stop 4190 * FAX 410-222-6105*
Website: www.aacounty.org/DPW/WasteManagement
Recycled Paper

ANNE ARUNDEL COUNTY
Department of Public Works
Waste Management Services

Inter-Office Correspondence

Date: December 5, 2013
For Inspection conducted on December 4, 2013

To: File #634

From: Chandra Chithaluru

Subject: Southern Recycling Center formerly known as Sudley Convenience Center and Closed Landfill
Comprehensive Annual SWP3 Compliance Evaluation for year 2013

Introduction:

The following personnel conducted the Storm Water Pollution Prevention Plan (SWP3) compliance inspection on December 4, 2013:

Southern Recycling Center formerly known as Sudley Convenience Center: Tim Cluney, Arthur Lewis, Steve Krajcsik, Micheal Zirnhelt, and Chandra Chithaluru

Sudley Closed Landfill: Chandra Chithaluru; Michael Zirnhelt and Steve Krajcsik.

The purpose of these evaluations was to determine the compliance status of the site with regards to the SWP3 and the General Storm Water Discharge Permit Number 02-SW. The format for this evaluation is on the attached outline. The last annual SWP3 inspection was conducted on November 9, 2012.

Summary

The evaluation revealed that the best management practices (BMPs) implemented as specified in the SWP3 continues to minimize the risk of pollutant releases. All of the BMPs specified in the SWP3 have been implemented.

The facility inspection revealed no evidence of pollutants in drainage and outfall areas. No reportable spills or leaks have been identified during this evaluation period.

It was the consensus of the Evaluation Team that the existing BMPs have and will effectively continue to eliminate storm water pollution at the facility. No BMP changes or modifications are planned or anticipated as a result of this evaluation.

Evaluation Findings

1. ***Recycling Center: The inspection logs for each pollutant source were reviewed and found up-to-date. The logs were signed, dated, and kept in 3-ring binders.***

2. ***Recycling Center: The Evaluation Team found that the convenience center is adequately equipped with spill kits; have labeled the odor control liquid barrel located near the public convenience center and have adequate plastic pallets.***

3. ***Recycling Center: The Evaluation Team discussed the drainage pattern change that needs to be incorporated in to the SWP3 once the construction upgrades to the Convenience Center are complete in 2014.***

4. ***Landfill: The Evaluation Team discussed upgrades necessary to the perimeter storm water ditch between the closed landfill and the convenience center. However, did not see a need for immediate grading or repairs.***

5. ***The employee SWP3 training is scheduled for Fall 2014 after the 12-Sw NOI and the associated SWPPP update.***

Southern Recycling Center & Sudley Closed Landfill
Outline of Evaluation

A. Verify descriptions of potential pollutant sources as listed below and update as necessary:

1) Landfill Area
Inspection: monthly and after significant rainfall events.

All documentation is current.

2) Borrow Area
Inspection: monthly and after significant rainfall events

OK

3) Public Convenience Center Area
Inspection: daily

OK

4) Maintenance Building
Inspection: daily

OK

5) Maintenance Yard Area
Inspection: daily

OK

6) Waste Oil Storage Area
Inspection: daily

OK

7) Yard waste Compost Pad

Inspection: daily

OK

B. Identify changes to drainage maps/systems, if any.

- ***Southern Recycling Center construction upgrade project work is on going and is expected to be completed in 2014. Once the upgrade work is complete the drainage maps/system as built drawings will be incorporated in to the SWP3 in 2014 accordingly.***

C. Review team roster and change, if necessary.

None

D. Update list of significant leaks or spills, if any.

No reportable leaks or spills for the reporting period.

E. Inspect SPCC materials and equipment; update report with changes, if any.

No changes needed. SPCC materials are adequate and are placed conspicuously near the pollutant source areas.

F. Identify any modifications to SWP3, compliance violations or deficiencies, and changes to BMPs, if any.

None.

The SWP3 is being updated and is expected to be complete by Spring 2014 to be included in the NOI per MDE's scheduled issuance of the new 12-SW general permit.

G. Plan training and update schedule for SWP3.

Annual employee training is scheduled for Fall 2014 after 12-SW permit NOI and SWPPP update.

Pollution Prevention Team Members
Sudley Road Facility

Team Leader:

Chandra Chithaluru
Title: Environmental Monitoring, Manager
Office Phone: (410) 222-6177, ext. 3111
Responsibilities: Supervisory Oversight and Coordination: Visual inspections, evaluations, preparation of compliance reports, assistance with employee training, preparation of SWP3 updates, implementation, oversight and directives for SWP3 compliance assurance.

PP Team:

Molly Cannon
Title: Program Manager, Waste Management Services
Department of Public Works
Office Phone: (410) 222-6108 ext. 3020
Responsibilities: Implementation of all aspects of the storm water pollution prevention plan, certification of site compliance reports, operation, maintenance and fiscal planning for the convenience center area.

Members:

Timothy Cluney
Title: Solid Waste Operations Supervisor I
Office Phone: (410) 222-6177, ext 3108
Responsibilities: Supervisor for Convenience Center operation, community service operation and bulk item pick up; conduct employee training; direction of personnel to ensure facility is operated and maintained in compliance with the SWP3.

Arthur Lewis
Title: Sudley Convenience Center Supervisor
Office Phone: (410) 222-1946
Responsibilities: Visual inspections and record keeping, assist in employee training, responsible for ensuring that maintenance requirements for the facility are completed and in compliance with the SWP3.

Steve Krajcsik

Title:	Disposal and Maintenance Manager
Office Phone:	(410) 222-6108, ext. 3006
Responsibilities:	Visual inspections, evaluations and provision of resources for specific tasks as necessary for compliance with the SWP3 for the landfill area.

Joel Saline

Title:	Landfill Manager, Waste Management Services
Office Phone:	(410) 222-6177, ext. 3113
Responsibilities:	Supervisor for facility operations, direction and training of personnel and direction of resources ensure facility is operated and maintained.

Mike Zirnhelt

Title:	Environmental Technician
Office Phone:	(410) 222-6177, ext. 3017
Responsibilities:	Primary Oversight: Visual inspections, completion of weekly inspections, monthly post-closure inspection forms, significant rainfall inspection form and primary oversight of SWP3 maintenance projects.

Mike Gravatt

Title:	Environmental Technician
Office Phone:	(410) 222-6177, ext. 3017
Responsibilities:	Secondary Oversight: Visual inspections, completion of weekly inspections, monthly post-closure inspection forms, significant rainfall inspection form and oversight of SWP3 maintenance projects.

EMPLOYEE TRAINING FOR 2013\2014

SUDLEY LANDFILL AND CONVENIENCE CENTER

TYPE	TOPIC	2012 TRAINING DATE(S)	2013/2014 PROPOSED TRAINING DATE(S)
Hazardous Waste Operations (Response)	* Review handling of hazardous materials, reporting and response, spill prevention and response procedures.	March 2012	Fall 2014
Good Housekeeping and Spill Prevention	* Review the use of absorbent materials. * Review good housekeeping practices.	March 2012	Fall 2014
Preventive Maintenance for Sediment and Erosion Control (stabilized areas)	* Discuss and review preventive maintenance, measures, case reviews and practices and procedures.	March 2012	Fall 2014
Runoff Control	* Discuss maintenance of existing controls and review pollution prevention measures *Discuss composting operations	March 2012	Fall 2014
Other Topics	* Review and discuss components and goals of SWPP plan. * Review and discuss record keeping and reporting, tracking and follow-up program.	March 2012	Fall 2014

Storm Water Pollution Prevention Plan (SWP3) Training Topics Detail

I. Provided an overview and discussion pursuant to the components and goals of the SWP3 required to be developed and implemented for the MDE General Storm Water Discharge Permit.

A. Identify and describe potential pollutant sources which may be reasonably expected to add significant amounts of pollutants to storm water discharges.

B. Describe and implement storm water management control devices known as Best Management Practices (BMP's) at the facility. The control devices (BMP's) shall address the following minimum components:

1. A preventive maintenance program that involves timely inspection and maintenance of storm water management devices (BMP's).
2. Good housekeeping program that requires the maintenance of a clean and orderly facility.
3. Spill prevention and response program identifying the necessary procedures and equipment available to clean up spills. This program also includes the requirement for the Spill Prevention Control and Counter Measure (SPCC) Plan required under Section 311 of the Clean Water Act.
4. Sediment and erosion control program to prevent the discharge of sediment and minimization of erosion of soil.
5. Storm water management practices used to divert, infiltrate, reuse or otherwise manage storm water runoff in a manner that reduces pollutants in storm water discharges. Practices shall be reasonable, appropriate and maintained.
6. Visual inspection program to ensure the controls to reduce pollutant sources identified in the SWP3 plan are being implemented and are adequate and maintained. Also, to determine if the description of pollutant sources is accurate or has to be updated. A comprehensive annual inspection shall be performed by the SWP3 pollution prevention team.
7. Facility Recordation Program that maintains records for a minimum of three (3) years at the facility that provides information on spills and other pollutant discharge incidents, and information describing the quality and quantity of storm water discharges. Also, visual inspection, preventive maintenance and good housekeeping activities shall be documented and recorded.
8. Requirements for facilities subject to SARA Title III, Section 313 by implementing devices (BMP's) used to control, contain, divert or prevent storm water from coming in contact with Section 313 water priority chemicals. Devices used include trays, drip pans, curbing, containment dikes, swales, sewers, gutters, roofs, covers, liners, etc.
9. Employee Training Program that informs personnel of the components and goals of the SWP's.

cc: Rhody Holthaus
Steve Krajcsik
Molly Cannon
Joel Saline
Tim Cluney
Arthur Lewis
Mike Zirnhelt
Sudley SWP3 File #OR-O-634

ANNE ARUNDEL COUNTY
Department of Public Works
Waste Management Services

Inter-Office Correspondence

DATE: November 25, 2013

For Inspection conducted on November 25, 2013

TO: File #634

FROM: Chandra Chithaluru

SUBJECT: Central Recycling Center formerly known as Millersville Convenience Center Comprehensive Annual SWP3 Compliance Evaluation for Year 2013

Introduction

The following personnel conducted the Storm Water Pollution Prevention Plan (SWP3) compliance inspection on November 25, 2013 at Millersville Convenience Center: Mike Gravatt, Chandra Chithaluru, Steve Krajcsik, Tim Cluney and Jonathan Rosetti.

The purpose of this evaluation was to determine the compliance status of the site with regards to the SWP3 and the General Storm Water Discharge Permit Number 02-SW. The format for this evaluation is on the attached outline. The last annual SWP3 inspection was conducted on November 5, 2012.

Summary

The evaluations revealed that the best management practices (BMPs) implemented as specified in the SWP3 continue to minimize the risk of pollutant releases. All of the BMPs specified in the SWP3 have been implemented.

The facility inspection revealed no evidence of pollutants in drainage and outfall areas. Potential storm water pollutant sources were identified as outlined, and no significant and reportable spills or leaks have occurred during this evaluation period. It was the consensuses of the Evaluation Team that the existing and proposed BMPs have and will effectively continue to eliminate storm water

pollution at the facility. No BMP changes or modifications are planned or anticipated as the result of this evaluation.

Evaluation Findings

1. ***The Convenience Center was found to be using BMPs effectively in all aspects of operations.***
2. ***The inspection logs for each pollutant source were reviewed. Preventive maintenance and housekeeping activities are documented on the inspection logs.***
3. ***Sufficient SPCC materials and equipment were present in inventory at the site***
4. ***The Evaluation Team discussed the importance of a street sweeper near the bulk area of the convenience center in order to keep trash from the storm water inlets.***
5. ***The employee SWP3 training is scheduled for Fall 2014 in anticipation of the 12-SW Permit and a new SWPPP.***

cc: Rhody Holthaus
Molly Cannon
Mike Gravatt
Mike Zirnhelt
Jonathan Rossetti
Tim Cluney
File #OR-O-634

November 25, 2013

Central Recycling Center - Outline of Evaluation
On November 25, 2013

A) Verify descriptions of potential pollutant sources as listed below and update as necessary:

1) Waste Oil, Used Antifreeze, and Used Battery Collection Facility
Inspection: twice daily

OK

2) Convenience Center Area and Stormwater Management Pond #8.6
Inspection: daily

OK

3) Paper Recycling Facility
Inspections: daily

OK

4) Bulk Waste Area
Inspections: daily

OK

5) The inspection logs for each pollutant source were reviewed.

OK

6) Identify changes to drainage maps/systems, if any.

None.

7) Review team roster and change, if necessary.

None

8) Update list of significant leaks or spills, if any.

No reportable spills during this inspection period

9) Inspect SPCC materials and equipment; update report with changes, if any.

OK.

10) Identify any modifications to SWP3, compliance violations or deficiencies, and changes to BMPs, if any.

The SWP3 is being updated upon a review of the 12-SW Draft permit issued by MDE. The new SWP3 will be submitted to MDE as part of the NOI once the 12-SW permit gets finalized in 2014.

11) Plan training and update schedule for SWP3.

The annual employee training is scheduled for Fall 2014 in anticipation of the 12-SW permit and the updated SWPPP.

November 25, 2013

Pollution Prevention Team Members
Millersville Convenience Center

Leader:
Chandra Chithaluru
Title: Environmental Monitoring Manager
Office Phone: (410) 222-6108, ext. 3111
Responsibilities: Visual inspections, evaluations, preparation of compliance reports, assistance with employee training, preparation of SWP3 updates, implementation, oversight and directives for SWP3 compliance assurance.

Members:
Molly Cannon
Title: Community Services Manager
Department of Public Works
Office Phone: (410) 222-6108, ext. 3020
Responsibilities: Implementation of all aspects of the storm water pollution prevention plan, certification of site compliance reports, operation, maintenance and fiscal planning for the convenience center area.

Tim Cluney
Title: Community Collections Supervisor
Office Phone: (410) 222-6108, ext. 3016
Responsibilities: Supervisor for Convenience Center operation, community service operation and bulk item pick up; conduct employee training; direction of personnel to ensure facility is operated and maintained in compliance with the SWP3.

Jonathan Rossetti
Title: Millersville Convenience Center – Crew Supervisor
Office Phone: (410) 222-6177, ext. 3012
Responsibilities: Visual inspections, evaluations and direction of personnel for general SWP3 compliance.

Mike Gravatt
Title: Environmental Technician
Office Phone: (410) 222-6177, ext. 3017

Responsibilities: Visual inspections, evaluations, recordation, preventative and operational maintenance, and general housekeeping for SWP3 compliance.

Mike Zirnhelt
Title: Environmental Technician
Office Phone: (410) 222-6177, ext. 3017
Responsibilities: Visual inspections, evaluations, recordation, preventative and operational maintenance, and general housekeeping for SWP3 compliance

November 25, 2013

EMPLOYEE TRAINING

MILLERSVILLE CONVENIENCE CENTER

TYPE	TOPIC	2012 TRAINING DATE(S)	2013/2014 PROPOSED TRAINING DATE(S)
Hazardous Waste Operations (Response)	* Review handling of hazardous materials, reporting and response spill prevention and response procedures.	March 2012	Fall 2014
Good Housekeeping and Spill Prevention	* Review the use of absorbent materials. * Review good housekeeping practices.	March 2012	Fall 2014
Preventive Maintenance for Sediment and Erosion Control (stabilized areas)	* Discuss and review preventive maintenance, measures, case reviews and practices and procedures.	March 2012	Fall 2014
Runoff Control	* Discuss maintenance of existing controls and review pollution prevention measures. *Discuss composting operations	March 2012	Fall 2014
Other Topics	* Review and discuss components and goals of SWPP plan. * Review and discuss record keeping and reporting, tracking and follow-up program.	March 2012	Fall 2014

ATTENDEES: Pollution Prevention Team Members, Operators and/or Maintenance Workers (as appropriate)

Storm Water Pollution Prevention Plan (SWP3) Training Topics Detail

I. Provided an overview and discussion pursuant to the components and goals of the SWP3 required to be developed and implemented for the MDE General Storm Water Discharge Permit.

A. Identify and describe potential pollutant sources which may be reasonably expected to add significant amounts of pollutants to storm water discharges.
B. Describe and implement storm water management control devices known as Best Management Practices (BMP's) at the facility. The control devices (BMP's) shall address the following minimum components:
    1. A preventive maintenance program that involves timely inspection and maintenance of storm water management devices (BMP's).
    2. Good housekeeping program that requires the maintenance of a clean and orderly facility.
    3. Spill prevention and response program identifying the necessary procedures and equipment available to clean up spills. This program also includes the requirement for the Spill Prevention Control and Counter Measure (SPCC) Plan required under Section 311 of the Clean Water Act.
    4. Sediment and erosion control program to prevent the discharge of sediment and minimization of erosion of soil.
    5. Storm water management practices used to divert, infiltrate, reuse or otherwise manage storm water runoff in a manner that reduces pollutants in storm water discharges. Practices shall be reasonable, appropriate and maintained.
    6. Visual inspection program to ensure the controls to reduce pollutant sources identified in the SWP3 plan are being implemented and are adequate and maintained. Also, to determine if the description of pollutant sources is accurate or has to be updated. A comprehensive annual inspection shall be performed by the SWP3 pollution prevention team.
    7. Facility Recordation Program that maintains records for a minimum of three (3) years at the facility that provides information on spills and other pollutant discharge incidents, and information describing the quality and quantity of storm water discharges. Also, visual inspection, preventive maintenance and good housekeeping activities shall be documented and recorded.
    8. Requirements for facilities subject to SARA Title III, Section 313 by implementing devices (BMP's) used to control, contain, divert or prevent storm water from coming in contact with Section 313 water priority chemicals. Devices used include trays, drip pans, curbing, containment dikes, swales, sewers, gutters, roofs, covers, liners, etc.
    9. Employee Training Program that informs personnel of the components and goals of the SWP's.

Recycle. More Often.

ANNE ARUNDEL COUNTY
Department of Public Works
Waste Management Services

Inter-Office Correspondence

DATE: November 25, 2013

TO: File # 534A

FROM: Chandra Chithaluru

SUBJECT: Millersville Landfill and Resource Recovery Facility
Comprehensive Annual SWP3 Compliance Evaluation for Year 2013

Introduction

The following personnel conducted the Storm Water Pollution Prevention Plan (SWP3) compliance inspection on November 25, 2013: Chandra Chithaluru, Michael Gravatt and Steve Krajcsik.

The purpose of this evaluation was to determine the compliance status of the site with regard to the SWP3 and the General Storm Water Discharge Permit Number 02-SW and Sediment and Erosion control Plan AASCD#307-24 for Cell 8. The last annual SWP3 inspection was conducted on November 5, 2012. The format for this evaluation is on the attached outline.

Summary

The evaluations revealed that the best management practices (BMPs) implemented as specified in the SWP3 continues to minimize the risk of pollutant releases. All of the "advanced" BMPs specified in the SWP3 have been implemented. The S&E Control BMPs are being implemented as required.

The facility inspection revealed no evidence of pollutants in drainage and outfall areas. Potential storm water pollutant sources were identified as outlined.

No significant and reportable spills or leaks have occurred during this evaluation period. It was the consensus of the Pollution Prevention Team that the existing and proposed BMPs have and will

*Telephone 410-222-6108 * Mail Stop 4190 * FAX 410-222-6105*
Website: www.aacounty.org/DPW/WasteManagement
Recycled Paper

effectively continue to eliminate storm water pollution at the facility. No BMP changes or modifications are planned or anticipated as the result of this evaluation.

Findings

Active Landfill Areas

The landfilling activity in Cell 8 was found to be in compliance with the S&E Control plans and General Storm Water NPDES Discharge Permit and the SWP3. All areas within the active landfill area including the haul roads around the cell 8 are graded and stabilized with the exception of the active working face.

In addition, the Landfill Supervisor and the site Environmental Technicians routinely perform sediment and erosion control inspections and perform stabilization and other maintenance activities as necessary.

Inactive Landfill Areas

All areas of closed landfill and inactive areas of the property are inspected on a routine basis by the landfill personnel and stabilized as needed including re-soiling and re-vegetation. All areas were found to be permanently graded and stabilized. Grounds maintenance activities will continue to remove vegetation from riprap down chutes and storm water conveyances in keeping with BMPs.

Cell 9 Soil Borrow Area

Cell 9 soil borrow area is routinely inspected by the landfill personnel and super silt fences and Cell 9 sedimentation pond (#9-2), are maintained according to its Dam Safety Permit # 08-PO-0085.

Additional Findings

1) The inspection logs for each pollutant source were reviewed and were found to be current.
2) Proper and timely housekeeping and preventative maintenance is being performed as per the BMPs at all of the pollutant sources.
3) Sufficient SPCC materials and equipment were present in inventory at the site.
4) There were adequate amounts of spill kits in each of the locations.

MLFRRF - Outline of Evaluation on November 25, 2013

A) Verify descriptions of potential pollutant sources as listed below and update as necessary:

1) Office Building Lawn and Parking Lot Infiltration Trench
Inspection: quarterly
OK

2) Materials Storage, Yard Area, and Sediment Trap
Inspection: weekly

OK

3) Maintenance Shop Facility
Inspections: daily
OK

4) Maintenance Yard Area Including Fuel Storage Area
Inspection: daily
OK

5) Leachate Collection, Pumping, Pretreatment, and Disposal Facilities
Inspection: during operation, daily
OK

6) Landfill Main Haul Road and Sediment Traps
Inspection: daily, weekly, semi-annually and after each heavy rain
OK

7) Landfill Road System
Inspection: monthly, semi-annually and after each heavy rain
OK

8) Sewage Grit Dewatering Facility
Inspection:
OUT OF SERVICE

Note: The system is identified to be removed from the SWP3 during the scheduled updates to the document. The SWP3 is being updated based on the upcoming 12-SW permit which is expected to be finalized in 2014.

9) Cell 8 Landfilling Activity and Stormwater Management Pond 8-1
Inspection: daily, weekly, monthly, quarterly, semi-annually and after each heavy rain
OK

10) Maintenance of Capped Cell 567 and Stormwater Management Ponds 3, 4, and 5.
Inspection: monthly, quarterly, semi-annually, and after each heavy rain
OK

11) Maintenance of Capped Cells 1 East, 2 and 4, and Stormwater Management Ponds 1 and 2
Inspection: monthly, quarterly, and semi-annually

OK

12) Composting Area
Inspection: weekly, quarterly, semi-annually

OK – *A litter fence was added on all sides of composting area to contain the wind blown plastic and appears to contain the debris.*

13) Record keeping
OK

B. Identify changes to drainage maps/systems, if any.
N/A

Note: Necessary changes will be reflected in the ongoing 2014 SWP3 updates.

C. Review team roster and change, if necessary.
NONE

D. Update list of significant leaks or spills, if any.

NO REPORTABLE SPILLS FOR THE YEAR 2013.

E. Inspect SPCC materials and equipment; update report with changes, if any.
OK

F. Identify any modifications to SWP3, compliance violations or deficiencies, and changes to BMPs, if any.
OK

The SWP3 is being updated based on MDE's issuance of draft 12-SW permit which is expected to be finalized in 2014.

G. Plan training and update schedule for SWP3.

The annual employee training is scheduled for Fall 2014 due to anticipated new SWPPP and 12-SW Permit.

cc:

Steve Krajcsik
Joel Saline
Mike Neafsey
Leroy Patterson
Mike Gravatt
Mike Zirnhelt
Millersville SWP3 File #534A

Pollution Prevention Team Members
Millersville Landfill and Resource Recovery Facility

Leader:

Chandra Chithaluru
Title: Environmental Monitoring Manager
Office Phone: (410) 222-6177, ext. 3016
Responsibilities: Visual inspections, evaluations, preparation of compliance reports, assistance with employee training, preparation of SWP3 updates, implementation, oversight and directives for SWP3 compliance assurance.

Members:

Joel Saline
Title: Landfill Manager, Waste Management Services
Office Phone: (410) 222-6177, ext. 3016
Responsibilities: Supervisor for facility operations, direction and training of personnel and direction of resources ensure facility is operated and maintained in compliance with the SWP3.

Steve Krajcsik
Title: Manager - Disposal and Maintenance Program, Waste Management Services,
Office Phone: (410) 222-6108
Responsibilities: Implementation of all aspects of the storm water pollution prevention plan, certification of site compliance reports, operation, maintenance and fiscal planning for the facility.

Michael Neafsey
Title: Landfill Supervisor
Office Phone: (410) 222-6108
Responsibilities: Visual inspections, evaluations and direction of personnel for general SWP3 compliance.

Leroy Patterson
Title: Maintenance Supervisor
Office Phone: (410) 222-6108
Responsibilities: Visual inspections, evaluations, direction of personnel and implementation assistance for general housekeeping and specific maintenance requirements in compliance with the SWP3.

Mike Gravatt	
Title:	Environmental Technician
Office Phone:	(410) 222-6177
Responsibilities:	Visual inspections, evaluations, recordation, preventative and operational maintenance, and general housekeeping for SWP3 compliance.

Mike Zirnhelt	
Title:	Environmental Technician
Office Phone:	(410) 222-6177
Responsibilities:	Visual inspections, evaluations, recordation, preventative and operational maintenance, and general housekeeping for SWP3 compliance.

EMPLOYEE TRAINING FOR 2013/2014

MILLERSVILLE LANDFILL AND RESOURCE RECOVERY FACILITY

TYPE	TOPIC	2012 TRAINING DATE(S)	Proposed 2013/2014 TRAINING DATE(S)
Hazardous Waste Operations (Response)	* Review handling of hazardous materials, reporting and response spill prevention and response procedures.	March 2012	Fall 2014
Good Housekeeping and Spill Prevention	* Review the use of absorbent materials. * Review good housekeeping practices.	March 2012	Fall 2014
Preventive Maintenance for Sediment and Erosion Control (stabilized areas)	* Discuss and review preventive maintenance, measures, case reviews and practices and procedures.	March 2012	Fall 2014
Runoff Control	* Discuss maintenance of existing controls and review pollution prevention measures. *Discuss composting operations	March 2012	Fall 2014
Other Topics	* Review and discuss components and goals of SWPP plan. * Review and discuss record keeping and reporting, tracking and follow-up program.	March 2012	Fall 2014

ATTENDEES: Pollution Prevention Team Members, Operators and/or Maintenance Workers (as appropriate)

Storm Water Pollution Prevention Plan (SWP3) Training Topics Detail

I. Provided an overview and discussion pursuant to the components and goals of the SWP3 required to be developed and implemented for the MDE General Storm Water Discharge Permit.
   A. Identify and describe potential pollutant sources which may be reasonably expected to add significant amounts of pollutants to storm water discharges.
   B. Describe and implement storm water management control devices known as Best Management Practices (BMP's) at the facility. The control devices (BMP's) shall address the following minimum components:
      1. A preventive maintenance program that involves timely inspection and maintenance of storm water management devices (BMP's).
      2. Good housekeeping program that requires the maintenance of a clean and orderly facility.
      3. Spill prevention and response program identifying the necessary procedures and equipment available to clean up spills. This program also includes the requirement for the Spill Prevention Control and Counter Measure (SPCC) Plan required under Section 311 of the Clean Water Act.
      4. Sediment and erosion control program to prevent the discharge of sediment and minimization of erosion of soil.
      5. Storm water management practices used to divert, infiltrate, reuse or otherwise manage storm water runoff in a manner that reduces pollutants in storm water discharges. Practices shall be reasonable, appropriate and maintained.
      6. Visual inspection program to ensure the controls to reduce pollutant sources identified in the SWP3 plan are being implemented and are adequate and maintained. Also, to determine if the description of pollutant sources is accurate or has to be updated. A comprehensive annual inspection shall be performed by the SWP3 pollution prevention team.
      7. Facility Recordation Program that maintains records for a minimum of three (3) years at the facility that provides information on spills and other pollutant discharge incidents, and information describing the quality and quantity of storm water discharges. Also, visual inspection, preventive maintenance and good housekeeping activities shall be documented and recorded.
      8. Requirements for facilities subject to SARA Title III, Section 313 by implementing devices (BMP's) used to control, contain, divert or prevent storm water from coming in contact with Section 313 water priority chemicals. Devices used include trays, drip pans, curbing, containment dikes, swales, sewers, gutters, roofs, covers, liners, etc.
      9. Employee Training Program that informs personnel of the components and goals of the SWP's.

Maryland Department of Environment

Water Management Administration
Compliance Program
1800 Washington Blvd, Baltimore, MD 21230
410-537-3510

Field Inspection Report by: Brian Connoley

Media Type(s): NPDES Industrial Stormwater

Inspection Date: October 28, 2014

Site Name: Millersville Landfill & Resource Recovery Facility

Facility Address: 389 Burns Crossing Rd, Severn, MD 21144

County: Anne Arundel County

NPDES Industrial Stormwater

Permit / Approval Numbers: 12SW1304

Site Status: Active

Site Condition: Satisfactory/Compliance

Contact(s): Chandra Chithaluru – Environmental Monitoring Manager

Recommended Action: Continue Routine Inspection

Inspection Reason: Routine Scheduled, Initial Quarterly, Initial Yearly

Evidence Collected: Visual Observation

Inspection Findings:

A routine inspection was conducted at the above facility, in regards to the general permit for discharges from stormwater associated with industrial activities on this date during mild, dry weather conditions. The facility is a landfill and resource recovery facility including a recycling center and compost operation for local residents. The majority of the site is comprised of eight closed/capped landfill cells, with one active cell and plans for a tenth cell. The 565.00 acre property is operated by the Anne Arundel County Department of Public Works – Waste Management Services. The facility includes multiple ponds throughout with stormwater runoff conveyed via overland flow to engineered conveyances, including drainage swales, catch basins and stormwater management facilities.

This inspector met with Mr. Chandra Chithaluru (Environmental Monitoring Manager) and an explanation of this visit was made clear to Mr. Chithaluru. The investigation consisted of a records review of the storm water pollution prevention plan (SWPPP) and a site inspection; Mr. Chithaluru accompanied. Post inspection, it was discovered that no violations were present and the site is considered satisfactory and compliant.

MDE will continue to monitor the site with routine compliance inspections. Please address any questions or comments to the attention of Brian Connoley at 410-537-3526 or at brian.connoley@maryland.gov. A copy of this report has been forwarded to Mr. Chithaluru.

Inspection Date: October 28, 2014
Site Name: Millersville Landfill & Resource Recovery Facility
Facility Address: 389 Burns Crossing Rd, Severn, MD 21144

NPDES Industrial Stormwater- Inspection Checklist

Inspection Item	*Status*	*Comments*
1. Does the facility have a discharge permit? [Environment Article §9-323a(1-3)]	No Violations Observed	
2. Is the discharge permit current? Has facility applied for renewal? [Environment Article §9-328a(1)]	No Violations Observed	
3. Is the facility as described in the current permit? Are treatment processes as described in the current permit? [COMAR 26.08.04.01.01B(4)]	No Violations Observed	
4. Has notification been submitted about any new, different or increased discharges? [40 CFR Part 122 Subpart C Section 122.42.b(1-3)]	No Violations Observed	
5. Is the number and location of discharge points as described in the discharge permit? [Environment Article §9-3314]	No Violations Observed	
6. Has permittee submitted correct name and address of receiving waters? [40 CFR 122.21.j(3)]	No Violations Observed	
7. Is the permittee meeting the compliance schedule per permit requirements? [COMAR 26.08.04.02-1.02-1A(3)]	No Violations Observed	
8. Has the operator or superintendent been certified by the Board in the appropriate classification for the facility? [COMAR 26.06.01.05A(1)]	Not Applicable	
9. Are adequate records being maintained for the sampling date, time, and exact location; analysis dates and times; individual performing analysis; and analytical results? [COMAR 26.08.04.03.03B(3)(a, b, c, e)]	Not Applicable	
10. Are adequate records being maintained for the analytical methods/techniques used? [COMAR 26.08.04.03.03B(3)(d)]	Not Applicable	
11. Does the permittee retained a minimum of 3 years worth of monitoring records including raw data and original strip chart recordings; calibration and maintenance records; and reports? [COMAR 26.08.04.03.03B(1)]	Not Applicable	
12. Is the lab and monitoring equipment being properly calibrated and maintained? Are they keeping records to reflect this? [Environment Article §9-3313]	Not Applicable	
13. Is laboratory controls and appropriate quality assurance procedures properly operated and maintained? [40 CFR Part 122 Subpart C Section 122.41.e]	Not Applicable	

Inspection Date: October 28, 2014
Site Name: Millersville Landfill & Resource Recovery Facility
Facility Address: 389 Burns Crossing Rd, Severn, MD 21144

NPDES Industrial Stormwater- Inspection Checklist

Inspection Item	*Status*	*Comments*
14. Has the permittee submitted the monitoring results on the proper Discharge Monitoring Report form? [COMAR 26.08.04.03.03C(1)]	Not Applicable	
15. Has the permittee submitted these results within the allotted time? [COMAR 26.08.04.03.03C(2)]	Not Applicable	
16. Are discharge monitoring reports complete and reflect permit conditions? [COMAR 26.08.04.03B(3)]	Not Applicable	
17. Is the facility being properly operated and maintained including:(a) stand-by power or equivalent provisions available, (b) adequate alarm system for power or equipment failure available, (c) all treatments units are in service, . [40 CFR Part 122 Subpart C Section 122.41.e]	Not Applicable	
18. Is sewage sludge managed correctly per permit requirements? [COMAR 26.04.06.03.03]	Not Applicable	
19. Any by-pass since last inspection? Has permittee submitted notice of any by-pass? [40 CFR Part 122 Subpart C Section 122.41.m(4)(i)(C)]	Not Applicable	
20. Any non-complying discharges experienced since last inspection? Has regulatory agency been notified? [40 CFR Part 122 Subpart C Section 122.41.l(6)]	Not Applicable	
21. Have overflows occurred since the last inspection? [COMAR 26.08.10.02A]	Not Applicable	
22. Has records of overflows been maintained at the facility for at least five years? [COMAR 26.08.10.06A-B]	Not Applicable	
23. Are flow measuring devices properly installed and operated, calibration frequency of flow meter adequate, flow measurement equipment adequate to handle expected ranges of flow? [40 CFR Part 122 Subpart C Section 122.41.e]	Not Applicable	
24. Are discharge monitoring points adequate for representative sampling? Do parameters and sampling frequency meet the minimum requirements? Does the permittee use the method of sample collection required by the permit? [Environment Article §9-331(4)]	No Violations Observed	
25. Are analytical testing procedures approved by EPA? If alternate analytical procedures are used, proper approval has been obtained? [COMAR 26.08.01.02B(1)]	Not Applicable	
26. Has the permittee notified the Department of the name and address of the commercial laboratory? [COMAR 26.08.04.03.03A(3)]	Not Applicable	

Inspection Date: October 28, 2014
Site Name: Millersville Landfill & Resource Recovery Facility
Facility Address: 389 Burns Crossing Rd, Severn, MD 21144

NPDES Industrial Stormwater- Inspection Checklist

Inspection Item	*Status*	*Comments*
27. Were discharges observed at the authorized outfalls? Does the facility have any unauthorized discharges to waters of the State? [Environment Article §9-322]	No Violations Observed	
28. Does the discharges or receiving waters have any visible pollutants (oil sheen, grease, turbidity, foam, floating solids, color), odor, noncompliant DO concentrations, and/or noncompliant temperature ranges? [Environment Article §9-314b(1)]	No Violations Observed	
29. Were discharge samples collected? [Environment Article §9-261c(1)]	Not Evaluated	
30. Is the facility required to have a storm water pollution prevention plan? Has storm water pollution prevention plan been developed and implemented as required? Does storm water pollution prevention plan require modifications to prevent runoff of pollutants? [40 CFR Part 122 Subpart B Section 122.26.c(1)(I)(A-B)]	No Violations Observed	
31. Are the permit conditions being met? [Environment Article §9-326a(1)]	No Violations Observed	

Inspector: Brian Connoley

Received by:

Maryland Department of Environment

Water Management Administration
Compliance Program
1800 Washington Blvd, Baltimore, MD 21230
410-537-3510

Field Inspection Report by: Brian Connoley

Media Type(s): NPDES Industrial Stormwater

Inspection Date: October 6, 2014

Site Name: Southern Recycling Center

Facility Address: 5400 Nutwell Sudley Rd, Deale, MD 20751

County: Anne Arundel County

NPDES Industrial Stormwater

Permit / Approval Numbers: 12SW0297

Site Status: Active

Site Condition: Noncompliance

Contact(s): Chandra Chithaluru – Environmental Monitoring Manager

Recommended Action: Additional Investigation Required

Inspection Reason: Routine Scheduled, Initial Quarterly, Initial Yearly

Evidence Collected: Visual Observation

Inspection Findings:

A routine inspection was conducted at the above facility, in regards to the general permit for discharges from stormwater associated with industrial activities on this date during warm, dry weather conditions. The facility is a recycling center for local residents with a closed/capped landfill cell making up for majority of the site. The 166.00 acre property is operated by the Anne Arundel County Department of Public Works – Waste Management Services and is now only a center for recycling of household debris, recyclables and yard waste. The facility includes five ponds in total, two wet and three bioretention, with two separate outfalls in total.

This inspector met with Mr. Chandra Chithaluru (Environmental Monitoring Manager) and an explanation of this visit was made clear to Mr. Chithaluru. The investigation consisted of a records review of the storm water pollution prevention plan (SWPPP) and a site inspection; Mr. Chithaluru accompanied. Post inspection, it was discovered that no physical violations were present; however, required records were not made available to the inspector.

With respect to the above MDE authorization, the following violation(s) of Environment Article Title 9 and the above referenced NPDES permit, by Anne Arundel County Department of Public Works – Waste Management Services, were observed on this date:

1. The permittee failed to provide the department up to date employee training records as required by the permit.

Inspection Date: October 6, 2014
Site Name: Southern Recycling Center
Facility Address: 5400 Nutwell Sudley Rd, Deale, MD 20751

To bring this site into compliance with Environment Article Title 9 the following corrections should be made immediately upon receipt of this report:

a. Locate up to date employee training records or immediately conduct employee training and document; and annually thereafter.

STATE LAW PROVIDES FOR PENALTIES FOR VIOLATIONS OF MARYLAND ENVIRONMENT ARTICLE TITLE 9 FOR EACH DAY THE VIOLATION CONTINUES. THE MARYLAND DEPARTMENT OF THE ENVIRONMENT MAY SEEK PENALTIES FOR THE AFOREMENTIONED VIOLATIONS OF TITLE 9 ON THIS SITE FOR EACH DAY THE VIOLATION CONTINUES.

A follow-up inspection will be conducted. The inspector can be reached at 410-537-3526 or at brian.connoley@maryland.gov. A copy of this report has been forwarded to Mr. Chithaluru.

NPDES Industrial Stormwater- Inspection Checklist

Inspection Item	*Status*	*Comments*
1. Does the facility have a discharge permit? [Environment Article §9-323a(1-3)]	No Violations Observed	
2. Is the discharge permit current? Has facility applied for renewal? [Environment Article §9-328a(1)]	No Violations Observed	
3. Is the facility as described in the current permit? Are treatment processes as described in the current permit? [COMAR 26.08.04.01.01B(4)]	No Violations Observed	
4. Has notification been submitted about any new, different or increased discharges? [40 CFR Part 122 Subpart C Section 122.42.b(1-3)]	No Violations Observed	
5. Is the number and location of discharge points as described in the discharge permit? [Environment Article §9-3314]	No Violations Observed	
6. Has permittee submitted correct name and address of receiving waters? [40 CFR 122.21.j(3)]	No Violations Observed	
7. Is the permittee meeting the compliance schedule per permit requirements? [COMAR 26.08.04.02-1.02-1A(3)]	Out of Compliance	See findings
8. Has the operator or superintendent been certified by the Board in the appropriate classification for the facility? [COMAR 26.06.01.05A(1)]	Not Applicable	
9. Are adequate records being maintained for the sampling date, time, and exact location; analysis dates and times; individual performing analysis; and analytical results? [COMAR 26.08.04.03.03B(3)(a, b, c, e)]	Not Applicable	
10. Are adequate records being maintained for the analytical methods/techniques used? [COMAR 26.08.04.03.03B(3)(d)]	Not Applicable	

Inspection Date: October 6, 2014
Site Name: Southern Recycling Center
Facility Address: 5400 Nutwell Sudley Rd, Deale, MD 20751

NPDES Industrial Stormwater- Inspection Checklist

Inspection Item	*Status*	*Comments*
11. Does the permittee retained a minimum of 3 years worth of monitoring records including raw data and original strip chart recordings; calibration and maintenance records; and reports? [COMAR 26.08.04.03.03B(1)]	Not Applicable	
12. Is the lab and monitoring equipment being properly calibrated and maintained? Are they keeping records to reflect this? [Environment Article §9-3313]	Not Applicable	
13. Is laboratory controls and appropriate quality assurance procedures properly operated and maintained? [40 CFR Part 122 Subpart C Section 122.41.e]	Not Applicable	
14. Has the permittee submitted the monitoring results on the proper Discharge Monitoring Report form? [COMAR 26.08.04.03.03C(1)]	Not Applicable	
15. Has the permittee submitted these results within the allotted time? [COMAR 26.08.04.03.03C(2)]	Not Applicable	
16. Are discharge monitoring reports complete and reflect permit conditions? [COMAR 26.08.04.03B(3)]	Not Applicable	
17. Is the facility being properly operated and maintained including:(a) stand-by power or equivalent provisions available, (b) adequate alarm system for power or equipment failure available, (c) all treatments units are in service, . [40 CFR Part 122 Subpart C Section 122.41.e]	Not Applicable	
18. Is sewage sludge managed correctly per permit requirements? [COMAR 26.04.06.03.03]	Not Applicable	
19. Any by-pass since last inspection? Has permittee submitted notice of any by-pass? [40 CFR Part 122 Subpart C Section 122.41.m(4)(i)(C)]	Not Applicable	
20. Any non-complying discharges experienced since last inspection? Has regulatory agency been notified? [40 CFR Part 122 Subpart C Section 122.41.l(6)]	Not Applicable	
21. Have overflows occurred since the last inspection? [COMAR 26.08.10.02A]	Not Applicable	
22. Has records of overflows been maintained at the facility for at least five years? [COMAR 26.08.10.06A-B]	Not Applicable	
23. Are flow measuring devices properly installed and operated, calibration frequency of flow meter adequate, flow measurement equipment adequate to handle expected ranges of flow? [40 CFR Part 122 Subpart C Section 122.41.e]	Not Applicable	

Inspection Date: October 6, 2014
Site Name: Southern Recycling Center
Facility Address: 5400 Nutwell Sudley Rd, Deale, MD 20751

NPDES Industrial Stormwater- Inspection Checklist

Inspection Item	*Status*	*Comments*
24. Are discharge monitoring points adequate for representative sampling? Do parameters and sampling frequency meet the minimum requirements? Does the permittee use the method of sample collection required by the permit? [Environment Article §9-331(4)]	No Violations Observed	
25. Are analytical testing procedures approved by EPA? If alternate analytical procedures are used, proper approval has been obtained? [COMAR 26.08.01.02B(1)]	Not Applicable	
26. Has the permittee notified the Department of the name and address of the commercial laboratory? [COMAR 26.08.04.03.03A(3)]	Not Applicable	
27. Were discharges observed at the authorized outfalls? Does the facility have any unauthorized discharges to waters of the State? [Environment Article §9-322]	No Violations Observed	
28. Does the discharges or receiving waters have any visible pollutants (oil sheen, grease, turbidity, foam, floating solids, color), odor, noncompliant DO concentrations, and/or noncompliant temperature ranges? [Environment Article §9-314b(1)]	No Violations Observed	
29. Were discharge samples collected? [Environment Article §9-261c(1)]	Not Evaluated	
30. Is the facility required to have a storm water pollution prevention plan? Has storm water pollution prevention plan been developed and implemented as required? Does storm water pollution prevention plan require modifications to prevent runoff of pollutants? [40 CFR Part 122 Subpart B Section 122.26.c(1)(I)(A-B)]	No Violations Observed	
31. Are the permit conditions being met? [Environment Article §9-326a(1)]	Out of Compliance	See findings

Inspector: _____
Brian Connoley

Received by: _____ Chandra Chitharam

Maryland Department of Environment

Water Management Administration
Compliance Program
1800 Washington Blvd, Baltimore, MD 21230
410-537-3510

Field Inspection Report by: Brian Connoley

Media Type(s): NPDES Industrial Stormwater

Inspection Date: October 28, 2014

Site Name: Southern Recycling Center

Facility Address: 5400 Nutwell Sudley Rd, Deale, MD 20751

County: Anne Arundel County

NPDES Industrial Stormwater

Permit / Approval Numbers: 12SW0297

Site Status: Active

Site Condition: Satisfactory/Compliance

Contact(s): Chandra Chithaluru - Environmental Monitoring Manager

Recommended Action: Continue Routine Inspection

Inspection Reason: Follow-up (Non-Compliance)

Evidence Collected: Visual Observation

Inspection Findings:

A follow-up inspection was conducted at the above facility, in regards to the general permit for discharges from stormwater associated with industrial activities on this date. The facility is a recycling center for local residents with a closed/capped landfill cell making up for majority of the site. The 166.00 acre property is operated by the Anne Arundel County Department of Public Works – Waste Management Services.

This inspector met with Mr. Chandra Chithaluru (Environmental Monitoring Manager) and an explanation of this visit was made clear to Mr. Chithaluru. The investigation consisted of a records review of missing documents from the initial inspection on *10-06-2014*. Post investigation, it was determined that all violations had been corrected and the site was considered satisfactory and compliant.

Routine inspections will continue. The inspector can be reached at 410-537-3526 or at brian.connoley@maryland.gov. A copy of this report has been forwarded to Mr. Chithaluru.

NPDES Industrial Stormwater- Inspection Checklist

Inspection Item	*Status*	*Comments*
1. Does the facility have a discharge permit? [Environment Article §9-323a(1-3)]	No Violations Observed	

Inspection Date: October 28, 2014
Site Name: Southern Recycling Center
Facility Address: 5400 Nutwell Sudley Rd, Deale, MD 20751

NPDES Industrial Stormwater- Inspection Checklist

Inspection Item	*Status*	*Comments*
16. Are discharge monitoring reports complete and reflect permit conditions? [COMAR 26.08.04.03B(3)]	Not Applicable	
17. Is the facility being properly operated and maintained including:(a) stand-by power or equivalent provisions available, (b) adequate alarm system for power or equipment failure available, (c) all treatments units are in service, . [40 CFR Part 122 Subpart C Section 122.41.e]	Not Applicable	
18. Is sewage sludge managed correctly per permit requirements? [COMAR 26.04.06.03.03]	Not Applicable	
19. Any by-pass since last inspection? Has permittee submitted notice of any by-pass? [40 CFR Part 122 Subpart C Section 122.41.m(4)(i)(C)]	Not Applicable	
20. Any non-complying discharges experienced since last inspection? Has regulatory agency been notified? [40 CFR Part 122 Subpart C Section 122.41.l(6)]	Not Applicable	
21. Have overflows occurred since the last inspection? [COMAR 26.08.10.02A]	Not Applicable	
22. Has records of overflows been maintained at the facility for at least five years? [COMAR 26.08.10.06A-B]	Not Applicable	
23. Are flow measuring devices properly installed and operated, calibration frequency of flow meter adequate, flow measurement equipment adequate to handle expected ranges of flow? [40 CFR Part 122 Subpart C Section 122.41.e]	Not Applicable	
24. Are discharge monitoring points adequate for representative sampling? Do parameters and sampling frequency meet the minimum requirements? Does the permittee use the method of sample collection required by the permit? [Environment Article §9-331(4)]	No Violations Observed	
25. Are analytical testing procedures approved by EPA? If alternate analytical procedures are used, proper approval has been obtained? [COMAR 26.08.01.02B(1)]	Not Applicable	
26. Has the permittee notified the Department of the name and address of the commercial laboratory? [COMAR 26.08.04.03.03A(3)]	Not Applicable	
27. Were discharges observed at the authorized outfalls? Does the facility have any unauthorized discharges to waters of the State? [Environment Article §9-322]	No Violations Observed	

Inspection Date: October 28, 2014
Site Name: Southern Recycling Center
Facility Address: 5400 Nutwell Sudley Rd, Deale, MD 20751

NPDES Industrial Stormwater- Inspection Checklist

Inspection Item	*Status*	*Comments*
28. Does the discharges or receiving waters have any visible pollutants (oil sheen, grease, turbidity, foam, floating solids, color), odor, noncompliant DO concentrations, and/or noncompliant temperature ranges? [Environment Article §9-314b(1)]	No Violations Observed	
29. Were discharge samples collected? [Environment Article §9-261c(1)]	Not Evaluated	
30. Is the facility required to have a storm water pollution prevention plan? Has storm water pollution prevention plan been developed and implemented as required? Does storm water pollution prevention plan require modifications to prevent runoff of pollutants? [40 CFR Part 122 Subpart B Section 122.26.c(1)(I)(A-B)]	No Violations Observed	
31. Are the permit conditions being met? [Environment Article §9-326a(1)]	No Violations Observed	

Inspector: _____
Brian Connoley

Received by: _____

ANNE ARUNDEL COUNTY
MARYLAND

Department of Health
J. Howard Beard
Health Services Building
3 Harry S. Truman Parkway
Annapolis, MD 21401
www.aahealth.org

Frances B. Phillips, R.N., M.H.A.
Health Officer

Health Matters

Water Quality and Swimming or Fishing In Anne Arundel County Rivers and Creeks

Under State of Maryland regulations, the Anne Arundel County Department of Health conducts water quality sampling at community bathing beaches along area rivers and creeks from Memorial Day to Labor Day. The water bodies are tested for levels of enterococci bacteria. Below are some of the most commonly asked questions about the Department of Health's water quality sampling and risks associated with natural water bodies.

What are enterococci?
Enterococci are bacteria found in the intestine of all warm-blooded animals including humans. Because the bacteria are always present in animal and human waste and are easy to detect, they are used as indicators of water quality conditions. Enterococci are in food, water and soils but cannot become airborne. The U.S. Environmental Protection Agency (EPA) recommends using enterococci levels to measure fecal contamination in recreational water.

What does monitoring for enterococci in water samples show?
Enterococci results are most useful for watching long-term trends in water quality. Results are collected over several weeks and then evaluated. Since many factors can affect readings, single sample results may be misleading. Rainwater runoff, waterfowl and tidal action can cause high results that nature will fix in a day or two. If over time, sample results remain high, the Department will look for possible sources of pollution such as human sewage.

What causes the Department of Health to issue an advisory recommending against swimming and water sports in a certain area?
Swimming in natural water bodies always poses some risk. If spills, leaks or other problems are known to have allowed human waste to enter the water, the Department advises people not to swim there. Because enterococci have many sources, the sample results are evaluated with other information about the waterway. The Department of Health makes every effort to identify the source or sources of bacteria. When the source is human waste, the Department requires corrective action.

When will the Department of Health lift an advisory for a closed area?
An area may be reopened after results are back to an acceptable level for at least two consecutive days. The acceptable level is determined by the State, U.S. Environmental Protection Agency and the Anne Arundel County Department of Health. For bodies of water that the Department samples weekly and biweekly during the peak swimming season, the acceptable level is 104 MPN (most probable number of colonies of organisms) or fewer organisms per 100 milliliters of water. For areas that are sampled monthly, the acceptable level is 158 MPN per 100 milliliters. During the summer months, once an area has been sampled five times or more, the acceptable level is 35 MPN per 100 milliliters.

What kinds of health risks are associated with swimming and other direct water contact?
Natural bodies of water can contain bacteria, viruses or other harmful microorganisms. Common problems associated with swimming in contaminated water are ear, eye and skin infections. Diarrhea and other water-related illnesses can occur from accidentally swallowing contaminated water. Disease-causing microorganisms, such as Mycobacterium marinum, can also enter the body through cuts and scrapes.

-Please turn over-

If you have symptoms of a gastrointestinal , skin, ear or other infection, consult your doctor for immediate treatment. Let your doctor know that you have had contact or suspected contact with contaminated water.

What are Mycobacterium marinum and Vibrio vulnificus?
Mycobacterium marinum is a bacterium most commonly found in fresh or saltwater that may cause infections in fish and people. It is a natural part of the ecosystem of the Chesapeake Bay and its tributaries and also in other water bodies worldwide. In humans it can cause skin and joint infections. Water-related infections can also be caused by Vibrio vulnificus, a bacterium found in salt water.

What precautions should I take before swimming in area creeks and rivers?
After rainfall, all County beaches are under a no swimming/no direct water contact advisory for 48 hours due to predicted elevated bacterial levels. Avoid swimming until at least 48 hours or until the water clears. Look for storm drains along the beach. Don't swim near them. Look for trash and other signs of pollution such as oil slicks or scum on the water. These kinds of pollutants may indicate the presence of disease causing microorganisms that may also have been washed into the water. If the Department of Health has issued an advisory, it is a warning to swimmers and others using the water that enterococci results have exceeded the acceptable level. Don't swim if you have an ear infection, perforated eardrum, open cuts, skin lesions or immunity problems.

What should I do after coming in contact with natural bodies of water?
Wash well with soap and warm water.

How can I prevent illnesses when crabbing and fishing?
Assure proper bandaging and care of wounds or abrasions. Wear sturdy gloves if you will have contact with water and sharp objects (fish fins and scales, boating equipment, etc.). Keep hands as clean as you can. Waterless hand cleansers kill many germs and are easier on the skin than constant hand washing.

Is it OK to eat crabs and fish from an area that is closed to swimming?
Because cooking kills bacteria and viruses, it's generally okay to eat crabs and fish taken from these areas as long as they are handled properly. Fish should be kept in a cool place or on ice and then cooked thoroughly. Live crabs should be thoroughly cooked. Cooked fish and crabs should not come back into contact with any surfaces or containers where they were kept uncooked.

How can I find information about my favorite river or creek?
From Memorial Day to Labor Day, the Anne Arundel County Department of Health provides water sampling results at **www.aahealth.org** and on a 24-hour information line (410-222-7999). Both the Web site and phone line provide reports on emergency closings of local waterways year-round. The Department of Health offers e-mail alerts of recreational waterway advisories and closings. To sign up for these alerts, visit **www.aahealth.org.**

For more information, contact:
Recreational Water Quality Program
Anne Arundel County Department of Health
3 Harry S. Truman Parkway
Annapolis, MD 21401
(410) 222-7241, Monday-Friday, 8 a.m. – 2 p.m.

The services and facilities of the Anne Arundel County Department of Health are available to all without regard to race, color, religion, political affiliation or opinion, national origin, age, sex, sexual orientation or disability. p. 5/2008 r.5/2008 1,000

ANNE ARUNDEL COUNTY
MARYLAND

Department of Health
J. Howard Beard
Health Services Building
3 Harry S. Truman Parkway
Annapolis, MD 21401
www.aahealth.org
www.aasalud.org

Health Matters

Bay Restoration Fund: Step-By-Step Instructions

Please follow these instructions to apply for the Bay Restoration Fund.

STEP 1: SUBMIT A COMPLETED BAY RESTORATION FUND GRANT APPLICATION FOR A NITROGEN-REDUCING PRETREATMENT UNIT

STEP 2: SUBMIT A PERC APPLICATION

You must fill out a Perc Application and schedule a site visit with the Area Sanitarian to determine whether your property is located in the Critical Area and if your septic system is failing. The perc test may or may not be necessary.

STEP 3: INCOME TAX VERIFICATION (APPLIES ONLY TO SITES OUTSIDE OF THE CRITICAL AREA OR SITES INSIDE THE CRITICAL AREA THAT DO NOT HAVE FAILING SEPTIC SYSTEMS)

If Bay Restoration program funds are available, the Department of Health must evaluate your federal income tax records and determine your eligibility for the program. Properties that are not the principle residence of the homeowner will qualify for no more than 25 percent funding of the nitrogen-reducing unit. A table showing Bay Restoration funding levels for ranges of taxable income is available at www.aahealth.org/brf/ or on our Bay Restoration Fund Income Eligibility Health Matters factsheet. A copy of the federal income tax records for each individual listed on the deed must be provided to the Department of Health for review and qualification for the program.

STEP 4: SELECT A BEST AVAILABLE TECHNOLOGY (BAT) UNIT FROM THE FIXED COST SYSTEM OR OBTAIN THREE WRITTEN BIDS FOR INSTALLATION OF A BAT UNIT

***Option 1**: Fixed Cost System*

Choose one of the two BAT units listed below. The property owner must contact the vendor, enter into a contract for the installation of a unit and submit a copy of the contract to the Anne Arundel County Department of Health, Sanitary Engineering Program, 3 Harry S. Truman Parkway, Annapolis MD 21041.

HOOT 600 BNR
Local Vendor: Mayer Bros. Inc., 410-796-1434
BAT Unit Price: $13,000 (100 percent funding)

NORWECO SINGULAIR (plastic or concrete tank)
Local Vendor: Back River Pre-Cast, LLC, 410-833-3394
BAT Unit Price: $11,533 (100 percent funding)

***Option 2**: Owner Selects BAT Unit and Obtains Three Written Bids*

The property owner may secure three written bids from a list of pre-qualified, licensed disposal system contractors. Property owners are encouraged to research the different units and select a BAT unit most suitable for their individual and household needs.

Written bids must itemize the purchase cost of the BAT unit, the cost of BAT installation, and the cost of a five-year operation and maintenance service contract. If the homeowner does not qualify for 100 percent funding, the bids must stipulate the amount to be paid by the homeowner and the amount to be paid by the County. All written bids must be submitted to the Department of Health. The Department reserves the right to evaluate and reject any written bid based on the purchase, installation, and five-year operation and maintenance cost of the BAT unit. If the property owner chooses a contractor other than the low-bid contractor, the property owner is responsible for paying the cost difference between the two bids.

-please turn over-

The property owner must indicate which BRF contractor was selected by signing that contractor's written bid. Written bids must be submitted to the Anne Arundel County Department of Health, Sanitary Engineering Program, 3 Harry S. Truman Parkway, Annapolis, MD 21401.

STEP 5: SIGN AND RETURN THE BAY RESTORATION FUND GRANT AGREEMENT

A Bay Restoration Fund Grant Agreement will be mailed to you once the Department of Health reviews the written bids. The agreement is a legal document that is recorded in Anne Arundel County Land Records against your property deed. The agreement must be signed in front of Department of Health staff or a notary public and must be returned within 30 days of receiving written bids.

STEP 6: WAIT FOR CERTIFICATE OF QUALIFICATION

Bay Restoration grant funds are administered on a first come, first served basis. Individual grants are awarded based on an applicant's meeting the program's eligibility requirements and the availability of BRF funds. A waiting list will be created if the number of eligible projects exceeds the availability of funds.

Based on the availability of funds, the Department of Health will send you and your contractor a Certificate of Qualification. The Certificate of Qualification certifies that Bay Restoration funds are available for the installation of a BAT unit on your property. The BAT unit must be installed within 45 days of receiving the Certificate of Qualification. Extensions are granted at the discretion of the Department of Health and are subject to the availability of BRF funds.

STEP 7: SCHEDULE INSTALLATION OF THE BAT UNIT

Schedule the installation of the BAT unit with the selected contractor. Your contractor is responsible for applying for a County permit to install the BAT unit and notifying the Department of Health 48 hours prior to BAT installation. The grant does not cover the cost of the County permit fee, which is the responsibility of the property owner. The Department of Health and a manufacturer representative will inspect the BAT unit to ensure it complies with manufacturer and County requirements.

STEP 8: VENDOR OR CONTRACTOR PAYMENT

The selected contractor or approved vendor must submit an invoice to the Department of Health for payment. Payment will be made to the approved contractor or vendor based on the grant award.

For more information, contact:

Sanitary Engineering Program
Bureau of Environmental Health
Anne Arundel County Department of Health
3 Harry S. Truman Parkway
Annapolis, Maryland 21401
410-222-7324

The services and facilities of the Anne Arundel County Department of Health are available to all without regard to race, color, religion, political affiliation or opinion, national origin, age, sex, sexual orientation or disability. *1,000 8/12*

ANNE ARUNDEL COUNTY
MARYLAND

Department of Health
J. Howard Beard
Health Services Building
3 Harry S. Truman Parkway
Annapolis, MD 21401
www.aahealth.org
www.aasalud.org

Edward Van Oeveren, M.D., M.P.H.
Health Officer

Health Matters

Senate Bill 554
Chesapeake Bay Nitrogen Reduction Act of 2009

New Requirements for the Repair, Replacement and Newly Constructed Septic Systems in the Critical Area

What is Senate Bill (SB) 554?

SB 554 is the Chesapeake Bay Nitrogen Reduction Act of 2009 (the Act) that establishes new requirements for the repair, replacement or new installation of septic systems within the Critical Area. The Act requires the installation of a nitrogen-reducing unit (NRU) in place of a septic tank.

What properties are affected by the Act?

The Act applies to the installation of septic tanks, drain fields, drywells, sand mound systems, pressure dosed beds and any other type of on-site sewage disposal system on a property in the Critical Area. This includes replacement of septic tanks on properties in the Critical Area. If any portion of a property falls within the Critical Area, the property must comply with the Act. Properties located outside the Critical Area and the repair or replacement of piping in the Critical Area due to clogged or broken sewer lines are not required to comply with the Act.

When do the new requirements take effect?

The new requirements take effect on October 1, 2009.

What type of nitrogen-reducing unit is necessary to comply with the Act?

The Act establishes Best Available Technology (BAT) for removing nitrogen as the type of NRU acceptable for complying with the Act. Only pre-qualified licensed disposal system contractors may install an NRU.

What information must I submit to install an NRU?

A site plan of the property and a completed Perc Application with appropriate fees must be submitted to:

Permit Application Center
2664 Riva Road
Annapolis, Maryland 21401

Anne Arundel County Government Office Building
7320 Ritchie Highway
Glen Burnie, Maryland 21061

Online Registration is available at www.aahealth.org, Environmental Health, Sanitary Engineering Program.

-Please turn over-

What programs are available to assist property owners with the cost of installing an NRU?

The Bay Restoration Fund provides grants to assist property owners with the cost of installing the nitrogen-reducing unit. If sufficient funds are available, applications are processed on a first come, first served basis with priority given to the repair of failing septic systems in the Critical Area.

The Linked Deposit Loan Program discounts the loan interest rate to install a nitrogen-reducing system or to repair or replace a failed septic system.

The Well and Septic System Assistance Program helps income-qualified applicants repair or replace failing septic systems.

More information on the above programs can be found by at www.aahealth.org or by contacting the Sanitary Engineering Program at 410-222-7193.

What other conditions apply to the installation of an NRU?

Each property owner is required to enter into an agreement, which specifies the maintenance responsibilities of the NRU and the square footage and the number of bedrooms of the dwelling. In addition, the property owner is required to maintain an operation and maintenance (O&M) service contract with a certified service provider for the life of the NRU. The certified service provider is required to submit annual reports on the inspection, operation and maintenance of the NRU to the Department of Health.

Where can I receive additional information?

For more information, contact:
Anne Arundel County Department of Health
Environmental Health
Sanitary Engineering Program
3 Harry S. Truman Parkway
Annapolis, MD 21401
410-222-7193

The services and facilities of the Anne Arundel County Department of Health are available to all without regard to race, color, religion, political affiliation or opinion, national origin, age, sex, sexual orientation or disability. 1,000 9/09

ANNE ARUNDEL COUNTY
MARYLAND

Department of Health
J. Howard Beard
Health Services Building
3 Harry S. Truman Parkway
Annapolis, MD 21401
www.aahealth.org
www.aasalud.org

Health Matters

Bay Restoration Fund (BRF): Income Eligibility Criteria

How much BRF assistance is available?

The repair of a failing system **in the Critical Area** (all land within 1,000 feet of the high water line of tidal waters of the Chesapeake Bay and its tributaries) is eligible for 100 percent assistance of the Best Available Technology (BAT) unit purchase, installation and five-year maintenance cost, regardless of the homeowner's income. After December 31, 2012, failing septic systems in the Critical Area will be subject to income and occupancy-based funding.

For all other properties, funding will be based on income and occupancy as shown in the table below.

Bay Restoration Fund Grant Award Guidelines for Homeowner-Occupied Properties Outside the Critical Area or in the Critical Area But Not Failing

% of Grant Award	2011 Taxable Income (Single)		2011 Taxable Income (Married)		2011 Taxable Income (Married Filing Separately)		2011 Taxable Income (Head of Household)	
	Over	Up to	Over	Up to	Over	Up to	Over	Up to
100	$0	$83,600	$0	$139,350	$0	$69,675	$0	$119,400
75	$83,600	$174,400	$139,350	$212,300	$69,675	$106,150	$119,400	$193,350
50	$174,400	$379,150	$212,300	$379,150	$106,150	$189,575	$193,350	$379,150
25	$379,150		$379,150		$189,575		$379,150	

The system repair or upgrade of a **commercial, rental or seasonally occupied property not certified to be a failing system in the Critical Area** will only be eligible for a grant not to exceed 25 percent.

Families with low or moderate incomes can apply for additional assistance to help with drainfield, dry well and other septic system replacement and repair costs.

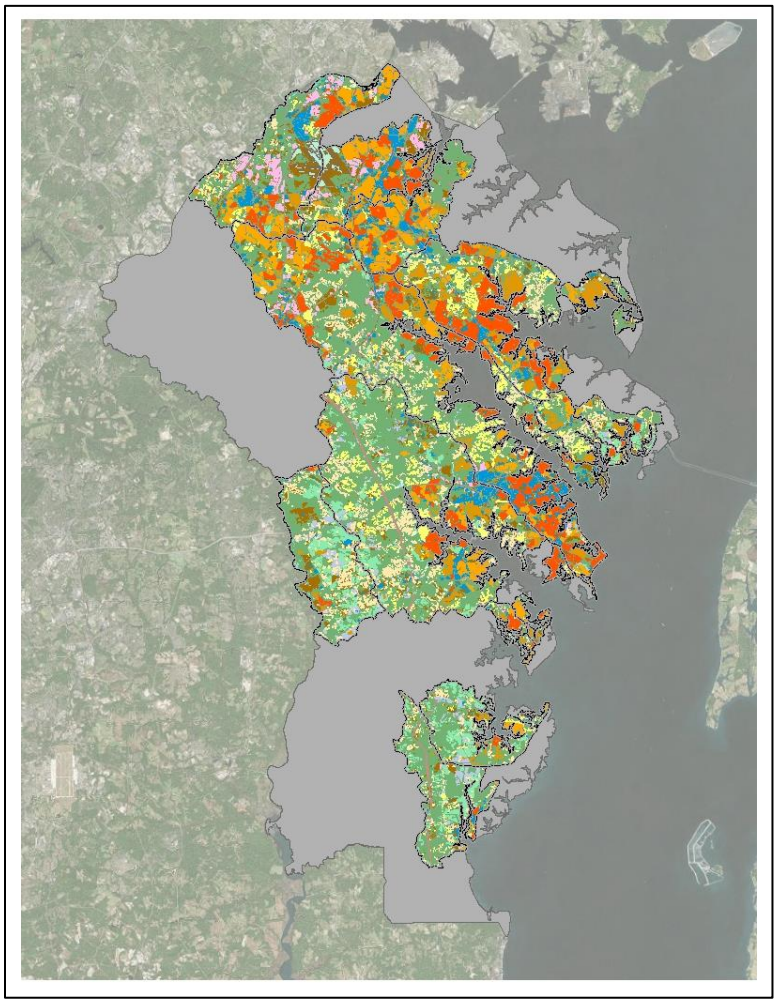
For more information, contact:

Sanitary Engineering Program
Bureau of Environmental Health
Anne Arundel County Department of Health
3 Harry S. Truman Parkway
Annapolis, Maryland 21401
410-222-7193

The services and facilities of the Anne Arundel County Department of Health are available to all without regard to race, color, religion, political affiliation or opinion, national origin, age, sex, sexual orientation or disability. *1,000 8/12*

Total Maximum Daily Load Restoration Plan for Bacteria

Draft Report



Prepared for:

Anne Arundel County
Department of Public Works
Watershed Protection and Restoration Services Division
2664 Riva Road
Annapolis, Maryland 21401

February 2015

URS ESA JOINT VENTURE

ACRONYMS AND ABBREVIATIONS v

EXECUTIVE SUMMARY 1

SECTION ONE: INTRODUCTION 1-1

1.1 Anne Arundel County Bacteria TMDLs 1-2
1.2 Definition and Requirements of a TMDL Restoration Plan 1-5
1.3 Four Categories of Bacteria Sources 1-6

SECTION TWO: EXISTING CONDITIONS 2-1

2.1 Magothy River Watershed – Magothy River Mainstem, Forked Creek, and Tar Cove 2-4
2.2 Patapsco River Lower North Branch 2-6
2.3 Patapsco River – Furnace Creek and Marley Creek 2-8
2.4 Patuxent River Upper 2-10
2.5 Rhode River – Bear Neck Creek and Cadle Creek 2-12
2.6 Severn River Watershed – Severn River Mainstem, Mill Creek, and Whitehall / Meredith Creeks 2-14
2.7 South River Watershed – South River Mainstem, Duvall Creek, Ramsey Lake, and Selby Bay 2-16
2.8 West Chesapeake Bay – Tracy and Rockhold Creeks 2-18
2.9 West River Watershed – West River Mainstem and Parish Creek 2-20
2.10 Development of Existing Conditions WTM 2-22
2.11 Impact of TMDL Restoration Plan to Tier II Waters 2-22

SECTION THREE: RESTORATION PLAN GOALS 3-1

3.1 TMDL Reduction Goals for Bacteria 3-1
3.2 Timeline for Meeting Bacteria TMDL 3-2

SECTION FOUR: RESTORATION STRATEGIES 4-1

4.1 Proposed Strategies 4-2
4.1.1 Tier A Strategies 4-2
4.1.2 Tier B Strategies 4-6
4.2 Implementation Costs of Proposed Restoration Strategies 4-12
4.3 Pollutant Load Reductions 4-13
4.3.1 Estimation of Load Reductions from Prior Management Measures 4-13
4.3.2 Estimation of Load Reductions for Proposed Strategies 4-15
4.4 Proposed Strategies with Largest Impact and Recommended Prioritization of Strategies 4-29

SECTION FIVE: PUBLIC AND STAKEHOLDER PARTICIPATION 5-1

5.1 Current Outreach Programs 5-1
5.2 Potential Challenges and Solutions to Improve the County's Current Outreach Programs 5-2
5.3 Potential Outreach Programs 5-4

SECTION SIX: FUNDING SOURCES AND TECHNICAL ASSISTANCE 6-1

6.1 Funding Sources 6-1

6.2 Technical Assistance 6-4

SECTION SEVEN: IMPLEMENTATION SCHEDULE AND MILESTONES 7-1

SECTION EIGHT: METHODS FOR EVALUATING PROGRESS 8-1

SECTION NINE: REFERENCES 9-1

List of Tables

Table 1-1: U.S. Environmental Protection Agency-Approved Bacteria TMDLs in Anne Arundel County 1-2

Table 2-1: Existing Land Use in Anne Arundel County's Bacteria TMDL Watersheds 2-1

Table 2-2: Anne Arundel County BMPs and Pollutant Removal Efficiencies 2-2

Table 2-3: Bacteria Source Distribution in the Magothy River Watershed 2-4

Table 2-4: Number of Existing BMPs in the Magothy River Watershed 2-4

Table 2-5: Bacteria Source Distribution in the Patapsco River Lower North Branch Watershed 2-6

Table 2-6: Number of Existing BMPs in the Patapsco River Lower North Branch Watershed 2-6

Table 2-7: Bacteria Source Distribution in the Furnace Creek and Marley Creek Watersheds 2-8

Table 2-8: Number of Existing BMPs in the Furnace Creek and Marley Creek Watersheds 2-8

Table 2-9: Bacteria Source Distribution in the Patuxent River Upper Watershed 2-10

Table 2-10: Number of Existing BMPs in the Patuxent River Upper Watershed 2-11

Table 2-11: Bacteria Source Distribution in the Rhode River Watershed 2-12

Table 2-12: Number of Existing BMPs in the Rhode River Watershed 2-13

Table 2-13: Bacteria Source Distribution in the Severn River Mainstem, Mill Creek, and Whitehall/Meredith Creek Watersheds 2-14

Table 2-14: Number of Existing BMPs in the Severn River Mainstem, Mill Creek, and Whitehall/Meredith Creek Watersheds 2-15

Table 2-15: Bacteria Source Distribution in the South River Mainstem, Ramsey Lake, Selby Bay, and Duvall Creek Watersheds 2-16

Table 2-16: Number of Existing BMPs in the South River Mainstem, Ramsey Lake, Selby Bay, and Duvall Creek Watersheds 2-17

Table 2-17: Bacteria Source Distribution in the Tracy and Rockhold Creeks Watershed 2-18

Table 2-18: Number of Existing BMPs in the Tracy and Rockhold Creeks Watershed 2-18

Table 2-19: Bacteria Source Distribution in the West River Mainstem and Parish Creek Watersheds 2-20

Table 2-20: Number of Existing BMPs in the West River Mainstem and Parish Creek Watersheds 2-20

Table 3-1: TMDL Reduction Goals for Bacteria from MDE's TMDL Reports 3-2
Table 4-1: List of Sanitary Sewer Overflows Occurring in Bacteria TMDL Watersheds from 2001 to 2014 4-3
Table 4-2: List of Active Sewage Pump Station Upgrade Projects in 12 of the 19 TMDL Watersheds 4-4
Table 4-3: Number of Septic Systems Selected for Retirement as Identified by the County Department of Public Works 4-6
Table 4-4: Number of Currently Unmanaged Impervious Acres[1] in Need of Treatment to Reach 20% Restoration Goal in NPDES Permit 4-8
Table 4-5: Number of Pre-2002 Dry Ponds Proposed for Retrofit in Each TMDL Watershed 4-9
Table 4-6: Estimates of Load Reductions from Prior Management Measures and Corresponding Adjustments to TMDL Required Percent Reductions 4-14
Table 4-7A: Estimated Load Reductions for Proposed Strategies in the Magothy Mainstem, Forked Creek, and Tar Cove Watersheds 4-17
Table 4-7B: Estimated Load Reductions for Proposed Strategies in the Patapsco River Lower North Branch Watershed 4-19
Table 4-7C: Estimated Load Reductions for Proposed Strategies in the Furnace Creek and Marley Creek Watersheds 4-20
Table 4-7D: Estimated Load Reductions for Proposed Strategies in the Patuxent River Upper Watershed. Note that a Livestock Fencing Strategy is included since this Watershed Contains Some Agricultural Land. 4-21
Table 4-7E: Estimated Load Reductions for Proposed Strategies in the Bear Neck and Cadle Creek Watersheds 4-22
Table 4-7F: Estimated Load Reductions for Proposed Strategies in the Severn River Mainstem, Mill Creek, and Whitehall-Meredith Creek Watersheds 4-23
Table 4-7G: Estimated Load Reductions for Proposed Strategies in the South River Mainstem, Duvall Creek, Ramsey Lake, and Selby Bay Watersheds 4-25
Table 4-7H: Estimated Load Reductions for Proposed Strategies in the Tracy and Rockhold Creek Watershed 4-27
Table 4-7I: Estimated Load Reductions for Proposed Strategies in the West River Mainstem and Parish Creek Watersheds. Note that a Livestock Fencing Strategy is included in the West River Mainstem Watershed Since this Watershed Contains Some Agricultural Land. 4-28
Table 4-8: Priority of Proposed Strategies 4-31
Table 5-1: Available County Outreach Programs/Materials that Promote Awareness Related to Bacteria Impairments 5-2
Table 5-2: Challenges and Solutions to Public and Stakeholder Participation in the Watershed Restoration Process 5-3
Table 6-1: Potential Funding Sources for Bacteria TMDL Implementation 6-1
Table 7-1: Bacteria TMDL Implementation Schedule by Milestone Year 7-1

Table 8-1: Potential Methods to Evaluate Progress 8-1
Table A-1: Land Use Classification and EMCs A-2
Table A-2: WTM Pollutant Concentration in Wastewater A-3
Table A-3: Bacteria Pollutant Removal Efficiency of OSDSs A-4
Table A-4: Pollutant Concentrations for Illicit Business Connections A-5
Table A-5: Livestock Census Data for Anne Arundel County (USDA, 2012) and Associated Bacteria Loads (MDE) A-6
Table A-6: Permitted Discharges of Non-stormwater Point Sources in the Study Watersheds A-7
Table A-7: Effectiveness of Media for Pet Waste Education Program A-8
Table A-8: Anne Arundel County BMPs and Pollutant Removal Efficiencies A-9
Table A-9: Baseline Bacteria Loads Contributing to Surface Water for Study Watersheds A-11
Table A-10: Septic Systems Identified by the County to Be Connected to a Public Sewer System A-13
Table A-11: Septic Systems Identified by the County to Be Connected to a Public Sewer System A-15
Table A-12: List of SPS Upgrades in the TMDL Watersheds A-16
Table A-13: Proposed Urban Stormwater Retrofits in the TMDL Watersheds A-18
Table A-14: Bacteria Load Reductions from Proposed Tier A and Tier B Strategies that Were Quantified Using WTM A-19

List of Figures

Figure 1-1: Location of Bacteria TMDL Watersheds 1-4
Figure 2-1: Land Use Map of Magothy River Watershed 2-5
Figure 2-2: Land Use Map of the Patapsco River Lower North Branch Watershed 2-7
Figure 2-3: Land Use Map of the Furnace Creek and Marley Creek Watersheds 2-9
Figure 2-4: Land Use Map of the Patuxent River Upper Watershed 2-11
Figure 2-5: Land Use Map of the Bear Neck Creek and Cadle Creek Watersheds 2-13
Figure 2-6: Land Use Map of the Severn River Mainstem, Mill Creek, and Whitehall-Meredith Creeks Watersheds 2-15
Figure 2-7: Land Use Map of the South River Mainstem, Duvall Creek, Ramsey Lake, and Selby Bay Watersheds 2-17
Figure 2-8: Land Use Map of the Tracy and Rockhold Creeks Watershed 2-19
Figure 2-9: Land Use Map of the West River Mainstem and Parish Creek Watersheds 2-21

List of Appendices

Appendix A Watershed Treatment Model Methodology

BMP	best management practice
BRF	Bay Restoration Fund
CIP	Capital Improvement Plan
CMOM	Capacity, Management, Operations, and Maintenance
COMAR	Code of Maryland Regulations
CWA	Clean Water Act
CWP	Center for Watershed Protection
DNR	Department of Natural Resources
DPW	Department of Public Works
EMCs	event mean concentrations
EPA	Environmental Protection Agency
EQIP	Environmental Quality Incentives Program
ESD	environmental site design
GIS	Geographic Information System
IDDE	Illicit Discharge Detection and Elimination
LA	Load Allocation
LNB	Lower North Branch
MACS	Maryland Agricultural Water Quality Cost-Share
MDE	Maryland Department of the Environment
ml	milliliters
MPN	Most Probable Number
MS4	Municipal Separate Storm Sewer System
NPDES	National Pollutant Discharge Elimination System
NPS	Nonpoint source
NRU	Nitrogen Removal Unit
OSDS	Onsite sewage disposal system (septic system)
PSA	Public Service Announcement
SPS	Sewage Pump Station
SPSC	Step Pool Storm Conveyance
SSO	sanitary sewer overflow
SW	stormwater
SWM	stormwater management

TMDLs	Total Maximum Daily Loads
TN	total nitrogen
TP	total phosphorus
TSS	total suspended solids
USDA	U.S. Department of Agriculture
WIP	Watershed Implementation Plan
WLA	wasteload allocation
WRF	Water Reclamation Facility
WTM	Watershed Treatment Model

EXECUTIVE SUMMARY

The Anne Arundel County Department of Public Works (DPW) Watershed Protection and Restoration Program is developing restoration plans to address local water quality impairments for watersheds with an approved Total Maximum Daily Load (TMDL) issued by the Maryland Department of the Environment (MDE) and approved by the U.S. Environmental Protection Agency (EPA). As defined by EPA, a TMDL sets a maximum load of a specific pollutant or stressor that a water body can assimilate and still meet water quality standards for its designated use.

There are currently 19 approved bacteria TMDLs associated with Anne Arundel County waterways. Fecal coliform is the impairing pollutant for 15 of the TMDLs, while E. coli and Enterococci are identified as the impairing pollutant for two TMDLs each. These bacteria are indicator organisms that suggest a potential for pathogenic bacteria to be present in the waterways. Anne Arundel County, via the requirements of its National Pollutant Discharge Elimination System (NPDES) Municipal Separate Storm Sewer System (MS4) permit (11-DP-3316, MD0068306), has developed this plan to address the Stormwater Waste Load Allocation (SW-WLA) associated with each of the 19 approved bacteria TMDLs.

This report presents a Bacteria TMDL Restoration Plan that identifies potential strategies for reducing bacteria to achieve the TMDL goals in each of the watersheds. MDE developed most of the TMDLs in the early 2000s. Based on the analyses conducted as part of the TMDL development, pet waste was identified as a primary source of bacteria in the watersheds, followed by wildlife, livestock, and human sources.

This restoration plan estimates bacteria load reductions for identified strategies based on modeling and literature review. The strategies were broken down into Tier A strategies (i.e., strategies that treat human sources) and Tier B strategies (i.e., strategies that treat non-human sources). Of the Tier B strategies, pet waste education was found to achieve the greatest load reductions for the least cost.

This Bacteria TMDL Restoration Plan recommends implementing a multi-media-based pet waste education program including increasing educational signage on public lands, adding pet waste stations on public lands, providing grant-funding for pet waste stations in targeted residential communities, and improving management of pet waste at existing dog parks. It is important to prioritize the target areas for the pet waste program because certain watersheds need more intensive outreach than others to reach the required TMDL load reductions.

Other non-structural Tier B strategies such as riparian buffer improvements and possibly localized waterfowl and wildlife management in specific areas (e.g., ponds, public parks, golf courses, campuses) were highly cost-effective, although the load reductions of these strategies may be difficult to measure. Stormwater retrofit projects such as conversion of dry ponds to shallow wetland/marsh filtering systems and step pool storm conveyance (SPSC) retrofits at impaired stream channels and outfalls (as recommended by the County's Chesapeake Bay

TMDL Phase II Watershed Implementation Plan [Phase II WIP]), are also considered Tier B strategies. As the County identifies and confirms dry pond drainage area and retrofit opportunities, this strategy will continue to be implemented.

The County's NPDES MS4 Permit (11-DP-3316, MD0068306) also requires that the County undertake efforts to restore 20 percent of the currently unmanaged impervious cover, within the County's MS4 area, before the end of the 5-year permit term. The County's Phase II WIP suggests this will be accomplished by implementing restoration practices such as SPSCs or other retrofit BMPs with high pollutant removal efficiency. Modeling this implementation strategy resulted in limited load reductions because managing only 20 percent of impervious area is not sufficient to mitigate bacteria loads from such highly urbanized watersheds. Lastly, livestock fencing was identified as a useful cost-effective tool for agricultural pastures that support livestock populations; however, there are only two TMDL watersheds where this strategy would be applicable.

Tier A strategies are a priority, as human bacteria sources pose a greater risk to public health than non-human sources. Implementation of Tier A strategies to treat human sources of bacteria are generally less cost-effective. These strategies primarily involve large projects in the County's Capital Improvement Program (e.g., wastewater capital improvement projects or septic system retirement). Estimated costs for these types of projects can be in the millions and result in relatively small bacteria load reductions.

Overall, it is clear that a suite of strategies should be implemented in combination to achieve bacteria TMDL SW-WLA goals in each watershed. For many of the bacteria TMDL SW-WLAs, all of the strategies are needed, and where load reduction gaps still exist, it is recommended to prioritize pet waste education in high pet-waste areas. There were no meaningful differences in the strategies needed from one watershed to the next, with the slight exception that livestock fencing is applicable in the two watersheds with agricultural areas.

SECTION ONE: INTRODUCTION

All natural water bodies contain bacteria of some kind, but in excessive amounts, bacteria can have ecological impacts and cause potentially serious health problems in humans. Most bacteria are beneficial to the ecosystem because they break down organic matter, help to recycle nutrients and carbon, and serve as part of the food chain. Certain types of bacteria, however, are pathogenic and may cause waterborne illnesses in humans.

Per Maryland State regulations, the Anne Arundel County (County) Health Department monitors more than 80 County beaches for Enterococci bacteria, a type of fecal bacteria that comes from the intestines of warm-blooded mammals, including humans. Enterococci are an indicator organism, meaning it indicates the potential presence of pathogens that cannot be directly measured because they are difficult to isolate and identify in a laboratory (EPA, 2001). While monitoring results establish a general characterization of the water, the data provide no information about the sources of bacteria in the watershed. The sources of bacteria can be difficult to discern, as many factors are involved, (e.g., amount of recent rainfall; presence of waterfowl and wildlife; and location of sewage spills, septic systems, and pet wastes).

The Maryland Department of the Environment (MDE) currently monitors, and has done so for years, various shellfish harvesting waters (Use II waters) in the County for fecal coliform, which is the indicator organism specified in the Code of Maryland Regulations (COMAR) for Use II waters. In the early 2000s, these monitoring data were used to develop the fecal coliform bacteria Total Maximum Daily Loads (TMDLs). Fifteen of the 19 total TMDLs in this TMDL Restoration Plan are for fecal coliform and occur in shellfish harvesting areas. Since the monitoring data at the time of TMDL development indicated that fecal coliform counts periodically exceeded water quality criteria, the 15 fecal coliform TMDL waterways are listed by MDE as restricted for shellfish harvesting. For Use II waters, the median fecal coliform concentration cannot exceed 14 Most Probable Number (MPN) per 100 milliliters (ml), and more than 10 percent of samples taken cannot exceed 43 MPN per 100 ml. For more details, see COMAR 26.08.02.03-3.

In addition to Use II waters, four of the 19 TMDL waterways are in designated Use I waters for public recreational use and are impaired for either E. coli or Enterococci. For Use I waters, the water quality criteria are: for freshwater, the steady state geometric mean cannot exceed 33 counts/100 ml for *Enterococci* and 126 counts/100 ml for *E. coli*; in marine water, the steady state geometric mean cannot exceed 35 counts/100 ml *Enterococci*. Again, for more details, see COMAR 26.08.02.03-3.

To address the concerns about bacteria pollution in the County's waterways, and to meet the requirements of the federal Clean Water Act (CWA), the MDE developed 19 bacteria TMDLs for areas in Anne Arundel County.

A TMDL is a calculation of the maximum amount of a pollutant that a water body can receive and still meet State water quality standards and designated uses. TMDLs are typically developed

using pollutant load models calibrated with monitoring data. The TMDL is made up of two major components. The first component is the wasteload allocation (WLA), which includes point sources such as municipal wastewater treatment plants (called Water Reclamation Facilities, or WRFs,) and National Pollutant Discharge Elimination System (NPDES) Municipal Separate Storm Sewer System (MS4)-regulated urban stormwater (referred to as the SW-WLA). The second component is the Load Allocation (LA), which includes nonpoint sources such as pet waste, wildlife, non-regulated stormwater, and septic systems. Some TMDLs also include a Margin of Safety, which accounts for uncertainty in the TMDL analyses, and a Future Allocation, which accounts for future increases in pollutant loads due to population growth and/or land use changes. However, these are not applicable to the County's bacteria TMDLs because they are built into the TMDL analyses. In summary, a TMDL can be expressed as follows:

$$TMDL = \text{total allowable load to waterway} = \text{point sources} + \text{nonpoint sources}$$
$$= WLA + LA$$

1.1 ANNE ARUNDEL COUNTY BACTERIA TMDLS

The U.S. Environmental Protection Agency (EPA)-approved bacteria TMDLs are listed in Table 1-1 and shown in Figure 1-1 below. The table lists TMDL watersheds and subwatersheds, along with each waterway's State-designated use. Throughout this plan, the TMDLs are presented in alphabetical order of watershed.

Table 1-1: U.S. Environmental Protection Agency-Approved Bacteria TMDLs in Anne Arundel County

TMDL Watershed	TMDL Subwatershed	Impairment	Designated Use[1]	Jurisdiction
Magothy River	Mainstem	Fecal Coliform	Use II	Anne Arundel County
	Forked Creek	Fecal Coliform	Use II	Anne Arundel County
	Tar Cove	Fecal Coliform	Use II	Anne Arundel County
Patapsco River	Furnace Creek	Enterococci	Use I	Anne Arundel County
	Marley Creek	Enterococci	Use I	Anne Arundel County
Patapsco River Lower North Branch	Patapsco River Lower North Branch	E. Coli[2]	Use I	Anne Arundel, Baltimore, Carroll, and Howard Counties, and Baltimore City
Patuxent River Upper	Patuxent River Upper	E. Coli	Use I	Anne Arundel and Prince George's Counties

TMDL Watershed	TMDL Subwatershed	Impairment	Designated Use[1]	Jurisdiction
Rhode River	Bear Neck Creek	Fecal Coliform	Use II	Anne Arundel County
	Cadle Creek	Fecal Coliform	Use II	Anne Arundel County
Severn River	Mainstem	Fecal Coliform	Use II	Anne Arundel County
	Mill Creek	Fecal Coliform	Use II	Anne Arundel County
	Whitehall and Meredith Creeks	Fecal Coliform	Use II	Anne Arundel County
South River	Mainstem	Fecal Coliform	Use II	Anne Arundel County
	Duvall Creek	Fecal Coliform	Use II	Anne Arundel County
	Ramsey Lake	Fecal Coliform	Use II	Anne Arundel County
	Selby Bay	Fecal Coliform	Use II	Anne Arundel County
West Chesapeake Bay Mainstem	Tracy and Rockhold Creeks	Fecal Coliform	Use II	Anne Arundel County
West River	Mainstem	Fecal Coliform	Use II	Anne Arundel County
	Parish Creek	Fecal Coliform	Use II	Anne Arundel County

1-Use I water = Water Contact Recreation, and Protection of Nontidal Warmwater Aquatic Life; Use II water = Support of Estuarine and Marine Aquatic Life and Shellfish Harvesting
2-Multiple bacteria indicators were used in the TMDL analyses; however, the TMDL is written for E. coli.



Figure 1-1: Location of Bacteria TMDL Watersheds

MDE requires the County to develop an SW-WLA Restoration Plan and it is enforceable, under the County's NPDES MS4 permit. All but two of the subject TMDLs (i.e., Patapsco River Lower North Branch and Patuxent River Upper) are located entirely within the County.

1.2 DEFINITION AND REQUIREMENTS OF A TMDL RESTORATION PLAN

A TMDL Restoration Plan is a planning-level document that identifies water quality-based strategies that a local jurisdiction may implement to control existing point and nonpoint pollutant sources in a degraded watershed. MDE allows flexibility in how local jurisdictions develop their TMDL Restoration Plans, provided that the approach is reasonable and that the Plan identifies management actions and practices that, when implemented, will restore the State water quality standards and designated uses of the impaired waterway (MDE, 2014).

The County's NPDES MS4 permit (Part IV.E.2.B) requires the development of a TMDL Restoration Plan for each SW-WLA approved by EPA. Once approved by MDE, the Restoration Plan is enforceable under the NPDES MS4 permit.

Pertinent to the development of a TMDL Restoration Plan is acknowledgement that other pollution source sectors such as agriculture or septic systems may contribute to the need for the TMDL. Although the NPDES MS4 permit requires only the SW-WLA to be addressed in the Restoration Plan, if greater load reductions can be achieved for less cost from another sector (i.e., upgrading of septic systems), the County has the option to pursue these strategies to meet the SW-WLA. Per MDE guidance, "if achieving [TMDL] targets is deemed to be technically infeasible via traditional stormwater controls, the jurisdictions are encouraged to offer alternative options to MDE for consideration" (MDE, 2014c). One of the objectives of this TMDL Restoration Plan is to provide the County with a wide array of strategies that can be implemented in all source sectors to maximize the potential for load reductions and achieve TMDL water quality goals.

At the federal level, EPA identifies nine required elements for an approvable watershed Restoration Plan (EPA, 2013b). These elements are commonly called the "a through i criteria." While these elements are specific to CWA Section 319 nonpoint source grants, they are strongly recommended by EPA and others for watershed restoration plans because they provide the basic framework needed for effective watershed planning and implementation (MDE, 2006; EPA, 2013a; EPA, 2013b). This Bacteria TMDL Restoration Plan is prepared in accordance with the EPA's nine elements for watershed planning. The nine elements are listed below along with the corresponding section in this document. For further explanation of the elements, see EPA (2013b).

a. Identification of causes and sources of bacteria (Section 2)

c. Description of management measures needed (Section 4.1)

b. An estimate of the load reductions expected from management measures (Section 4.3)

e. Information and education activities to enhance public understanding of the Restoration Plan and encourage the public's participation (Section 5)

d. Financial and technical assistance needed to implement the above management measures (Section 6)

f. Schedule for implementing the above management measures (Section 7)

f. Description of interim measurable milestones to determine whether the above management measures are being implemented (Section 7)

g. Set of indicators to evaluate progress toward water quality standards (Section 8)

h. Monitoring program to evaluate effectiveness of implementation efforts (Section 8)

1.3 FOUR CATEGORIES OF BACTERIA SOURCES

MDE's TMDL analyses identify four categories of bacteria sources in each of the 19 TMDL watersheds. The four categories are: pet waste, wildlife, humans, and livestock. During the development of the TMDLs, MDE quantified the contribution for each of these categories to the observed impairment in the waterway. Among all 19 TMDL watersheds, the average percent contribution for each category was determined to be:

- pet waste – 46.0 percent
- wildlife – 34.5 percent
- human – 6.9 percent
- livestock – 12.6 percent

Throughout this Restoration Plan, this is referred to as the "bacteria source distribution." The following sections briefly describe and characterize the four primary categories of bacteria.

Pet waste: Pets (mainly domestic dogs) contribute bacteria to a waterway through their waste products that seep into waterways during storms. It is estimated that about 40 percent of households own a dog, and of these, 60 percent pick up their pet's waste (Swann, 1999). Dog waste may contain up to 23 million bacteria per gram, much more than wildlife waste (e.g., deer) and about twice as much as human waste (Van der Wel, 1995; RIDEM, 2014). This is typically due to the diet of many dogs, which contains animal products (unlike herbivores such as deer).

EPA (2012) states that in watersheds up to 20 square miles or 12,800 acres (about the size of the Magothy River Watershed), two to three days of droppings from a population of about 100 dogs may contribute enough bacteria to temporarily close a waterway to swimming and shellfish harvesting. Unlike wildlife waste, pet waste is usually concentrated (e.g., in residential communities where people walk their dogs). Other harmful effects of dog waste include:

- Dog waste may take up to a year to fully decompose; therefore, there is a high likelihood of it being transported to local waterways
- Dog waste may potentially contain parasites and pathogens that remain infectious in contaminated soil and water
- Dog waste is a poor fertilizer and does not enrich the soil (in fact, it can seriously harm soil quality)
- Dog waste attracts rodents and nuisance insects
- Dog waste poses a public health risk, especially to children playing outside

Wildlife: Wildlife contribute bacteria through their waste products that are either directly deposited into streams or on land subject to stormwater runoff. In MDE's TMDL reports, the following are considered to be part of the "wildlife" category: beaver, deer, goose, duck, muskrat, raccoon, and wild turkey. Depending on the analysis method used, some TMDLs also identify foxes, rabbits, swans, squirrels, and herons as potential sources of bacteria. In general, most wildlife is distributed throughout the landscape wherever food and water resources are available. Wildlife diffuse bacteria widely, with the possible exception of Canada geese, which tend to congregate in small open water areas (e.g., a pond). Wildlife may occur in urban or non-urban settings. Some examples of urban wildlife include deer and fox in residential communities, waterfowl in urban ponds, and raccoons feeding on food scraps in poorly managed urban trash receptacles. Non-urban wildlife include beaver, deer, fox, and turkeys in wooded habitats, especially woods with abundant water resources.

Livestock: Livestock in pasture areas are another potential source of bacteria. This category includes farm animals such as horses, chicken, cattle, and sheep. During the grazing season, livestock may deposit their waste products directly into the stream (if the stream is unfenced), or on land near the stream that is subject to runoff. Livestock areas are limited in the County TMDL watersheds, which tend to be urbanized. Although there aren't significant livestock areas in the County TMDL watersheds, according to the Watershed Treatment Model (WTM), dairy cattle are assumed to contribute the highest per-animal loads of bacteria relative to other farm animals. The methodology used for estimating the number of livestock in the County TMDL watershed is included in Appendix A.

Humans: Bacteria from human sources are typically associated with aging urban infrastructure, which is more prone to failure than new infrastructure. Potential sources include sanitary sewer overflows, illicit sewer connections to the MS4, point source discharge from municipal WRFs, and poorly maintained or failing septic systems. Additional sources of human bacteria include homeless encampments, public facilities that lack adequate sanitary services, and marinas without sewage pumpout stations or where boaters do not utilize them. In general, human sources of bacteria pose a much greater public health risk than non-human sources (i.e., pets, wildlife, and livestock) due to the potential for waterborne disease transmission. Therefore,

strategies that reduce or mitigate human bacteria sources are considered a top priority in this Restoration Plan and are discussed in Section 4.

SECTION TWO: EXISTING CONDITIONS

This section describes the existing conditions in each of the 19 watersheds in the County with EPA-approved bacteria TMDLs. The description includes current land use (from the County's 2011 land use and impervious cover Geographic Information System [GIS] data), existing best management practices (BMPs), water resource conditions, and the TMDL bacteria source distribution from MDE's TMDL reports.

Existing land use information from the County GIS for the TMDL watersheds is summarized in Table 2-1. County land uses can be grouped into five broad categories: residential urban, non-residential urban, agricultural, forested, and open water. The residential urban category includes low-density, medium-density, and high-density residential land uses. The non-residential urban category includes urban open space, commercial airport, roadways, and industrial land uses. The agricultural category includes pasture/hay and row crops, and the forest category includes forests and forested wetlands type land uses. Land use maps of the TMDL watersheds are provided in their respective sub-sections (i.e., Sections 2.1 through 2.9).

Table 2-1: Existing Land Use in Anne Arundel County's Bacteria TMDL Watersheds

Bacteria TMDL Watershed	Residential Urban	Non-Residential Urban	Agricultural	Forested	Open Water	Total	Total Acres	Total % Impervious
Magothy River Mainstem	56%	15%	0.03%	28%	1%	100%	14,567	20%
Magothy River/Forked Creek	67%	6%	0.00%	26%	1%	100%	849	20%
Magothy River/Tar Cove	50%	14%	0.00%	34%	1%	100%	2,103	15%
Patapsco River Lower North Branch	26%	39%	0.23%	34%	1%	100%	15,022	27%
Patapsco River/Furnace Creek	34%	48%	0.07%	17%	0%	100%	8,579	34%
Patapsco River/Marley Creek	46%	23%	0.84%	30%	0%	100%	8,737	28%
Patuxent River Upper	24%	17%	19.77%	39%	1%	100%	10,449	6%
Rhode River/Bear Neck Creek	50%	16%	0.45%	33%	2%	100%	880	16%
Rhode River/Cadle Creek	70%	9%	0.00%	20%	2%	100%	320	20%
Severn River Mainstem	44%	19%	1.59%	35%	1%	100%	37,011	19%
Severn River/Mill Creek	47%	15%	3.47%	34%	1%	100%	3,256	14%
Severn River/Whitehall and Meredith Creeks	37%	15%	12.63%	35%	1%	100%	2,945	12%
South River Mainstem	32%	15%	6.08%	46%	1%	100%	33,549	12%
South River/Duvall Creek	76%	14%	0.00%	9%	1%	100%	601	23%
South River/Ramsey Lake	65%	17%	0.00%	17%	2%	100%	384	21%
South River/Selby Bay	62%	12%	2.01%	22%	3%	100%	349	20%
W. Chesapeake Bay/Tracy and Rockhold Creeks	18%	15%	14.68%	52%	1%	100%	7,962	5%

Bacteria TMDL Watershed	Residential Urban	Non-Residential Urban	Agricultural	Forested	Open Water	Total	Total Acres	Total % Impervious
West River Mainstem	25%	8%	20.72%	45%	1%	100%	6,304	6%
West River/Parish Creek	41%	25%	0.00%	31%	4%	100%	324	18%
Average:	**46%**	**18%**	**4%**	**31%**	**1%**			**18%**

Residential Urban = low-density, medium-density, and high-density residential land uses
Non-Residential Urban = urban open space, commercial, airport, roadway, and industrial land uses
Agricultural = pasture/hay and row crops
Forested = forests and forested wetlands

The existing BMPs located in the TMDL watersheds were identified using County GIS data and grouped into the following three performance categories based on their bacteria removal efficiency: non-performing (0 percent bacteria removal efficiency), mid-performing (50 percent removal efficiency), and high-performing (75 percent or greater removal efficiency). Drainage areas for the BMPs were obtained using the County GIS data and available BMP inspection database. The County is in the process of compiling the drainage areas for all the BMPs, and as result, drainage areas and impervious areas associated with some of the BMPs were not populated. The Restoration Plan database will be updated when the information becomes available.

The bacteria removal efficiency for each type of practice was obtained from the County's NPDES MS4 Annual Report (Anne Arundel County, 2013). Based on the information provided in the report, infiltration and filtering practices such as infiltration trenches, bioretention systems, step pool conveyance systems, and environmental site design (ESD) practices have high bacteria removal efficiencies. Stormwater management practices that provide limited water quality management, such as extended detention dry pond and underground storage, are mid-performing BMPs in terms of bacteria removal efficiency. Stormwater management facilities that provide runoff quantity control, such as dry ponds, are categorized under non-performing BMPs and have 0 percent bacteria pollutant removal. Bacteria removal efficiencies are provided in Table 2-2, as well as Table A-8 in Appendix A.

Table 2-2: Anne Arundel County BMPs and Pollutant Removal Efficiencies

BMP Type	Bacteria Pollutant Removal Efficiency (%)	Category
Attenuation Trench	0	non-performing
Bioretention	90	high-performing
Check Dam	0	non-performing
Disconnection of Non-Rooftop Runoff	75	high-performing
Disconnection of Rooftop Runoff	75	high-performing
Dry Pond	0	non-performing

BMP Type	Bacteria Pollutant Removal Efficiency (%)	Category
Dry Wells	75-90	high-performing
Environmental Site Design	75	high-performing
Extended Detention	50	mid-performing
Extended Detention Structure, Dry	50	mid-performing
Extended Detention Structure, Wet	75	high-performing
Forestation on Pervious Urban	0	non-performing
Infiltration Trench with Complete Exfiltration Microbasin	90	high-performing
Infiltration Basin	90	high-performing
Infiltration Berms	75	high-performing
Infiltration Trench	90	high-performing
Infiltration Trench with Partial Exfiltration	90	high-performing
Infiltration Trench with Water Quality Exfiltration	90	high-performing
Landscape Infiltration	75	high-performing
Level Spreader	0	non-performing
Micro Pool	75	high-performing
Micro-Bioretention	75	high-performing
Oil-Grit Separator	50	mid-performing
Other	0	non-performing
Permeable Pavement	75	high-performing
Porous Pavement	90	high-performing
Rain Gardens	75-80	high-performing
Rainwater Harvesting	75	high-performing
Regenerative Step Pool Storm Conveyance	90	high-performing
Sand Filter	0	non-performing
Shallow Marsh	75	high-performing
Sheetflow to Conservation Areas	75	high-performing
Submerged Gravel Wetlands	75	high-performing
Swales	75	high-performing
Underground Storage	50	mid-performing
Vegetated Buffer	80	high-performing
Wet Pond	75	high-performing
Wet Structure	75	high-performing

2.1 MAGOTHY RIVER WATERSHED – MAGOTHY RIVER MAINSTEM, FORKED CREEK, AND TAR COVE

The Magothy River Watershed is located in the northeastern portion of the County near Pasadena and Severna Park. The Magothy River flows southeast into the Chesapeake Bay near Gibson Island. Forked Creek is a small tidal creek located along the south shoreline of the river near its mouth and has a mainstem about 2.5 miles long. Tar Cove is on the opposite shoreline (north), adjacent to Sillery Bay. The primary land use category in all three watersheds is residential (Table 2-1 and Figure 2-1).

The Magothy River Watershed has approved bacteria TMDLs for the Magothy River Mainstem, Forked Creek, and Tar Cove. All three of these waterways are designated as Use II waters and are classified as "restricted" shellfish harvesting areas (MDE, 2005c). The Magothy River Mainstem is restricted only in the upper portion; the lower 12.4 miles of the river is unrestricted and is not considered part of the listed bacteria TMDLs.

The bacteria TMDL source distribution provided in MDE's TMDL report for Magothy River Watershed, as shown in Table 2-3, identifies pet waste as the largest bacteria source in all three watersheds: Magothy River Mainstem, Forked Creek, and Tar Cove (MDE, 2005e).

Table 2-3: Bacteria Source Distribution in the Magothy River Watershed

Bacteria TMDL Watershed	Percent of Fecal Coliform Source Loads				Total
	Pets	Wildlife	Livestock	Human	
Magothy River Mainstem	65.2%	22.0%	10.8%	2.0%	100%
Magothy River/Forked Creek	85.8%	13.2%	0.4%	0.6%	100%
Magothy River/Tar Cove	54.4%	32.6%	9.9%	3.1%	100%

The Magothy River Mainstem has 1,294 existing BMPs, Tar Cove has 132, and Forked Creek has 86, most of which are high-performing BMPs with 75 percent or greater bacteria removal efficiency (Table 2-4).

Table 2-4: Number of Existing BMPs in the Magothy River Watershed

Bacteria TMDL Watershed	Non-Performing BMPs	Mid-Performing BMPs	High-Performing BMPs	No. (%) of BMPs Without Drainage Area Data	Total
Magothy River Mainstem	62	58	1119	55 (4%)	1,294
Magothy River/Forked Creek	2	0	83	1 (1%)	86
Magothy River/Tar Cove	5	3	122	2 (2%)	132

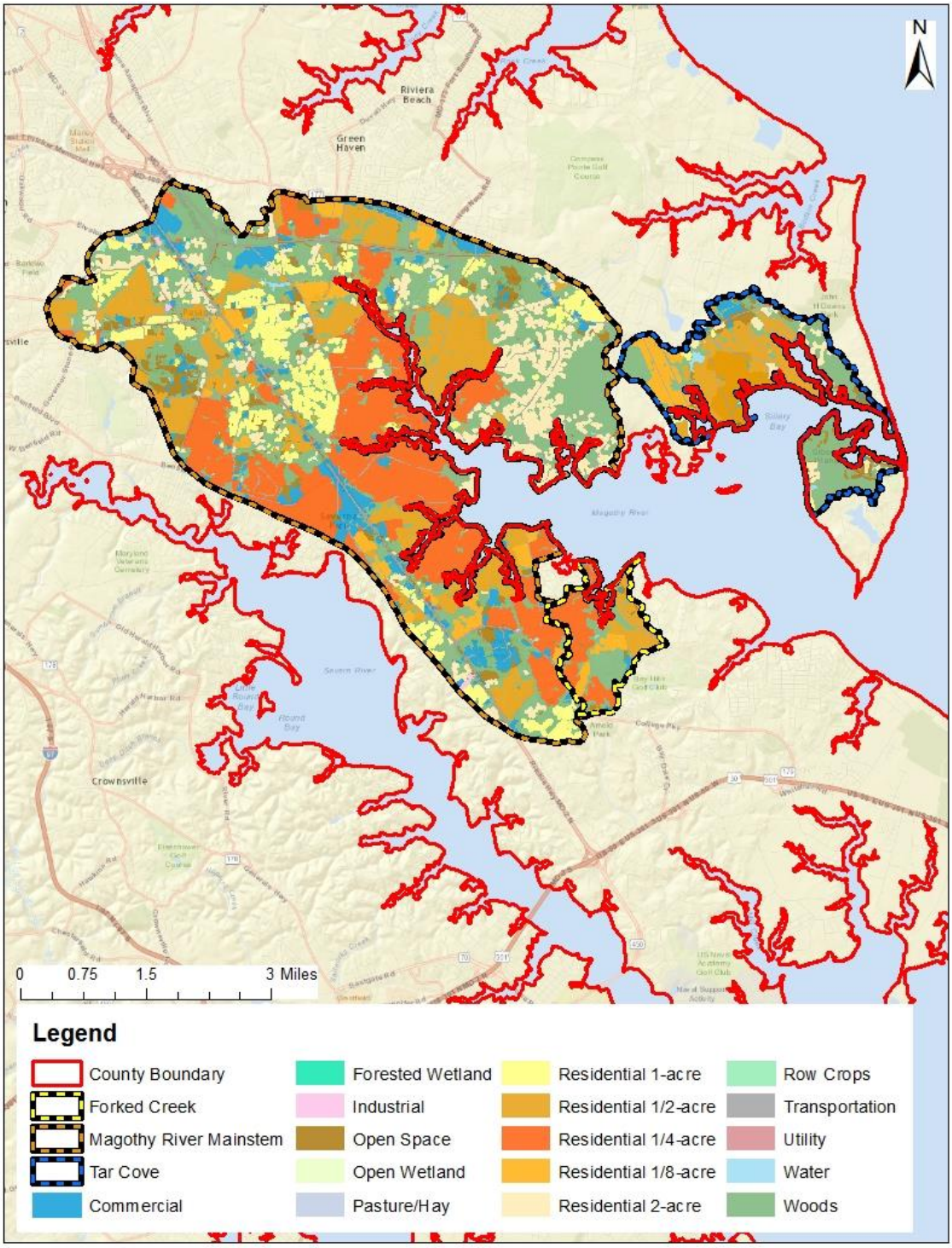


Figure 2-1: Land Use Map of Magothy River Watershed

2.2 PATAPSCO RIVER LOWER NORTH BRANCH

The Patapsco River Lower North Branch (LNB) forms the northwestern boundary of Anne Arundel County. The Patapsco River LNB TMDL covers Baltimore County, Carroll County, Howard County, and Baltimore City in addition to Anne Arundel County. The County's portion of the watershed (15,022 acres) is on the south side of the Patapsco River and includes numerous tributaries that flow north to the mainstem of the LNB, which then flows into the Baltimore Harbor in Baltimore City. The Patapsco River LNB is generally nontidal, which differentiates it from tidal areas of the Patapsco drainage (e.g., Furnace and Marley Creeks; see Section 2.3 below). The County's portion of the watershed is highly developed, and much of it was built in the 1980s and early 1990s, before modern stormwater regulations (Anne Arundel County, 2011). The watershed is 34 percent forested and 26 percent residential (Table 2-1 and Figure 2-2). Total imperviousness is 27 percent. The Patapsco River LNB watershed also includes green spaces such as riverine wetlands, forested floodplains, greenways, and Critical Area lands which help protect water quality.

The Patapsco River LNB has an approved E. coli bacteria TMDL (MDE, 2009b) and is a State-designated Use I water (Water Contact Recreation, and Protection of Nontidal Warmwater Aquatic Life). The bacteria source distribution from MDE's TMDL report for Patapsco River LNB (MDE, 2009b) is shown in Table 2-5. Holiday Mobile Estates is the only Water Reclamation Facility (WRF) in the Patapsco River LNB; it is a privately owned and operated WRF with an average flow (based on their NPDES permit) of 0.108 million gallons per day and reported monthly average bacteria concentrations of 3.0 MPN/100 ml. Given the low daily average flow, this WRF is a relatively minor source of bacteria compared to other sources in the watershed.

Table 2-5: Bacteria Source Distribution in the Patapsco River Lower North Branch Watershed

Bacteria TMDL Watershed	Percent of Fecal Coliform Source Loads				Total
	Pets	Wildlife	Livestock	Human	
Patapsco River LNB	20.7%	36.7%	9.7%	32.9%	100%

There are 615 existing BMPs in the watershed, and the majority are high-performing BMPs (Table 2-6). Drainage area information is unavailable for three percent of the BMPs at this time.

Table 2-6: Number of Existing BMPs in the Patapsco River Lower North Branch Watershed

Bacteria TMDL Watershed	Non-Performing BMPs	Mid-Performing BMPs	High-Performing BMPs	No. (%) of BMPs Without Drainage Area Data	Total
Patapsco River LNB	107	102	387	19 (3%)	615

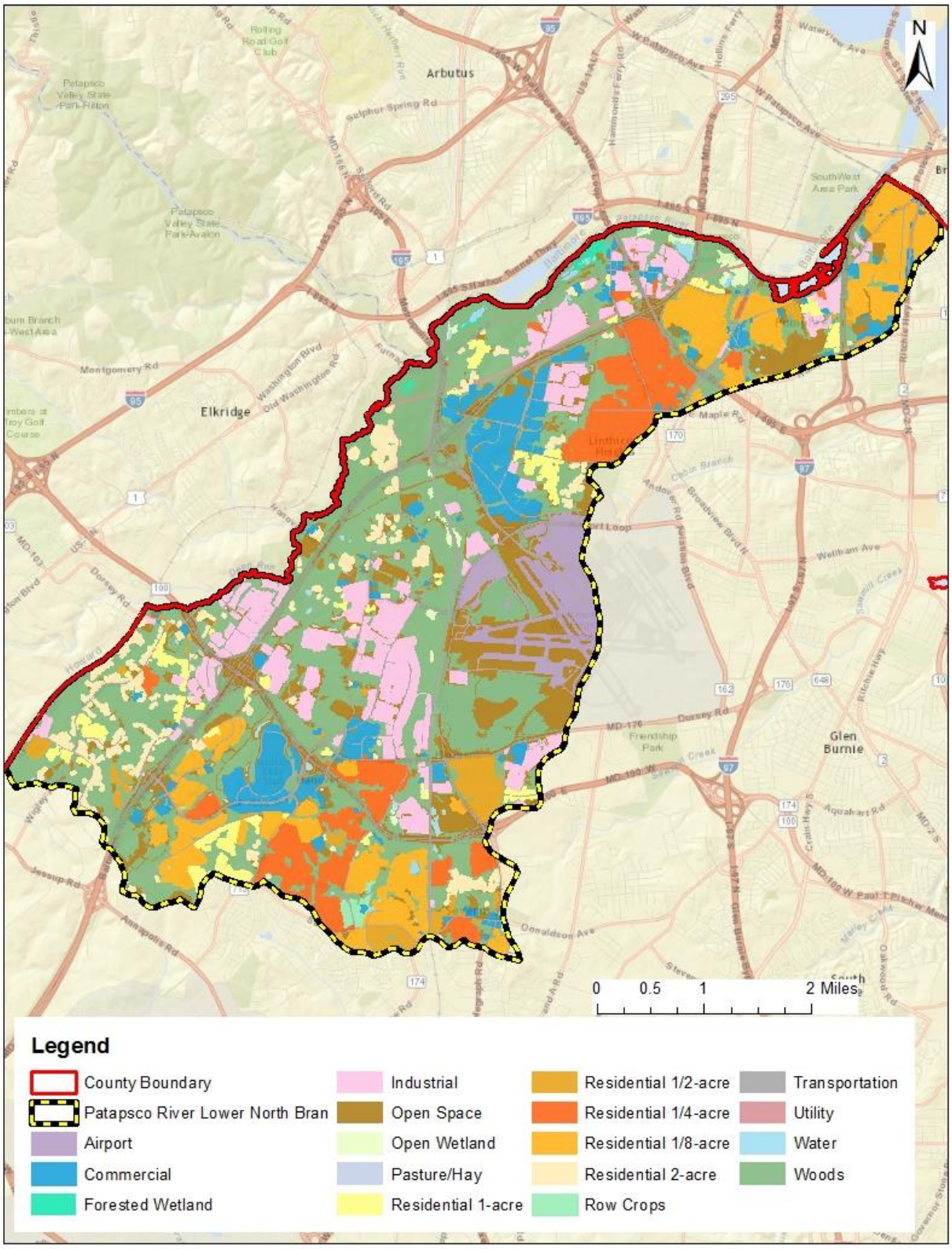


Figure 2-2: Land Use Map of the Patapsco River Lower North Branch Watershed

2.3 PATAPSCO RIVER – FURNACE CREEK AND MARLEY CREEK

Furnace Creek and Marley Creek are tidal creeks in the northern portion of the County, a few miles east of Baltimore-Washington International airport. The Furnace Creek and Marley Creek watersheds are similar in size (8,579 acres for Furnace Creek, 8,737 acres for Marley Creek), are highly urbanized with much residential development (Table 2-1 and Figure 2-3), and are each about 30 percent impervious. Some developments in these watersheds date back to the 1940s (Anne Arundel County, 2012b).

Furnace and Marley Creeks are MDE-designated Use I waters, and the bacteria TMDL impairment is Enterococci (MDE, 2010a). These are the only two watersheds in the County that have TMDLs for Enterococci (see Table 1-1 in Section 1).The Furnace Creek and Marley Creek watersheds have similar bacteria source distributions (Table 2-7 below) as identified by MDE (2010c). There are no livestock loads in either watershed. In each watershed, the contribution from human sources and wildlife is greater than 30 percent of total source loads. Pet waste contributes slightly less than 30 percent of the total loads in Furnace Creek and 34.6 percent of the total loads in Marley Creek. There are no point sources within the watersheds other than permitted MS4 stormwater discharges.

Table 2-7: Bacteria Source Distribution in the Furnace Creek and Marley Creek Watersheds

Bacteria TMDL Watershed	Percent of Fecal Coliform Source Loads				Total
	Pets	Wildlife	Livestock	Human	
Furnace Creek	29.4%	38.1%	0.0%	32.5%	100%
Marley Creek	34.6%	31.2%	0.0%	34.2%	100%

There are 451 and 570 existing BMPs in the Furnace Creek and Marley Creek watersheds, respectively (Table 2-8). A majority of them are high-performing BMPs for bacteria, which include various types of infiltration BMPs and ESD practices. Thirteen percent of the existing BMPs in the Furnace Creek watershed and 17 percent of the existing BMPs in the Marley Creek watershed do not have drainage area data.

Table 2-8: Number of Existing BMPs in the Furnace Creek and Marley Creek Watersheds

Bacteria TMDL Watershed	Non-Performing BMPs	Mid-Performing BMPs	High-Performing BMPs	No. (%) of BMPs Without Drainage Area Data	Total
Furnace Creek	52	26	314	59 (13%)	451
Marley Creek	114	33	328	95 (17%)	570

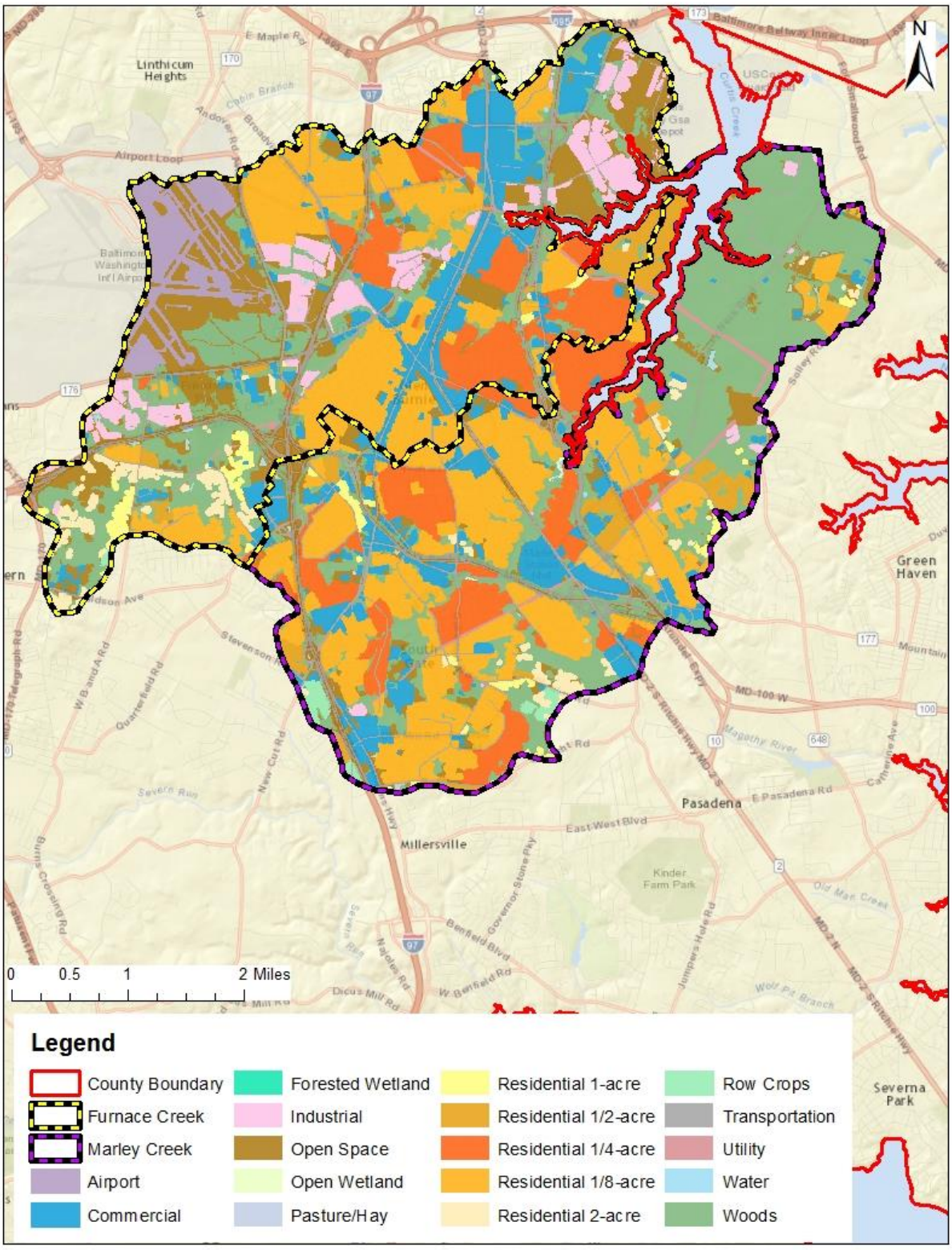


Figure 2-3: Land Use Map of the Furnace Creek and Marley Creek Watersheds

2.4 PATUXENT RIVER UPPER

The Patuxent River is one of the largest watersheds in Maryland. It flows from north to south and forms the boundary between Anne Arundel County to the east and Prince George's County to the west. The river is a designated Use I waterway. The impaired portion for the TMDL consists of a small subwatershed known as the Patuxent River Upper. This subwatershed is in the west central part of Anne Arundel County and extends across the river into Prince George's County. Anne Arundel County's portion is 10,450 acres and extends from the confluence with the Little Patuxent River in the north to the Queen Anne Bridge Road crossing in the south. Over 200,000 additional acres drain from upriver, outside the listed TMDL portion.

The Patuxent River valley is largely forested and includes numerous riparian wetlands. On the Anne Arundel County side of the river (eastern shore), there are several green spaces, including the Globecom Wildlife Management Area, Patuxent River Park, and Davidsonville Park. The upland area is agricultural interspersed with low- to medium-density residential developments (Table 2-1 and Figure 2-4). Major tributaries include Ropers Branch, Kings Branch, and Davidsonville Branch, which all flow from east to west into the Patuxent River Upper Mainstem.

The Patuxent River was placed on the State's 303(d) list in 2008 for fecal coliform impairments, and the bacteria TMDL was approved by EPA in 2011 (EPA, 2011). The TMDL is based on *E. coli*; however, the bacteria source distribution is based on *Enterococci*. This is because the monitoring datasets used to develop the TMDL included multiple pathogen indicators. MDE's TMDL report uses the generic term "fecal bacteria" to refer to all types of bacteria (MDE, 2010b).

MDE's bacteria source distribution in the Patuxent River Upper watershed is shown in Table 2-9 (MDE, 2010d). Wildlife (35.0 percent) and livestock (28.0 percent) are the dominant bacteria sources, but human (19.0 percent) and pet sources (18.0 percent) are also present. Wildlife are the largest source of bacteria in the Patuxent River Upper watershed, probably due to wildlife waste deposited in the river's riparian zone where there is abundant habitat and water resources for animals.

Livestock is the second largest contributor based on MDE's TMDL analyses, which includes not just cattle but also horses, sheep, chickens, and other farm animals. This part of the County has been identified to have a growing equestrian sector. Approximately 20 percent of the land use in the Patuxent River Upper watershed is agricultural. There are no point sources in the listed portion of the Patuxent River Upper watershed other than permitted MS4 stormwater discharges.

Table 2-9: Bacteria Source Distribution in the Patuxent River Upper Watershed

Bacteria TMDL Watershed	Percent of Fecal Coliform Source Loads				Total
	Pets	Wildlife	Livestock	Human	
Patuxent River Upper	18.0%	35.0%	28.0%	19.0%	100%

There are 125 existing BMPs in the Patuxent River Upper watershed (Table 2-10). Of these, 113 are high-performing BMPs for bacteria. Seven percent of the existing BMPs do not have drainage area data.

Table 2-10: Number of Existing BMPs in the Patuxent River Upper Watershed

Bacteria TMDL Watershed	Non-Performing BMPs	Mid-Performing BMPs	High-Performing BMPs	No. (%) of BMPs Without Drainage Area Data	Total
Patuxent River Upper	1	2	113	9 (7%)	125

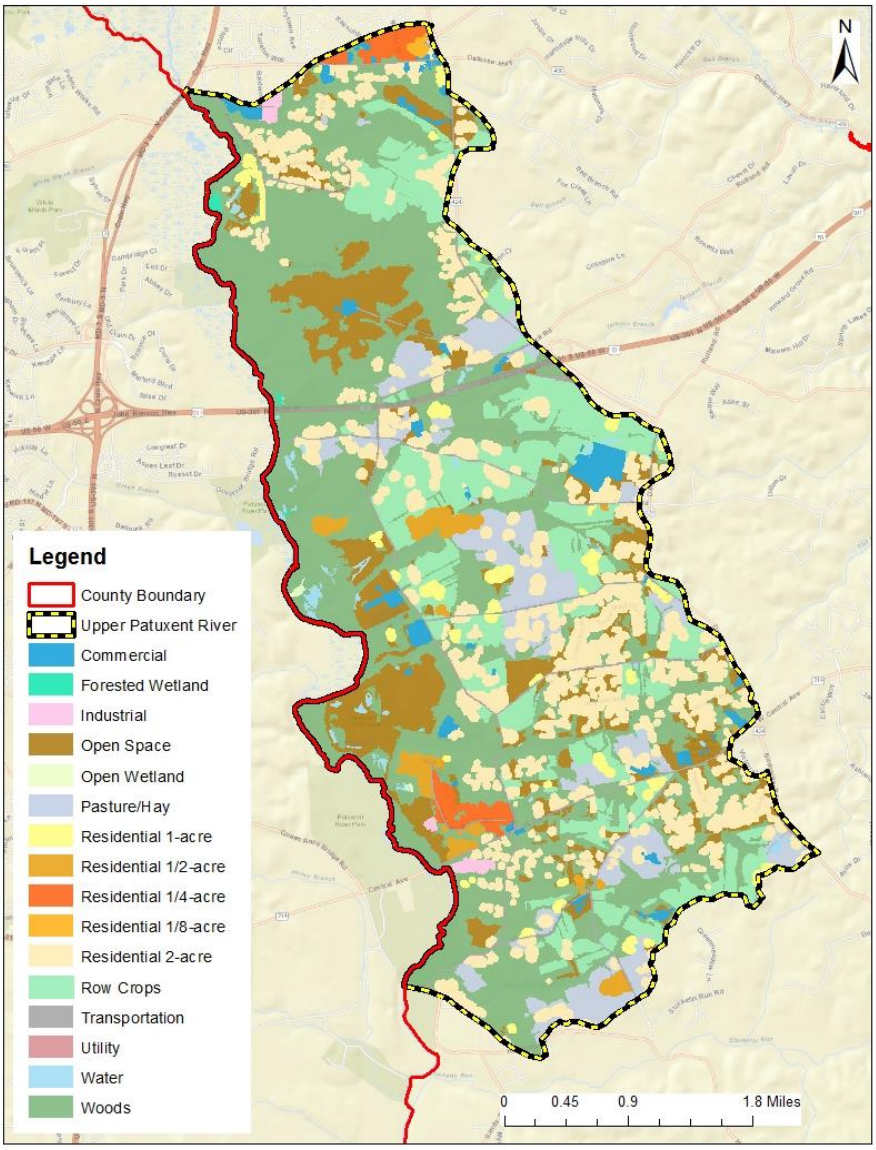


Figure 2-4: Land Use Map of the Patuxent River Upper Watershed

2.5 RHODE RIVER – BEAR NECK CREEK AND CADLE CREEK

Bear Neck Creek and Cadle Creek are located in the Rhode River Watershed. Even though Bear Neck Creek and Cadle Creek are tributaries of Rhode River, their TMDLs are not associated with Rhode River. According to MDE's TMDL report (MDE, 2005g), Bear Neck and Cadle Creeks are fairly large creeks at approximately 1,000 feet wide and about 3 feet deep on average. The Bear Neck Creek watershed is 880 acres with 50 percent of its land use being residential, mainly consisting of the community of Mayo. Most of the developments are on the east side of the creek, while the western shore is mainly forested (Table 2-1 and Figure 2-5). The Bear Neck Creek watershed as a whole is 16 percent impervious, which consists of roofs, driveways, roads, parking lots, and a few marina lots. The Cadle Creek watershed is 320 acres. Approximately 70 percent of the land use is residential and 20 percent is impervious.

Bear Neck Creek and Cadle Creek have approved TMDLs for bacteria. Both of the creeks are Use II waterways and are classified as "conditionally approved" for shellfish harvesting (MDE, 2005b).

The bacteria source distribution for Bear Neck Creek and Cadle Creek from the MDE's TMDL report (MDE, 2005g) are shown in Table 2-11. Livestock is listed as the primary source of bacteria at 46.3 percent in Bear Neck. However, this is not consistent with current land use, which is < 1 percent agricultural according to the County's 2011 GIS land use data. This discrepancy may be due to conversion of farmland in the watershed to urban developments in the last 10 or so years (i.e., since the TMDL was developed). It may be that livestock sources are less of a factor today. Pet waste contributes 33.9 percent of the bacteria load and is likely generated in residential communities. In the Cadle Creek watershed, pet waste contributes 80.2 percent of the total bacteria source loads.

Table 2-11: Bacteria Source Distribution in the Rhode River Watershed

Bacteria TMDL Watershed	Percent of Fecal Coliform Source Loads				Total
	Pets	Wildlife	Livestock	Human	
Bear Neck Creek	33.9%	19.7%	46.3%	0.1%	100%
Cadle Creek	80.2%	19.5%	0.0%	0.3%	100%

The Bear Neck Creek watershed has 77 existing BMPs and the Cadle Creek watershed has 54 existing BMPs (Table -12). These two are among the watersheds for which the County is currently updating the drainage area database for the BMPs, and as a result, drainage area data are unavailable for many of the BMPs as this report is being written. One restoration project in the Bear Neck Creek watershed is the Ponder Cove storm drain retrofit project in the Holly Hill Harbor community. To date, the County has been able to retrofit about 40 linear feet of storm drain pipe with perforated pipe to facilitate infiltration. The total drainage area treated is approximately 11.9 acres of which 2.6 acres are impervious.

Table 2-12: Number of Existing BMPs in the Rhode River Watershed

Bacteria TMDL Watershed	Non-Performing BMPs	Mid-Performing BMPs	High-Performing BMPs	No. (%) of BMPs Without Drainage Area Data	Total
Bear Neck Creek	1	0	17	59 (77%)	77
Cadle Creek	0	1	6	47 (87%)	54

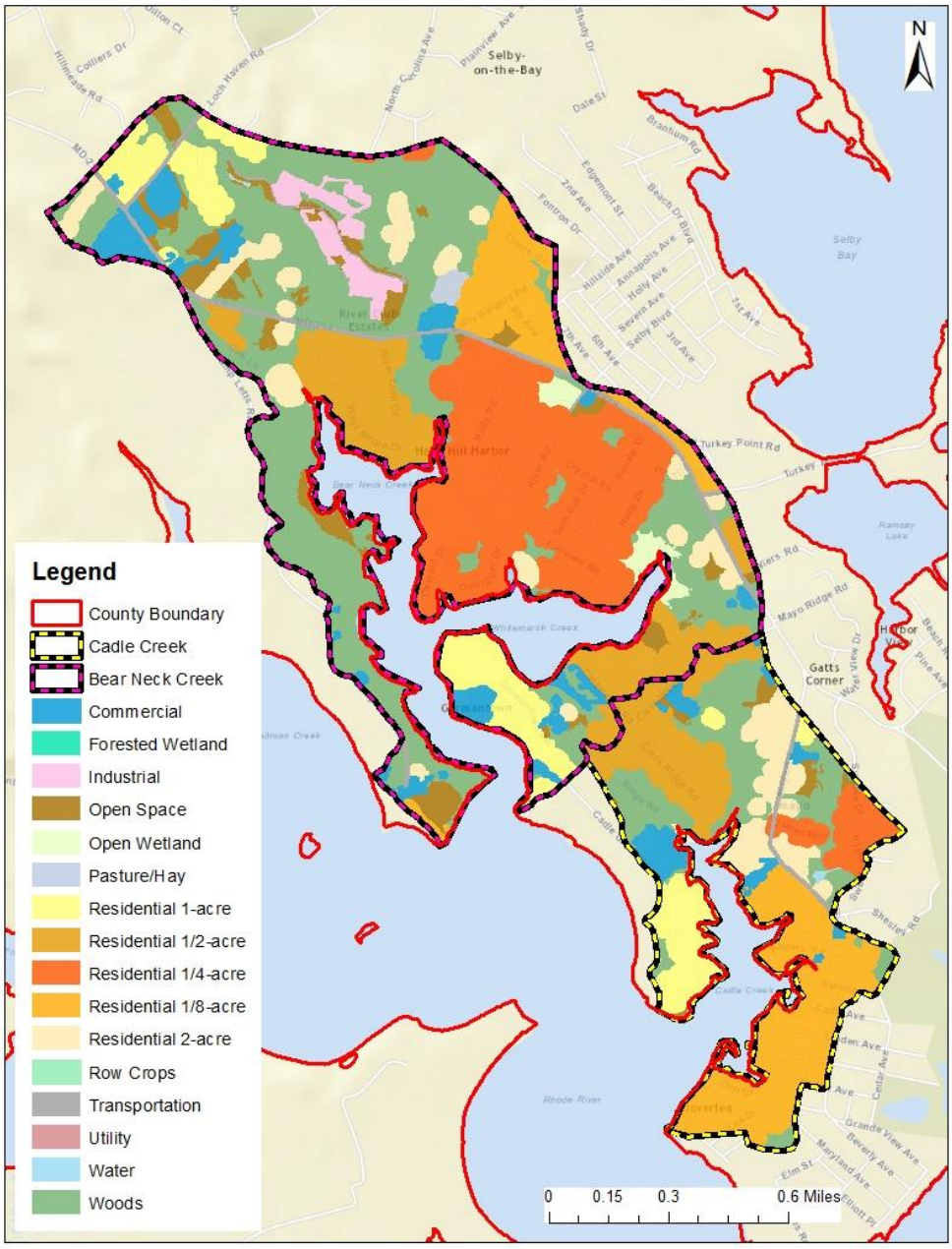


Figure 2-5: Land Use Map of the Bear Neck Creek and Cadle Creek Watersheds

2.6 SEVERN RIVER WATERSHED – SEVERN RIVER MAINSTEM, MILL CREEK, AND WHITEHALL / MEREDITH CREEKS

The Severn River Mainstem flows from northwest to southeast across the center of the County, from the community of Severn at the headwaters to the city of Annapolis near the mouth. According to MDE's TMDL report (MDE, 2008), the river is fairly deep, with an average depth of about 11 feet. The total watershed area is 37,011 acres, and the dominant land uses are residential at 44 percent and forested at 35 percent (Table 2-1 and Figure 2-6). Approximately 20 percent of the watershed is impervious.

Mill Creek, Whitehall Creek, and Meredith Creek are all located a few miles northeast of the Severn River's mouth and discharge into the Chesapeake Bay just west of the Bay Bridge. Mill Creek has a watershed area of 3,256 acres, of which 14 percent is impervious, and consists of residential developments along the shoreline. The Whitehall and Meredith Creeks' combined watershed is 12 percent impervious. These creeks are shallow with an average depth of approximately 3 feet (MDE, 2008).

The Severn River Mainstem, Mill Creek, and Whitehall/Meredith Creeks have approved TMDLs for fecal coliform. Whitehall and Meredith Creeks have one combined TMDL due to their proximity. The Severn River, Mill Creek, and Whitehall/Meredith Creeks are MDE-designated Use II waters and are "restricted" for shellfish harvesting (EPA, 2008). MDE's bacteria source distributions are shown in Table 2-13. The largest bacteria source in the Severn River Mainstem is pet waste (68.8 percent), while the largest source in Mill Creek and Whitehall and Meredith Creeks is wildlife at 59.0 percent and 71 percent, respectively. The Severn River Watershed has two permitted point sources: the Annapolis WRF and the U.S. Naval Academy. Dreams Landing WRF, a privately owned and operated facility, was listed as one of the point sources by MDE at the time of TMDL development; however, the WRF is now defunct. The total combined load from both point sources is 7.41 x 10^9 fecal coliform counts per day based on the allowable (NPDES-permitted) monthly median concentration of 14 MPN/100 ml. Aside from urban stormwater, which can also contribute substantial fecal coliform loads to the receiving waters, there are no other permitted point sources in the Whitehall/Meredith watershed.

Table 2-13: Bacteria Source Distribution in the Severn River Mainstem, Mill Creek, and Whitehall/Meredith Creek Watersheds

Bacteria TMDL Watershed	Percent of Fecal Coliform Source Loads				Total
	Pets	Wildlife	Livestock	Human	
Severn River Mainstem	68.8%	28.9%	1.4%	0.9%	100%
Mill Creek	38.0%	59.0%	1.0%	2.0%	100%
Whitehall/Meredith Creeks	26.0%	71.0%	2.0%	1.0%	100%

The Severn River Mainstem watershed has 1,999 existing BMPs, which include 1,294 high-performing BMPs (Table 2-14). The Mill Creek watershed has 216 existing BMPs of which 141

are high-performing. The Whitehall/Meredith Creek watershed has 130 existing BMPs with 74 high-performing BMPs. The number of BMPs without drainage area data is provided in Table 2-14.

Table 2-14: Number of Existing BMPs in the Severn River Mainstem, Mill Creek, and Whitehall/Meredith Creek Watersheds

Bacteria TMDL Watershed	Non-Performing BMPs	Mid-Performing BMPs	High-Performing BMPs	No. (%) of BMPs Without Drainage Area Data	Total
Severn River Mainstem	88	30	1,294	587 (29%)	1,999
Mill Creek	20	2	141	53 (25%)	216
Whitehall/Meredith Creeks	8	1	74	47 (36%)	130

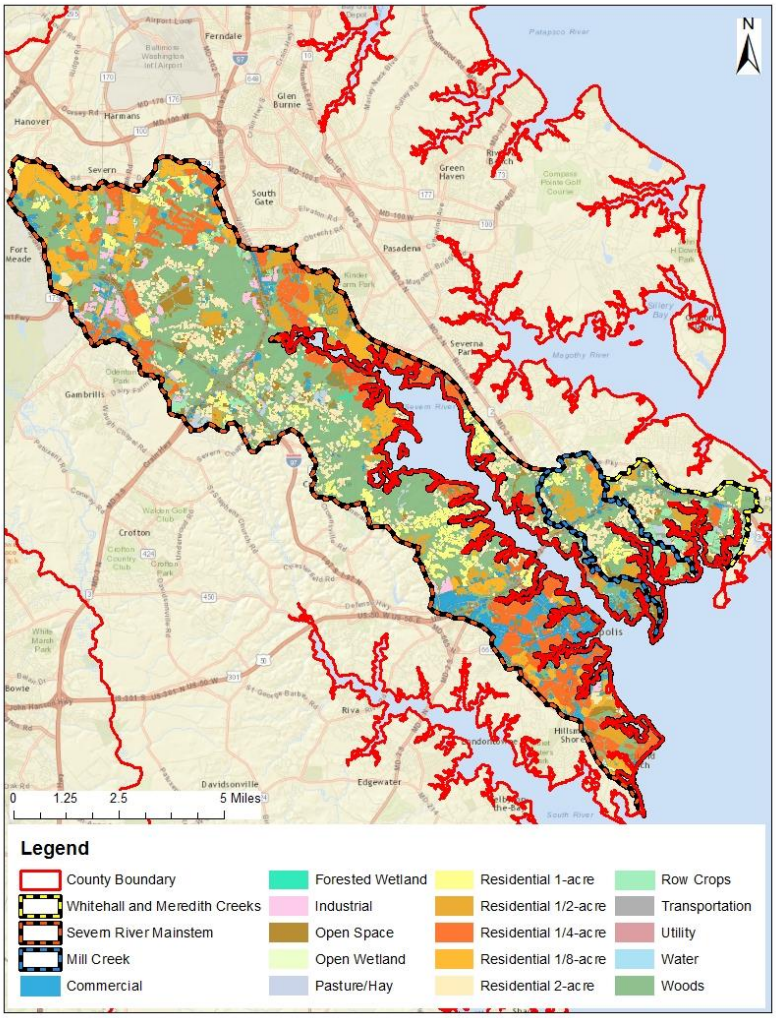


Figure 2-6: Land Use Map of the Severn River Mainstem, Mill Creek, and Whitehall-Meredith Creeks Watersheds

2.7 SOUTH RIVER WATERSHED – SOUTH RIVER MAINSTEM, DUVALL CREEK, RAMSEY LAKE, AND SELBY BAY

The South River Watershed has four impaired waterways with approved bacteria TMDLs: the South River Mainstem, Duvall Creek, Ramsey Lake, and Selby Bay. The South River is located immediately south of the Severn River in the central portion of the County. Like the Severn, it flows from northwest to southeast. The headwaters are near the town of Crownsville. The mouth, where it discharges to the Chesapeake Bay, is near Thomas Point Park. According to MDE's TMDL report (MDE, 2005f), the South River has an average width of 1.2 miles and an average water depth of 8.6 feet. The river drains 33,549 acres and has mixed land use consisting primarily of residential developments (32 percent) and forest (46 percent) (Table 2-1 and Figure 2-7). About 12 percent of the South River watershed is impervious. Duvall Creek, Ramsey Lake, and Selby Bay are small embayments near the mouth of the South River. Duvall Creek is on the north shore of the river and has 76 percent residential land use. Recreational activities in Duvall Creek include boating, canoeing, and windsurfing, and there are many individually moored vessels. Ramsey Lake and Selby Bay are on the south shore of the river. Like Duvall Creek, the majority of the land use in the Ramsey Lake and Selby Bay areas is residential.

The four TMDLs are mostly in restricted shellfish harvesting areas (designated Use II waters) due to fecal coliform impairments; the exception is the lower 3 miles of the South River Mainstem from near the mouth of Almshouse Creek to the mouth, which is not restricted and is currently open to shellfish harvesting according to MDE's shellfish harvesting closure area map (MDE, 2014e).

Based on MDE's TMDL report for South River Watershed (MDE, 2005f), the primary sources of fecal coliform bacteria in the South River Mainstem, Duvall Creek, Ramsey Lake, and Selby Bay are pet waste and wildlife (Table 2-15). Livestock sources also occur in the South River Mainstem and Duvall Creek watersheds. However, the County's GIS data from 2011 shows very little land in agricultural use, suggesting that some of the formerly agricultural land may have been converted to urban developments in the last 10 or so years. Therefore, livestock sources may be less significant today, although this cannot be quantified. Human sources are relatively minor (≤ 2 percent) in all the watersheds. There are no point sources other than permitted MS4 stormwater discharges.

Table 2-15: Bacteria Source Distribution in the South River Mainstem, Ramsey Lake, Selby Bay, and Duvall Creek Watersheds

Bacteria TMDL Watershed	Percent of Fecal Coliform Source Loads				Total
	Pets	Wildlife	Livestock	Human	
South River Mainstem	43%	34%	22%	1%	100%
Duvall Creek	68%	17%	15%	0.1%	100%
Ramsey Lake	63%	37%	0%	0.3%	100%
Selby Bay	63%	35%	0%	2%	100%

The South River Watershed has 1,320 existing BMPs (Table 2-16), of which 935 are high-performing; these are mainly infiltration type BMPs with 90 percent bacteria removal efficiency. Duvall Creek, Ramsey Lake, and Selby Bay also have high-performing BMPs, which make up 87, 80, and 70 percent of the total BMPs in the respective watersheds.

Table 2-16: Number of Existing BMPs in the South River Mainstem, Ramsey Lake, Selby Bay, and Duvall Creek Watersheds

Bacteria TMDL Watershed	Non-Performing BMPs	Mid-Performing BMPs	High-Performing BMPs	No. (%) of BMPs Without Drainage Area Data	Total
South River Mainstem	145	82	935	158 (12%)	1,320
Duvall Creek	2	0	41	4 (9%)	47
Ramsey Lake	3	2	54	7 (10%)	67
Selby Bay	5	1	57	18 (22%)	81

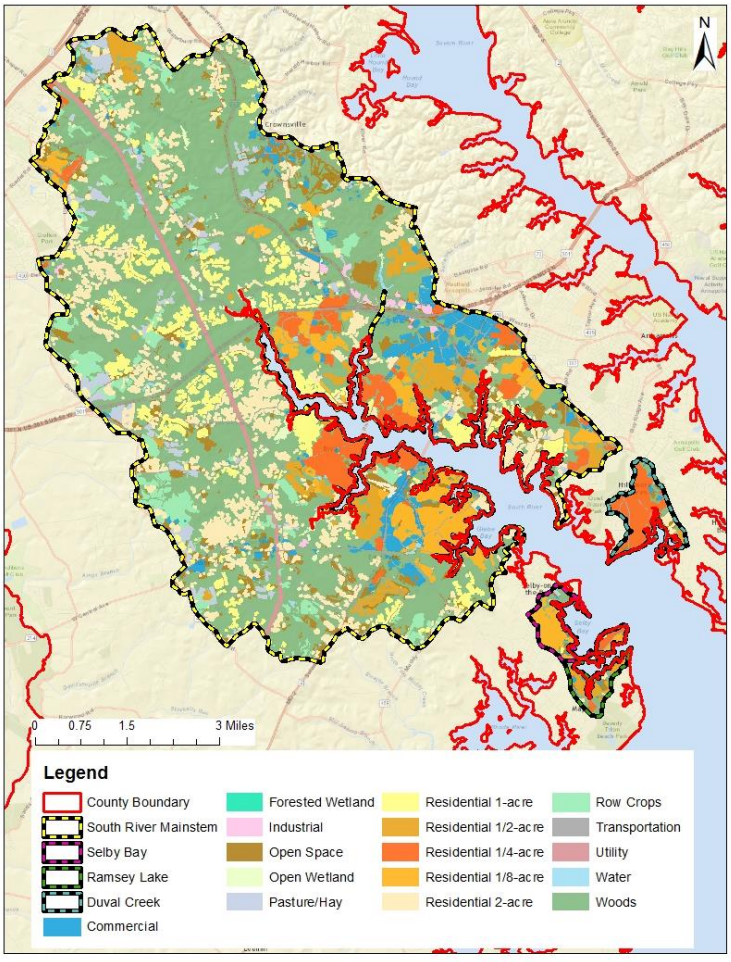


Figure 2-7: Land Use Map of the South River Mainstem, Duvall Creek, Ramsey Lake, and Selby Bay Watersheds

2.8 WEST CHESAPEAKE BAY – TRACY AND ROCKHOLD CREEKS

The West Chesapeake Bay Watershed, also known as the Herring Bay watershed is in the southeast corner of the County. Tracy Creek is lined with mature forests and riparian wetlands. Upland areas consist mainly of agricultural uses including livestock pastures. Rockhold Creek is located immediately east of Tracy Creek. The watershed is slightly more developed and includes the community of Deale along the eastern shoreline.

Tracy and Rockhold Creeks have a combined watershed area of 7,962 acres, about half of which is forest. Residential developments make up 18 percent of the watershed, and agricultural uses make up 15 percent (Table 2-1 and Figure 2-8). Imperviousness is approximately 5 percent.

The West Chesapeake Bay Watershed has an approved bacteria TMDL for Tracy Creek and Rockhold Creek due to fecal coliform impairment. Both are designated as Use II waters and are classified as "restricted" for shellfish harvesting area (MDE, 2005d). In MDE's TMDL report, Tracy and Rockhold Creeks are represented as one watershed and have one associated TMDL because they are close and both drain to Herring Bay (MDE, 2005h).

The bacteria source distribution for the Tracy and Rockhold Creeks watershed is shown in Table 2-17. Wildlife is the primary bacteria source at 72 percent, and pet waste is the secondary source at 21 percent. There are no point source facility discharges in the watershed other than permitted MS4 stormwater discharges.

Table 2-17: Bacteria Source Distribution in the Tracy and Rockhold Creeks Watershed

Bacteria TMDL Watershed	Percent of Fecal Coliform Source Loads				Total
	Pets	Wildlife	Livestock	Human	
Tracy and Rockhold Creeks	21%	72%	7%	<1%	100%

There are 67 existing BMPs in the watershed (Table 2-18). Thirteen of them are high-performing BMPs with 75 percent or greater bacteria removal efficiency. Drainage area data are unavailable for 73 percent of the BMPs.

Table 2-18: Number of Existing BMPs in the Tracy and Rockhold Creeks Watershed

Bacteria TMDL Watershed	Non-Performing BMPs	Mid-Performing BMPs	High-Performing BMPs	No. (%) of BMPs Without Drainage Area Data	Total
Tracy and Rockhold Creeks	5	0	13	49 (73%)	67

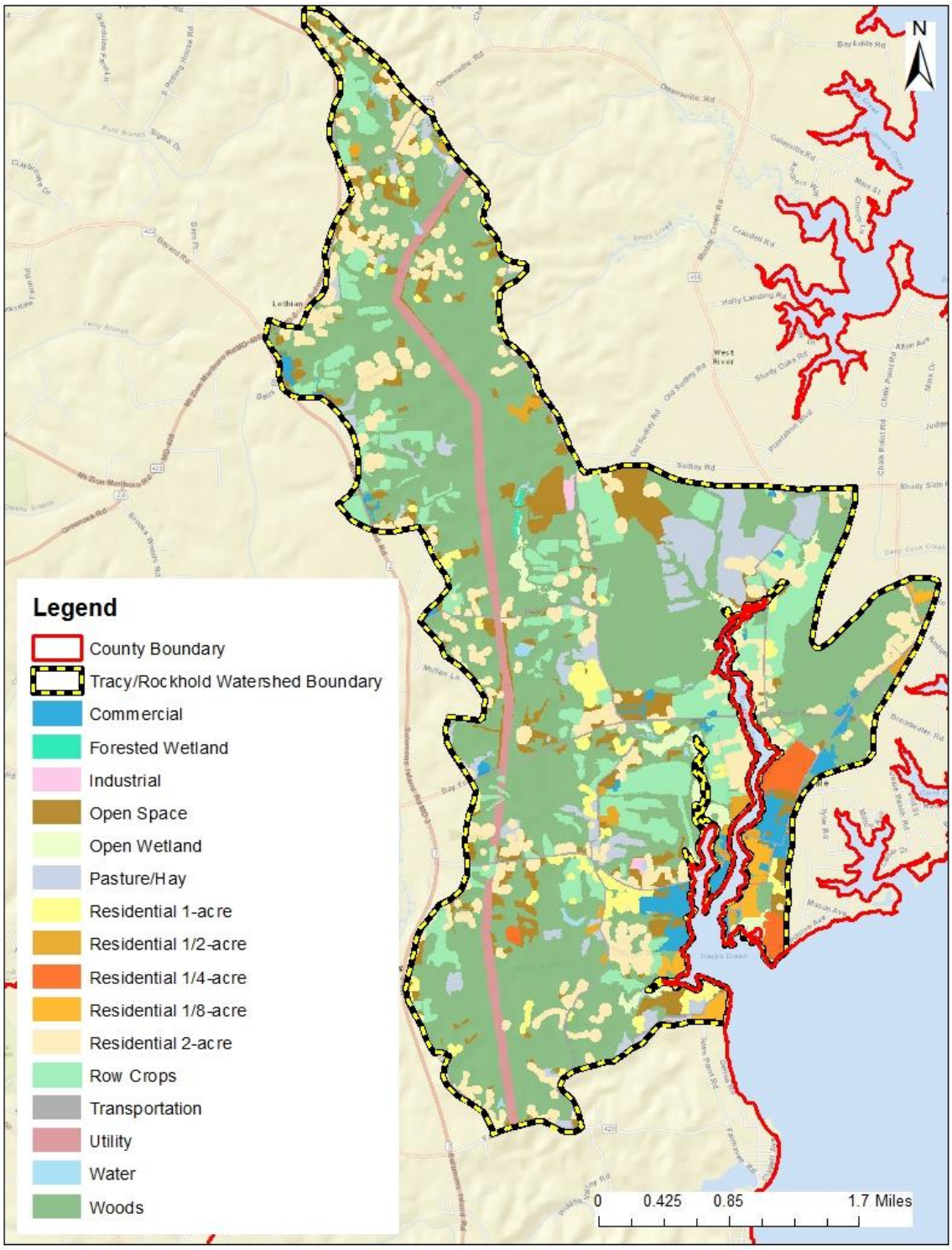


Figure 2-8: Land Use Map of the Tracy and Rockhold Creeks Watershed

2.9 WEST RIVER WATERSHED – WEST RIVER MAINSTEM AND PARISH CREEK

The West River is a tidal estuary and river system in the southeast portion of the County near the town of Galesville. The restricted portion is 0.6 mile wide and 3.2 feet deep on average. It flows northeast into the unrestricted lower river and then into the Chesapeake Bay. The watershed area is 6,304 acres, about 45 percent of which is forest. Residential developments make up 25 percent of the watershed, and agricultural land use (pasture/hay and row crops) makes up 20 percent (Table 2-1 and Figure 2-9). Imperviousness is relatively low compared to the other TMDL watersheds at 6 percent. Parish Creek is a small estuary east of the West River, near the town of Shadyside. Parish Creek drains an area of 324 acres, of which 41 percent is residential and 31 percent is forest.

The West River Watershed has approved bacteria TMDLs for the West River Mainstem and Parish Creek. Both are in restricted shellfish harvesting areas (designated Use II waters) due to fecal coliform impairments. Only the upper portion of the West River Mainstem is restricted; the lower river from Chalk Point to the mouth (a distance of about 1.5 miles) is unrestricted.

The bacteria source distribution in the West River Mainstem is shown in Table 2-19 below. The primary bacteria source is livestock (57.1 percent), which is consistent with the agricultural land use. In Parish Creek, the primary sources are wildlife at 59.0 percent and pets at 40.2 percent (Table 2-19). There are no point sources in either the West River Mainstem or Parish Creek watersheds other than permitted MS4 stormwater discharges.

Table 2-19: Bacteria Source Distribution in the West River Mainstem and Parish Creek Watersheds

Bacteria TMDL Watershed	Percent of Fecal Coliform Source Loads				Total
	Pets	Wildlife	Livestock	Human	
West River Mainstem	15.7%	26.8%	57.1%	0.4%	100%
Parish Creek	40.2%	59.0%	0.0%	0.8%	100%

The West River Mainstem watershed has 125 BMPs, and the Parish Creek watershed has 15. West River Mainstem and Parish Creek are among the watersheds for which the County is currently updating drainage area information for the BMPs, and as a result, drainage area data are unavailable for the majority of the BMPs (Table 2-20).

Table 2-20: Number of Existing BMPs in the West River Mainstem and Parish Creek Watersheds

Bacteria TMDL Watershed	Non-Performing BMPs	Mid-Performing BMPs	High-Performing BMPs	No. (%) of BMPs Without Drainage Area Data	Total
West River Mainstem	1	1	19	104 (83%)	125
Parish Creek	0	0	0	15 (100%)	15

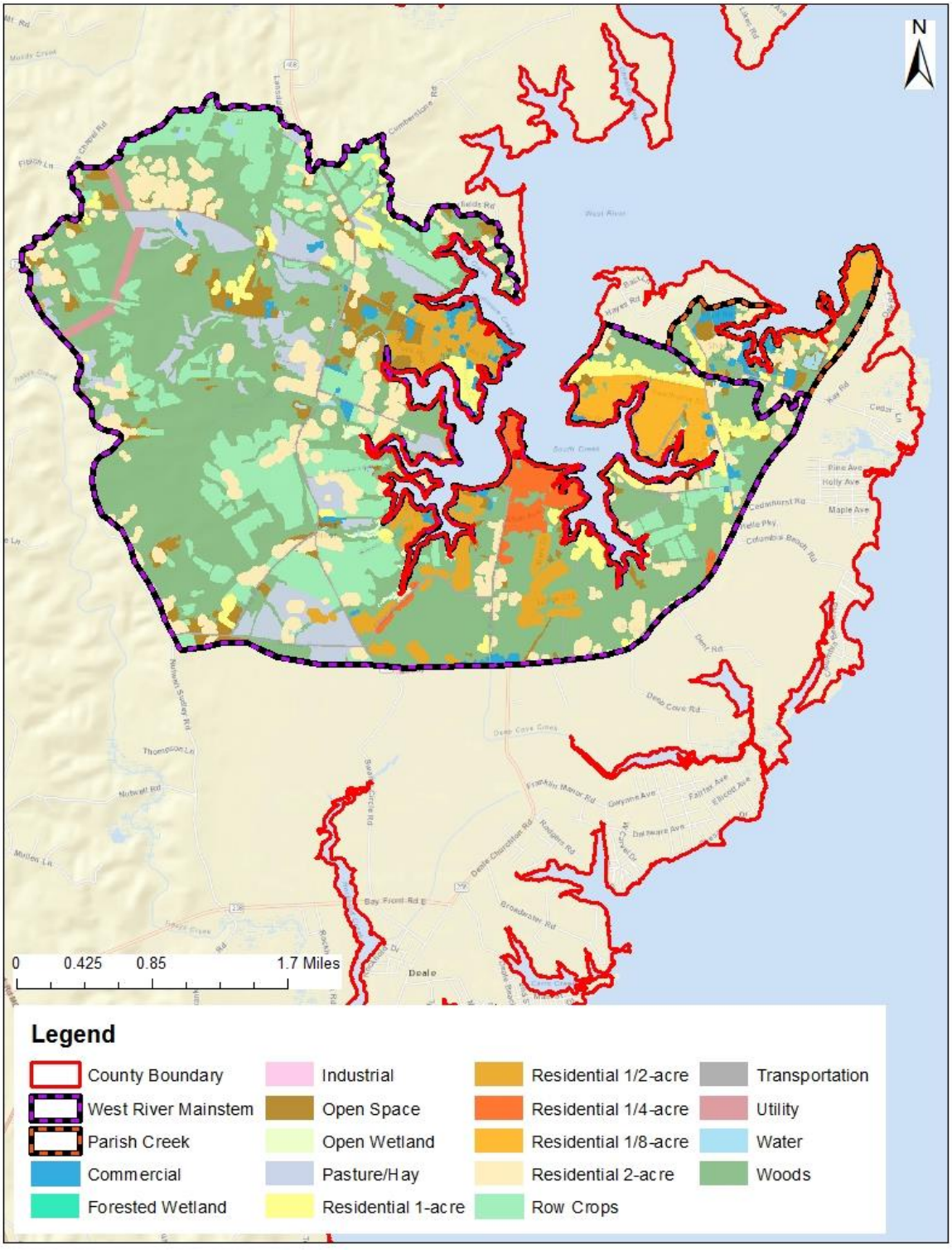


Figure 2-9: Land Use Map of the West River Mainstem and Parish Creek Watersheds

2.10 DEVELOPMENT OF EXISTING CONDITIONS WTM

As a part of development of TMDL Restoration Plan for bacteria impairments, water quality models were developed for all the study watersheds. The Watershed Treatment Model (WTM), a spreadsheet-based model developed by the Center for Watershed Protection (Caraco 2013) was used to characterize and quantify the bacteria loads for existing conditions from primary (land use) and secondary sources of pollutants (e.g. illicit discharges, sanitary sewer overflows) and estimate the potential bacteria load reductions from existing BMPs. The WTM models were developed using the County GIS data and literature review. Appendix A contains the approach adopted to develop the existing conditions model along with the results.

2.11 IMPACT OF TMDL RESTORATION PLAN TO TIER II WATERS

Maryland State water quality standards consist of three components:

- The designated use of the waterway (Use I or Use II in this case);
- Numerical water quality criteria (i.e., bacteria concentrations below certain levels) that are protective of that designated use; and
- An anti-degradation policy specifically for Tier II waters that maintains high quality waters so they do not degrade.

According to COMAR 26.08.02.04-1, high quality waters are where the water quality is better than the minimum requirements specified by the water quality standards. They are listed by MDE as "Tier II" waters. Based on MDE data, Tier II waters occur in two locations in the County:

- Lyons Creek, just west of the Tracy and Rockhold Creeks; it is not part of any TMDL watershed
- Patuxent River, just upstream of the Patuxent River Upper; it is not part of any TMDL watershed

Any watershed restoration or other activities that would affect the above Tier II waters, such as new or major modifications to discharges to the water bodies, are restricted by MDE. However, Lyons Creek flows west, away from Tracy and Rockhold Creeks, and the Tier II portion of the Patuxent River is upstream of the listed Patuxent River Upper TMDL portion. Therefore, the presence of Tier II waters is not expected to impact restoration plans for the 19 TMDL watersheds.

SECTION THREE: RESTORATION PLAN GOALS

The goal of this TMDL Restoration Plan is to reduce or mitigate existing sources of bacteria so that water quality standards and designated uses of the impaired waterways are restored. The approved TMDLs require significant reductions in bacteria loads ranging from 18 percent reduction to 90 percent reduction among the 19 TMDL watersheds (average 50 percent, see Section 3.1); therefore, extensive restoration efforts will be required to meet the TMDL goals.

In addition to meeting the TMDL goals as required by the County's NPDES MS4 permit, this restoration plan will help the County meet overarching goals, which include protecting environmental features such as riparian buffers, forests, and green spaces, as well as restoring water quality and improving habitat conditions. This restoration plan will help prevent further degradation of water resources and help to off-set any future load increases due to population growth and new development.

3.1 TMDL REDUCTION GOALS FOR BACTERIA

To restore the designated uses in each of the impaired waterways and ensure they meet State water quality standards, the MDE requires that loads from bacteria sources be reduced or mitigated by a specific amount. This is expressed in each of the MDE-published TMDLs as a required percent reduction in bacteria loads. The percent reduction is calculated as the difference between the current load (at the time the TMDL was developed) and the allowable load, divided by the current load, as follows:

$$Required\ Load\ Reduction = \frac{Current\ Load - Allowable\ Load}{Current\ Load}\ x\ 100\%$$

The current load is the mass of all bacteria sources in the watershed that drain to the water body and contribute to the observed impairment. It represents the "existing conditions" at the time the TMDLs were developed, typically in the early 2000s. The MDE calculated the current load using a pollutant load model calibrated with monitoring data collected at the base of each watershed.

The allowable load is the amount of pollutant a water body can take in without exceeding its maximum allowable water quality standard for that pollutant. The allowable load is computed using the same approach as the current load except that the applicable State water quality criteria are used instead of the monitoring data.

The State-approved TMDL water quality goals for all Anne Arundel County watersheds are presented in Table 3-1. The data presented in the table were obtained from the MDE published TMDL reports for each watershed and include the percent reductions required to restore the designated use and water quality of the waterways. These are the ultimate goals for this restoration plan and represent the end point of implementation for the County.

Table 3-1: TMDL Reduction Goals for Bacteria from MDE's TMDL Reports

TMDL Watershed	TMDL Current Load, Counts/Day	TMDL Allowable Load, Counts/Day	Required Percent Reduction
Magothy Mainstem	4.97×10^{12}	4.33×10^{12}	33 to 54 [1]
Magothy River/Forked Creek	1.83×10^{11}	1.35×10^{11}	26
Magothy River/Tar Cove	9.82×10^{11}	2.07×10^{12}	21 to 33[1]
Patapsco River/Furnace Creek	3.66×10^{12}	8.14×10^{11}	78
Patapsco River Lower North Branch	7.78×10^{11}	6.38×10^{11}	18[2]
Patapsco River/Marley Creek	6.19×10^{12}	1.50×10^{12}	76
Patuxent River Upper	7.61×10^{11}	4.02×10^{11}	47[2]
Rhode River/Bear Neck Creek	3.55×10^{11}	2.01×10^{11}	43
Rhode River/Cadle Creek	3.54×10^{11}	9.85×10^{10}	72
Severn River Mainstem	6.07×10^{12}	4.92×10^{12}	19
Severn River/Mill Creek	1.78×10^{12}	2.49×10^{11}	86
Severn River/Whitehall and Meredith Creek	4.92×10^{11}	4.92×10^{10}	90
South River/Duvall Creek	1.52×10^{11}	8.27×10^{10}	46
South River Mainstem	1.32×10^{13}	9.31×10^{12}	46
South River/Ramsey Lake	5.57×10^{11}	2.27×10^{11}	59
South River/Selby Bay	3.27×10^{11}	3.75×10^{11}	28
W. Chesapeake Bay/Tracy and Rockhold Creeks	1.67×10^{12}	3.06×10^{11}	82
West River Mainstem	1.77×10^{12}	1.15×10^{12}	35
West River/Parish Creek	2.56×10^{11}	1.2×10^{11}	53

1- A range of reduction percentages is presented because of the method used by MDE to develop the TMDL.MDE used a segmented tidal prism model; therefore, it was not possible to present a single TMDL for the entire estuary.
2- Applies only to County's portion of drainage.

3.2 TIMELINE FOR MEETING BACTERIA TMDL

The EPA-approved TMDL reports do not include a specific final date for bacteria TMDL compliance. MDE, through the NPDES MS4 Permit, requires that the TMDL Restoration Plan be an iterative process until the TMDL goals are met. It is proposed that the restoration schedule be integrated with the Chesapeake Bay TMDL implementation schedule; therefore, 2025 can be considered the target timeline for meeting the bacteria TMDL. Merging the bacteria restoration activities with the Bay TMDL implementation is proposed because its bacteria reduction strategies are similar to those required by the County's Phase II Watershed Implementation Plan (WIP) (Anne Arundel County, 2012). For example, retrofitting impaired pipe outfalls and degraded stream channels with step pool storm conveyances (SPSCs), a requirement of the WIP, has a removal efficiency per acre of 57 percent for nitrogen, 66 percent for phosphorus, and 70 percent for sediment (MDE, 2014d). For bacteria, the removal efficiency is 90 percent, which

makes it a highly desirable BMP to meet goals for bacteria and Bay TMDLs. A detailed implementation schedule for meeting the County's bacteria TMDLs is provided in Section 7.

SECTION FOUR: RESTORATION STRATEGIES

This section outlines restoration strategies proposed to meet the required TMDL load reductions and restore State water quality standards in the County's impaired waterways. The proposed restoration strategies were developed in consultation with several County departments, including the Department of Health, the Department of Public Works' (DPW) Watershed Protection and Restoration Program (WPRP) and Utility Planning divisions, using existing County data and reports. This section also includes planning-level implementation costs for each restoration strategy along with potential load reductions estimated using Center for Watershed Protection's WTM and literature review. The proposed strategies address both point and nonpoint bacteria sources as identified in MDE's bacteria TMDL reports for all 19 TMDL watersheds.

The proposed strategies are broadly grouped into Tier A and Tier B strategies. Tier A strategies are proposed to reduce human bacteria sources and Tier B strategies are proposed to reduce non-human sources (i.e. from wildlife waste, pet waste, and livestock waste). Tier A strategies are considered high priority for the County because human sources of bacteria pose a higher potential public health risk (MDE, 2014b), and these strategies are already part of the County's NPDES MS4 program (e.g., illicit discharge detection and elimination) and the County DPW wastewater program (e.g., sanitary sewer repairs and septic system retirement). However, per the MDE guidance document for developing restoration plans for addressing bacteria TMDL, jurisdictions have considerable flexibility in selecting the order of implementation of the proposed strategies, provided that the required TMDL load reductions are achieved in a reasonable time frame (MDE, 2006; MDE, 2014a; J. White pers. communication, January 8, 2015). Therefore, it is recommended that the County initially implement additional and new strategies that are the most cost-effective while concurrently continuing the existing programs (e.g. illicit discharge detection and elimination and the DPW wastewater program); these new strategies are identified below and more specific recommendations are provided in this section.

Certain strategies are not proposed in this restoration plan because preliminary modeling and information in the TMDL reports indicated that the bacteria load reductions achievable with these strategies is minimal. These strategies include upgrades to County-owned WRFs and management of deer populations. The preliminary modeling results indicated that the County-owned WRFs were a relatively minor bacteria point source in the TMDL watersheds where they occur due to the low effluent concentrations permitted by their WRF NPDES point source discharge permits (14 MPN/100 ml) for fecal coliform bacteria. Further, MDE's TMDL reports assume that deer waste represents a relatively minor source of bacteria relative to other wildlife species such as waterfowl.

4.1 PROPOSED STRATEGIES

4.1.1 Tier A Strategies

Tier A strategies are those that address potential human sources of bacteria such as septic system effluent from poorly maintained septic systems, sanitary sewage overflows, and illicit connections that discharge household human wastewater into the MS4. For all Tier A strategies, bacteria load reductions were estimated using WTM, one of MDE's recommended tools for identifying source loads and estimating pollutant load reductions (MDE, 2014b). County GIS data and related reports were used to develop the existing and proposed conditions WTM to produce a representative estimate of bacteria load reductions. Details on the modeling methodology are included in Appendix A. The Tier A strategies are described below.

Elimination of Household Illicit Connections

Residential household illicit connections are sanitary sewers connected directly to the storm drain instead of to the sanitary sewer, leading to discharge of raw untreated human wastewater into the local waterway. Wash water illicit connections occur when either commercial washwater (from carwashes, fleet washing, commercial laundry wastewater, or floor washing of shop drains) or residential grey water (laundry) is discharged into the MS4 rather than being disposed of properly (CWP, 2004). Commercial washwater and residential grey water primarily contain pollutants such as detergents/surfactants, ammonia, and others, and has an insignificant percentage of bacteria (CWP, 2004).

The County's NPDES MS4 permit (11-DP-3316, MD0068306) requires the County to conduct dry weather field screening and outfall sampling of 150 outfalls annually to detect potential illicit residential household and commercial waste water connections. This Tier A strategy assumes that all illicit connections detected by the County will be enforced and eliminated. From 2005 to 2013, the County-wide illicit detection rate was approximately 2 percent. This was based on 29 illicit connections detected out of 1,350 outfalls surveyed, as documented in the County's Annual NPDES MS4 Reports. It is assumed that the same detection rate of illicit connections would continue through 2020. The County-wide rate of 2 percent was apportioned among the 19 TMDL watersheds based on the amount of impervious cover in each TMDL watershed relative to the total impervious cover in the County (based on 2011 impervious data). It was further assumed that half of the illicit connections detected would be from households that discharge bacteria. The obtained proportioned rate of illicit detection and elimination was modeled in the proposed conditions WTM for each watershed to estimate the potential bacteria load reductions from this Tier A strategy.

Abatement of Sanitary Sewer Overflows

In the County, Sanitary Sewer Overflows (SSOs) generally occur as a result of power and mechanical failures at sewage pump stations (SPSs). According to data provided by the County, 533 SSOs of varying intensity and duration have occurred in the last 14 years (2001 to 2014); of

these, approximately 101 have occurred in areas that affected the bacteria TMDL waterways. Table 4-1 below provides a summary of the County data related to SSOs.

Table 4-1: List of Sanitary Sewer Overflows Occurring in Bacteria TMDL Watersheds from 2001 to 2014

TMDL Watershed	TMDL Subwatershed	Number	Frequency (times per year on average)	Volume Range (gallons)
Magothy River	Mainstem	12	1.0	0 – 3,000,000
	Forked Creek	1	n/a (only one occurrence)	4,500
	Tar Cove	n/a	n/a	n/a
Patapsco River	Furnace Creek	8	0.7	100 – 78,000
	Marley Creek	13	1.2	0 – 222,000
Patapsco River Lower North Branch	Patapsco River Lower North Branch	2	0.7	290 – 1,200
Patuxent River Upper	Patuxent River Upper	2	0.6	0 – 50,000
Rhode River	Bear Neck Creek	11	1.0	0 – 79,600
	Cadle Creek	8	1.1	100 - 550
Severn River	Mainstem	14	2.0	0 – 54,000
	Mill Creek	2	0.3	200 - 350
	Whitehall and Meredith Creeks	1	n/a (only one occurrence)	200
South River	Mainstem	7	0.9	0 – 11,000
	Duvall Creek	3	0.6	200 – 2,000
	Ramsey Lake	10	1.3	0 - 500
	Selby Bay	4	0.8	200 – 2,000
West Chesapeake Bay Mainstem	Tracy and Rockhold Creeks	1	n/a (only one occurrence)	800
West River	Mainstem	2	0.5	300 – 8,000
	Parish Creek	n/a	n/a	n/a

This Tier A strategy proposes to reduce the number of SSOs and thereby reduce the discharge of human bacteria to surface waters. Specific wastewater projects that are considered SPS upgrades or otherwise designed to improve the reliability of the sanitary system were identified by the County (G. Heiner, pers. Communication November 6, 2014). A total of 35 wastewater projects in 12 of the 19 TMDL watersheds are currently listed as active in the County's Wastewater Capital Budget and Program annual reports (see Table 4-2 below). The projects were entered into the proposed conditions WTM to estimate the bacteria load reductions from implementing

the SPS upgrades. Table 4-2 lists the SPS projects in the TMDL watersheds as identified by the County's Wastewater Capital Budget and Program annual reports along with cost estimates.

Table 4-2: List of Active Sewage Pump Station Upgrade Projects in 12 of the 19 TMDL Watersheds

Project	Project Title	Current Status	Description	TMDL Watershed	Qty. of Pump Stations Being Upgraded	Estimated Annual Cost[1]
S804700	Mill Creek SPS Upgrade	Active	Various upgrades to the Mill Creek sewage pumping station	Magothy River Mainstem	1	$300,000
S806700	Cinder Cove FM Rehab	Active	Construction of 10,000 linear feet of 30" force main to improve operational reliability	Patapsco River/Furnace Creek	1	$1,342,000
S805400	Marley SPS Upgrade	Active	Construction of various upgrades to Marley Sewage Pumping Station to improve operation and reliability	Patapsco River/Marley Creek	1	$900,000
S804900	Parole SPS Upgrade	Active	Construction of miscellaneous improvements to the Parole Sewage Pumping Station to increase operation and reliability	South River Mainstem	1	$100,000
S804000	Sylvan Shores PS Upgrade	Active	Construction of improvements to Sylvan Shore Sewage Pumping Station to improve reliability and efficiency of system	South River Mainstem	1	$407,000
S799200	Mayo Collection Sys Upgrade	Active	Expansion of Mayo Wastewater Collection and Conveyance System to accommodate planned growth within Mayo Sewer service area	Rhode River/Cadle Creek	1	$500,000
S806200	SPS Fac Gen Replacement	Active	Generator replacement	Magothy River Mainstem	3	$782,000
S806200	SPS Fac Gen Replacement	Active	Generator replacement	Magothy River/Forked Creek	1	$260,667
S806200	SPS Fac Gen Replace	Active	Generator replacement	Patapsco River LNB	2	$521,333
S806200	SPS Fac Gen Replace	Active	Generator replacement	Patapsco River/Furnace Creek	1	$260,667
S806200	SPS Fac Gen Replace	Active	Generator replacement	Patapsco River/Marley Creek	1	$260,667

Project	Project Title	Current Status	Description	TMDL Watershed	Qty. of Pump Stations Being Upgraded	Estimated Annual Cost[1]
S806200	SPS Fac Gen Replace	Active	Generator replacement	Severn River/Mill Creek	1	$260,667
S806200	SPS Fac Gen Replace	Active	Generator replacement	South River Mainstem	4	$1,042,667
S806200	SPS Fac Gen Replace	Active	Generator replacement	South River/Duvall Creek	1	$260,667
S791800	Upgr/Retrofit SPS	Multi-Year	Upgraded existing sewage pump stations	Magothy River Mainstem	1	$397,917
S791800	Upgr/Retrofit SPS	Multi-Year	Upgraded existing sewage pump stations	Patapsco River LNB	1	$397,917
S791800	Upgr/Retrofit SPS	Multi-Year	Upgraded existing sewage pump stations	Patapsco River/Furnace Creek	1	$397,917
S791800	Upgr/Retrofit SPS	Multi-Year	Upgraded existing sewage pump stations	Patapsco River/Marley Creek	1	$397,917
S791800	Upgr/Retrofit SPS	Multi-Year	Upgraded existing sewage pump stations	Severn River Mainstem	6	$2,387,500
S791800	Upgr/Retrofit SPS	Multi-Year	Upgraded existing sewage pump stations	West River/Bear Neck Creek	1	$397,917
S791800	Upgr/Retrofit SPS	Multi-Year	Upgraded existing sewage pump stations	West River/Parish Creek	1	$397,917
S805300	Cinder Cove SPS Mods	Active	Pump station reliability improvements necessary to minimize risks of sanitary sewer overflows	Patapsco River/Furnace Creek	1	$64,104[2]
S806300	Big Cypress SPS Retro	Active	Upgrades to Big Cypress sewage pump station	Magothy River Mainstem	1	$231,577[3]
S797800	Furnace Brn Swr Repl	Active	Construct new sewer line and replace existing sewer to relieve capacity problems	Patapsco River/Furnace Creek	1	$123,000[4]
				TOTALS:	**35**	**$12,392,018**

1-Annual costs were estimated from the wastewater CIP budget for FY2015 except where noted.
2-Cost estimate represents funds expended between April 1, 2013 and April 1, 2014. No fiscal year annual budget information was available.
3-Cost estimate represents funds expended between April 1, 2013 and April 1, 2014. No fiscal year annual budget information was available.
4-Cost estimate represents FY2009 annual budget. No fiscal year annual budget information was available.

Retirement of County Septic Systems

Retirement of failing septic systems by connecting them to the public sanitary system reduces human bacteria sources in the watershed. The number of septic systems to be retired was identified in each TMDL watershed based on GIS data provided by the County DPW. A total of 16,007 septic systems were identified in 10 of the 19 TMDL watersheds. These septic systems were previously identified by the County as contributing nitrogen discharges to the Chesapeake Bay and were selected for retirement for the purposes of meeting the Chesapeake Bay TMDL. The number of septic systems to be retired is presented in Table 4-3 below. This information was entered into the proposed conditions WTM to estimate the bacteria load reductions that would be achieved by implementing this strategy.

Table 4-3: Number of Septic Systems Selected for Retirement as Identified by the County Department of Public Works

Bacteria TMDL Watershed	No. of Septic Systems to Be Retired
Magothy Mainstem	4,814
Magothy River/Forked Creek	113
Magothy River/Tar Cove	1,708
Patapsco River/Furnace Creek	252
Patapsco River LNB	174
Patapsco River/Marley Creek	0
Patuxent River Upper	289
Rhode River/Bear Neck Creek	0
Rhode River/Cadle Creek	0
Severn River Mainstem	5,475
Severn River/Mill Creek	1,168
Severn River/Whitehall and Meredith Creek	320
South River/Duvall Creek	0
South River Mainstem	1,694
South River/Ramsey Lake	0
South River/Selby Bay	0
W. Chesapeake Bay/Tracy and Rockhold Creeks	0
West River Mainstem	0
West River/Parish Creek	0

4.1.2 Tier B Strategies

Tier B strategies are those that address non-human sources of bacteria, such as pet waste, wildlife waste, and livestock waste. For the purposes of this TMDL Restoration Plan, urban

stormwater runoff is also considered a non-human bacteria source. Many of the Tier B strategies are non-structural measures that are expected to have relatively low implementation costs and are considered a cost-effective means for the County to achieve credit for bacteria load reductions. Non-human sources are considered secondary in importance relative to human sources for public health reasons (MDE, 2014b). Bacteria load reductions for Tier B strategies were estimated using the WTM, as well as literature review. Each of the Tier B strategies and the assumptions and methods used to develop each strategy are described below. The priority of implementing Tier A or Tier B strategies is at the County's discretion.

Tier B strategies that address urban stormwater retrofits were placed into two categories: restoration of 20 percent of currently unmanaged impervious cover and retrofit of pre-2002 ponds to meet current MDE stormwater criteria. This strategy was developed based on the Anne Arundel County's Urban Phase II Watershed Implementation Plan (2012) and requirements of the current NPDES MS4 Permit (11-DP-3316, MD0068306). The current NPDES MS4 Permit requires the County to treat 20% of the impervious area that currently has limited/no stormwater management. Even though the impervious areas draining to pre-2002 ponds can be categorized as impervious area with limited stormwater management and can be counted towards the NPDES MS4 impervious area restoration goals, they are not merged with the "Restoration of 20 Percent of Currently Unmanaged Impervious Cover" strategy in this restoration plan. The purpose of separating these two strategies is to evaluate the relative cost-benefit of each strategy. The objective is to assist the County in 1) identifying the most cost-effective approach to stormwater management, and 2) identifying the optimal combination of retrofits to meet the NPDES permit requirements and Phase II WIP recommendations.

Restoration of 20 Percent of Currently Unmanaged Impervious Cover

The County's NPDES MS4 permit requires the County to undertake efforts to restore 20 percent of currently unmanaged impervious cover. To simulate this requirement, the proposed conditions WTM were configured to treat 20 percent of unmanaged impervious cover in each TMDL watershed. The County's impervious cover data from 2011 which is the latest data available, was used for the development of this restoration plan. However, the County is in the process of deriving a new impervious area baseline assessment as a part of the NPDES MS4 requirements to identify managed and unmanaged areas. Therefore, the impervious information presented in the following sections does not reflect the most recent information. The updated data, when available, will be used to update this Bacteria TMDL Restoration Plan. BMPs with high bacteria removal efficiencies, such as SPSCs and infiltration practices, were selected to manage the 20 percent for consistency with the urban stormwater strategies recommended in the County's Phase II WIP (Anne Arundel County, 2012). As SPSCs are considered a relatively cost-effective BMP for treating larger drainage areas compared to BMPs such as bioretention (see Regenerative Stormwater Conveyance [RSC] factsheet on County's website, Anne Arundel County 2012c), they are considered a high priority for implementation. According to the County's Phase II WIP, SPSC retrofits are proposed for sites in the County that meet the following criteria: streams with physical habitat index rankings of "degraded" or "severely degraded"; and outfalls that are 24

inches or greater in diameter, have a D ranking for impairment, and occur in watersheds that are a high priority for restoration. Table 4-4 below presents the number of unmanaged impervious acres proposed to meet the 20 percent NPDES MS4 restoration goal in each TMDL watershed. This information was entered into the proposed conditions WTM to estimate the expected bacteria load reductions from implementing the 20 percent impervious restoration strategy.

Table 4-4: Number of Currently Unmanaged Impervious Acres[1] in Need of Treatment to Reach 20% Restoration Goal in NPDES Permit

Bacteria TMDL Watershed	Impervious Acres to Be Treated With High Pollutant Removal BMPs such as SPSC[2]
Magothy Mainstem	351.6
Magothy River/Forked Creek	25.5
Magothy River/Tar Cove	51.5
Patapsco River/Furnace Creek	427.1
Patapsco River LNB	491.5
Patapsco River/Marley Creek	368.5
Patuxent River Upper	77.0
Rhode River/Bear Neck Creek	19.2
Rhode River/Cadle Creek	11.6
Severn River Mainstem	877.4
Severn River/Mill Creek	43.1
Severn River/Whitehall and Meredith Creek	44.6
South River/Duvall Creek	25.2
South River Mainstem	349.1
South River/Ramsey Lake	13.6
South River/Selby Bay	13.2
W. Chesapeake Bay/Tracy and Rockhold Creeks	74.2
West River Mainstem	73.2
West River/Parish Creek	11.2

1 Impervious acres listed here are based on 2011 impervious data. The County is in the process of deriving a new impervious area baseline assessment. The updated impervious areas will be included in future evaluation and tracking of this Bacteria TMDL Restoration Plan's implementation.

2 SPSC=Step Pool Storm Conveyance

Retrofit of Pre-2002 Ponds to Meet Current MDE Stormwater Criteria

According to County's Phase II WIP, existing pre-2002 dry ponds in the TMDL watersheds are recommended to be retrofitted to meet current Maryland stormwater management criteria. Currently, dry ponds have a bacteria removal efficiency of 0 percent based on information in the County's 2012 Annual NPDES MS4 report. Converting the dry ponds to shallow wetland/marsh filtering systems or SPSCs, as recommended in the County's Phase II WIP, would increase the

bacteria removal efficiency to 75 percent or 90 percent, which in either case is considered a high-performing BMP for bacteria. Based on the WIP recommendations, only dry ponds with drainage areas of 10 acres or more were proposed for retrofit. The number of ponds proposed for retrofit for each TMDL watershed is shown in Table 4-5 below. This information was entered into the proposed conditions WTM to estimate the expected load reductions from implementing this strategy.

Table 4-5: Number of Pre-2002 Dry Ponds Proposed for Retrofit in Each TMDL Watershed

Bacteria TMDL Watershed	No. of Dry Pond Proposed Retrofits
Magothy Mainstem	8
Magothy River/Forked Creek	0
Magothy River/Tar Cove	0
Patapsco River/Furnace Creek	8
Patapsco River LNB	5
Patapsco River/Marley Creek	11
Patuxent River Upper	0
Rhode River/Bear Neck Creek	0
Rhode River/Cadle Creek	0
Severn River Mainstem	13
Severn River/Mill Creek	3
Severn River/Whitehall and Meredith Creek	0
South River/Duvall Creek	0
South River Mainstem	14
South River/Ramsey Lake	0
South River/Selby Bay	0
W. Chesapeake Bay/Tracy and Rockhold Creeks	0
West River Mainstem	0
West River/Parish Creek	0

Riparian Buffer Education

Riparian buffers help reduce non-human bacteria source loads from the watershed by slowing down and filtering stormwater runoff before it discharges to the waterway. COMAR requires a 100-foot minimum riparian buffer, or larger if steep slopes, hydric soils, highly erodible soils, nontidal wetland, or a Nontidal Wetland of Special State Concern are present (see COMAR 27.02.01.01). Maintaining a minimum buffer size helps preserve the water quality function of the buffer. Development pressure may potentially alter the buffer over time, resulting in a reduced ability of the buffer to filter pollutants (Caraco, 2013a). For this Tier B strategy, the proposed

conditions WTM was used to estimate the expected bacteria load reductions from implementing a riparian buffer education program in areas where the buffer is reduced or altered, or where private property abuts the waterway. The education program is recommended to include buffer enhancement components, such as no mow areas, planting trees and shrubs, and promoting the growth of native vegetation.

Expanded Pet Waste Education Program

This strategy involves implementing a multi-media-based pet waste education program to encourage pet owners to pick up after their pets. Other related practices such as dog park improvements, more pet waste stations, and increased enforcement of leash laws may also help to instill behavior change in pet owners and reduce bacteria loads from pet waste. According to MDE's published TMDL reports, pet waste is one of the primary bacteria sources in many of the TMDL watersheds (see Table 2-11); therefore, implementing a strategy to reduce pet waste at its source may potentially have a large impact on improving water quality in the County's impaired waterways.

Some possibilities for an expanded pet waste education program and related practices include:

- Expanding the number of pet waste stations in residential areas and County public parks. Based on a website developed by Winters (2015), there are 11 mapped pet waste stations along the Baltimore and Annapolis Trail, 20 mapped stations in the Annapolis area, and 5 mapped stations in Crofton, although these are only the mapped stations and there are likely many more opportunities throughout the County.
- Increasing signage about leash laws and ranger presence at public parks to enforce leash laws and issue citations
- Developing Public Service Announcements (PSAs) for television and post professionally made videos to the County website. An example of a PSA video, which was developed by the state of Washington and cost $27,000 to develop, is available at http://mynorthwest.com/11/512462/Washington-uses-dog-doogity-music-video-to-encourage-pet-waste-cleanup
- Improving management of pet waste at existing dog parks
- Providing grants to communities to install pet waste stations on community properties.

Bacteria load reductions from implementing a pet waste education program were estimated using the methodology proposed in the Virginia Department of Environmental Quality's (DEQ's) *Bacterial Implementation Plan Development for the James River and Tributaries – City of Richmond Technical Report* (VA DEQ, 2011). The bacteria loads from pet waste were computed by applying the percent of bacteria load contribution from pet waste from the TMDL reports (Table 2-19). To estimate the load reduction, a 25 percent bacteria removal efficiency was used, again based on VA DEQ (2011). The amount of load reduction was subtracted from the total

load to get the adjusted load. The percent load reduction was then calculated as the difference between the total load and the adjusted load. This is summarized as follows:

1. $TMDL\ Total\ Load\ x\ \%\ Pet\ Sources\ from\ TMDL\ Bacteria\ Source\ Distribution\ x\ 25\%\ Removal\ Efficency = Amount\ of\ Load\ Reduction$
2. $TMDL\ Total\ Load - Amount\ of\ Load\ Reduction = Adjusted\ Load$
3. $\frac{(TMDL\ Total\ Load - Adjusted\ Load)}{TMDL\ Total\ Load} x\ 100 = \%\ Estimated\ Load\ Reduction$

Livestock Fencing (Two TMDL Watersheds Only)

This Tier B strategy proposes to install livestock fencing along streams in pasture areas to prevent grazing livestock from accessing the stream. A study by Zeckoski et al. (2012) in Virginia found that water quality improved once livestock fencing was installed, and the excluded livestock put on 5 to 10 percent additional weight over 9 to 10 months when provided with alternative water sources such as springs and wells. The study also states that livestock fencing may potentially reduce the risk of livestock disease associated with the livestock drinking from the same stream water that is contaminated with their waste.

There are various types of livestock fencing systems available. A simple solution is to provide a trough or alternative water source in the upland area away from the stream; this measure alone may reduce the amount of time the livestock spend in the stream by 80 to 99 percent because livestock prefer drinking from troughs (Zeckoski et al., 2012). More complex systems involve both streamside fencing and cross fencing, i.e., a hardened controlled access point where livestock may cross the stream to reach pasture on the other side without being able to drink from the stream.

The Tier B proposed strategy of livestock fencing is recommended in the Patuxent River Upper and West River mainstream watersheds because these are the only watersheds that have sufficient pastures to support livestock and have a relatively large contribution from livestock waste (see Table 2-19). Load reductions from implementing livestock fencing were estimated by reducing the existing loads from livestock waste by 50 percent.

Canada Goose Management (Site-Specific)

This Tier B strategy involves management of non-migratory Canada goose populations at sites that contain open water, such as ponds, parks, golf courses, campuses, and shorelines. There are many potential management techniques for Canada geese. These include lethal controls (euthanasia, egg addling/oiling, hunting), exclusion methods (fencing, vegetative barriers), habitat alteration (reducing mowing, planting less palatable grass species, steepening banks), public education (signs and handouts at public parks), bird dispersal methods (harassment with trained dogs), and molt capture programs where the captured geese can be processed for food through a program called Farmers and Hunters Feeding the Hungry**.** Multiple techniques are recommended, as geese readily adapt to any single technique. Over the long-term, the more

effective methods will be those that reduce the population rather than those that simply disperse the geese to other areas. According to French and Parkhurst (2009), geese often return to the same nesting areas unless transported at least 200 miles away. The U.S. Department of Agriculture's Wildlife Services and Maryland DNR's Wildlife and Heritage Services are potential partners for the County to work with to develop goose management programs.

For the purposes of this TMDL Restoration Plan, the bacteria load reductions were estimated by assuming that 25 percent of existing Canada geese would be removed through various management techniques similar to those described above. The potential bacteria load reductions from this strategy were calculated as follows:

- $TMDL\ bacteria\ load\ from\ geese\ =$
  $TMDL\ total\ load\ x\ \%\ wildlife\ x\ \%\ geese\ out\ of\ total\ wildlife$
- $Total\ bacteria\ load\ from\ geese\ x\ 25\%\ = Amount\ of\ load\ reduction$
- $TMDL\ total\ load - amount\ of\ load\ reduction\ = adjusted\ load$
- $\frac{(TMDL\ total\ load - adjusted\ load)}{TMDL\ total\ load}\ x\ 100\% = \%\ estimated\ load\ reduction$

4.2 IMPLEMENTATION COSTS OF PROPOSED RESTORATION STRATEGIES

The costs of the proposed Tier A and Tier B restoration strategies were estimated from local literature sources, the County's CIP annual budget reports, and in some cases best professional judgment based on a range of approximate costs from available literature. The costs of non-structural strategies such as pet waste education and goose management were generally more difficult to estimate due to the lack of available data. The available data unit costs were estimated as follows:

- **Dry pond retrofits**: $171,307 per pond, based on an average of past County expenditures for pond retrofits
- **SPSC retrofits**: $64,500 per impervious acre treated (King and Hagan, 2011)
- **Abatement of SSOs**: varies by SPS upgrade project. Average cost of 35 planned or active projects is $351,463, estimated from CIP wastewater budget reports
- **Retirement of County septic systems**: $51,000 per septic system, estimated from County Phase II WIP; this may be a higher estimate and would be revised in the annual progress report for this restoration plan based on actual implementation costs
- **Livestock fencing**: $12,400 per system, $4.00 per linear foot to install and maintain fencing (Zeckoski et al., 2012)
- **Elimination of household illicit connections**: $121,000 per year, estimated from County 2013 NPDES MS4 Annual Report (Anne Arundel County, 2014)

- **Expanded pet waste education program**: $150,000 per year (includes pet waste video for $27,000 and several television PSAs at $10,000 to $12,000 each)
- **Riparian buffer education program**: $60,000 per year, estimated from other types of education programs cited in the literature
- **Goose management program**: $25,000 to $300,000, depending on intensity of program

4.3 POLLUTANT LOAD REDUCTIONS

As mentioned previously, water quality models were developed using the Center for Watershed Protection's WTM to characterize and quantify the bacteria loads for existing conditions. The model was also used to estimate the pollutant load reductions from restoration measures as described in the following sections. Appendix A contains the WTM modeling approach and results.

4.3.1 Estimation of Load Reductions from Prior Management Measures

MDE (2014b) recommends estimating load reductions from prior management measures to account for progress toward TMDL goals made to date. In the case of the County's bacteria TMDLs, about 10 to 15 years have elapsed since the development of the TMDLs, during which time the County has implemented BMPs and retired septic systems, both of which provide credit for bacteria removal.

To estimate the credit for bacteria removal from the BMPs already implemented, a methodology was developed through correspondence with MDE staff. The methodology involved entering the original TMDL data from the MDE published TMDL reports from 2000 into the WTM and calibrating the WTM baseline loads to the MDE baseline loads. Then, the post-TMDL BMPs and the post-TMDL septic system retirements were entered in the model and the percent reduction relative to the MDE baseline was calculated. "Post-TMDL" refers to the period from 2000 to present. The year 2000 was used as the cut-off because that was the year of the land use data MDE used to develop the TMDLs.

The calculated bacteria load reductions from prior management measures are presented in Table 4-6 below for each of the TMDL watersheds. Some of the load reductions are under-estimated because drainage area data from some BMPs were unavailable, as the County is currently in the process of updating this information. Bacteria load reductions from septic system retirement were typically less than 1 percent (0.88 percent on average) because few have been retired since 2000. In many watersheds, no septic systems have been retired (Table 4-3).

The prior percent load reductions from post-TMDL BMPs and from post-TMDL septic system retirements were added together and subtracted from the overall TMDL-required percent load reduction. The resulting "adjusted" TMDL required percent reduction represents the remaining bacteria load reduction that is required to be achieved to meet the TMDL water quality goals (Table 4-6). On average, the adjusted TMDL reduction was 4.60 percent lower than the original TMDL reduction (Table 4-6).

Table 4-6: Estimates of Load Reductions from Prior Management Measures and Corresponding Adjustments to TMDL Required Percent Reductions

Bacteria TMDL Watershed	Prior Load Reductions Since 2000		TMDL Targets	
	Post-TMDL BMPs	Post-TMDL Septic System Retirement	TMDL Required % Reduction	Adjusted TMDL Required % Reduction
Magothy Mainstem	3.30%	0.61%	54.00%	50.09%
Magothy River/Forked Creek	4.91%	None	26.27%	21.36%
Magothy River/Tar Cove	2.44%	None	32.66%	30.22%
Patapsco River/Furnace Creek	4.47%	0.38%	77.79%	72.94%
Patapsco River LNB	3.70%	2.61%	56.1%	49.79%
Patapsco River/Marley Creek	5.41%	0.26%	75.70%	70.03%
Patuxent River Upper	8.36%	None	47.2%	38.84%
Rhode River/Bear Neck Creek	11.96%	None	43.32%	31.36%
Rhode River/Cadle Creek	3.43%	None	72.16%	68.73%
Severn River Mainstem	1.19%	0.35%	19.00%	17.46%
Severn River/Mill Creek	4.30%	None	86.00%	81.70%
Severn River/Whitehall and Meredith Creek	6.45%	0.43%	90.00%	83.12%
South River/Duvall Creek	3.77%	None	45.56%	41.79%
South River Mainstem	8.09%	0.06%	46.00%	37.85%
South River/Ramsey Lake	6.00%	None	59.30%	53.30%
South River/Selby Bay	1.20%	None	28.4%	27.20%
W. Chesapeake Bay/Tracy and Rockhold Creeks	0.35%	2.70%	82.00%	78.95%
West River Mainstem	0.27%	0.48%	35.41%	34.66%
West River/Parish Creek	None	None	53.04%	53.04%
Average:	4.38%	0.88%	Avg Adjustment = 4.60% lower	

4.3.2 Estimation of Load Reductions for Proposed Strategies

This section provides estimations of potential bacteria load reductions for the proposed Tier A and Tier B strategies described in Sections 4.1.1 and 4.1.2. The load reductions were estimated using modeling techniques, local literature sources, and County data.

The estimated bacteria load reductions are presented in Table 4-7A through Table 4-7I below for all of the TMDL watersheds. Each table includes the estimated load reductions associated with each strategy, the total estimated cost of the strategy, a cost-benefit ratio, and the Tiered Recommendation (either A or B). Also included are the total estimated load reductions for implementing all Tier A strategies, all Tier B strategies, all Tier A and Tier B strategies combined, and the adjusted TMDL required percent reduction, which reflects the remaining reductions needed to meet the TMDL after prior load reductions are accounted for (see Section 4.3.1). The Tier B strategy of livestock fencing is presented as a strategy for only two of the TMDL watersheds (the Patuxent River Upper and the West River Mainstem) since these are the only two where sufficient pasture exists to support livestock.

The load estimation tables show that the greatest bacteria reductions were attributed to the Tier B strategy of pet waste education in seven of the 19 TMDL watersheds (Magothy Mainstem, Forked Creek, Bear Neck Creek, Cadle Creek, Duvall Creek, Ramsey Lake, and Selby Bay), and pet waste education was also one of the most cost-effective strategies. In other watersheds, the highest load reductions were correlated with various Tier A (human sources) and Tier B (non-human sources) strategies, as follows:

- Septic system retirement resulted in the greatest load reductions in Tar Cove, Mill Creek, Whitehall-Meredith Creeks, and South River Mainstem watersheds
- Removal of household illicit connections resulted in the greatest load reductions in the Patapsco River LNB, Marley Creek, and Severn River Mainstem watersheds
- Restoration of 20 percent impervious cover with high pollutant removal efficiency practices such as SPSCs resulted in the greatest load reductions in the Furnace Creek watershed
- Riparian buffer education resulted in the greatest load reductions in the Patuxent River Upper watershed
- SSO abatement resulted in the greatest load reductions in the Parish Creek watershed
- Livestock fencing resulted in the greatest load reductions in the West River Mainstem watershed (of the two pasture watersheds where this strategy was applicable)
- Goose management resulted in the greatest load reductions in the Tracy and Rockhold Creeks watershed

Non-structural Tier B strategies such as pet waste education, riparian buffer education, and goose management were relatively cost-effective compared to structural Tier A strategies such as SPS

upgrades and septic system retirement. Livestock fencing was also highly cost-effective in the two pasture watersheds where it was proposed as a strategy (Patuxent River Upper and West River mainstem). Urban stormwater management, including retrofitting pre-2002 dry ponds and restoring of 20 percent of unmanaged impervious cover with SPSCs, was less cost-effective due to the high unit cost assumptions (see Section 4.2) of implementing these types of stormwater projects. Eliminating household illicit connections was also less cost-effective than the other strategies due to the low rate (2 percent, see Section 4.1.1) of detecting and eliminating bacteria sources from household illicit connections.

The magnitude of the load reduction requirements indicates that multiple strategies will need to be implemented in combination in each TMDL watershed to achieve the required TMDL percent reductions. In most of the watersheds, implementing all Tier A and all Tier B strategies is sufficient to meet, or come close to meeting, the TMDL goals. However, this is not the case in seven of the watersheds, where even implementing all the Tier A and Tier B strategies is still not enough to meet the TMDL required reductions. These watersheds include: Furnace Creek (Table 4-7C), Marley Creek (Table 4-7C), Cadle Creek (Table 4-7E), Mill Creek (Table 4-7F), Tracy-Rockhold Creek (Table 4-7H), Whitehall-Meredith Creek (Table 4-7F), and Ramsey Lake (Table 4-7G). In the first five of these watersheds, it is recommended to prioritize pet waste education in high-density residential areas. In the last two watersheds (Whitehall-Meredith Creek and Ramsey Lake), load reductions are limited by other factors, primarily the lack of pond retrofit, SPS upgrade, and septic system retirement opportunities in these watersheds. For example, in the Ramsey Lake watershed, there are no existing dry ponds and no planned SPS upgrade projects. To achieve the TMDL goals in these watersheds, additional restoration opportunities with bacteria removal benefits will need to be identified, and multiple non-structural strategies such as pet waste education and possibly goose management will need to be implemented on a large scale to restore the water quality standards of the impaired waterways.

Table 4-7A: Estimated Load Reductions for Proposed Strategies in the Magothy Mainstem, Forked Creek, and Tar Cove Watersheds

TMDL Watershed: Magothy Mainstem				
Proposed Strategy	**Expected % Load Reduction**	**Total Estimated Cost in Millions**	**Cost-Benefit Ratio**	**Tiered Recommendation**
Pre-2002 Pond Retrofits	4.27%	$1.37	32.1	B
Restore 20% Impervious Area with High Pollutant Removal Efficiency BMPs such as SPSC	4.48%	$22.68	506.2	B
Eliminate Household Illicit Connections	8.74%	$0.61	6.9	A
Abatement of SSOs	1.12%	$1.71	152.8	A
Septic Retirement/Connection	13.55%	$245.51	1811.9	A
Riparian Buffer Education	0.91%	$0.06	6.2	B
Expanded Pet Waste Education	16.30%	$0.15	0.9	B
Expanded Goose Management Program	2.88%	$0.03	1.0	B
All Tier A Strategies:	**23.41%**			
All Tier B Strategies:	**28.84%**			
All Strategies:	**52.25%**			
Adjusted TMDL Required % Reduction:	**50.09%**			
TMDL Watershed: Magothy River/Forked Creek				
Proposed Strategy	**Expected % Load Reduction**	**Total Estimated Cost in Millions**	**Cost-Benefit Ratio**	**Tiered Recommendation**
Pre-2002 Pond Retrofits	N/A	N/A	N/A	B
Restore 20% Impervious Area with High Pollutant Removal Efficiency BMPs such as SPSC	7.02%	$1.64	23.4	B
Eliminate Household Illicit Connections	1.13%	$0.61	53.5	A
Abatement of SSOs	12.40%	$0.26	2.1	A
Septic Retirement/Connection	6.14%	$5.76	93.9	A
Riparian Buffer Education	1.93%	$0.06	2.9	B
Expanded Pet Waste Education	21.45%	$0.15	0.7	B
Expanded Goose Management Program	1.73%	$0.03	1.7	B
All Tier A Strategies:	**19.67%**			
All Tier B Strategies:	**32.13%**			
All Strategies:	**51.80%**			
Adjusted TMDL Required % Reduction:	**21.36%**			

Table 4-7A Continued: Estimated Load Reductions for Proposed Strategies in the Magothy Mainstem, Forked Creek, and Tar Cove Watersheds

TMDL Watershed: Magothy River/Tar Cove				
Proposed Strategy	**Expected % Load Reduction**	**Total Estimated Cost in Millions**	**Cost-Benefit Ratio**	**Tiered Recommendation**
Pre-2002 Pond Retrofits	N/A	N/A	N/A	B
Restore 20% Impervious Area with High Pollutant Removal Efficiency BMPs such as SPSC	3.76%	$3.32	88.3	B
Eliminate Household Illicit Connections	0.67%	$0.61	90.3	A
Abatement of SSOs	N/A	N/A	N/A	A
Septic Retirement/Connection	25.25%	$87.11	345.0	A
Riparian Buffer Education	1.02%	$0.06	5.9	B
Expanded Pet Waste Education	13.60%	$0.15	1.1	B
Expanded Goose Management Program	4.27%	$0.03	0.6	B
All Tier A Strategies:	**25.92%**			
All Tier B Strategies:	**22.65%**			
All Strategies:	**48.57%**			
Adjusted TMDL Required % Reduction:	**30.22%**			

Table 4-7B: Estimated Load Reductions for Proposed Strategies in the Patapsco River Lower North Branch Watershed

TMDL Watershed: Patapsco River Lower North Branch				
Proposed Strategy	**Expected % Load Reduction**	**Total Estimated Cost in Millions**	**Cost-Benefit Ratio**	**Tiered Recommendation**
Pre-2002 Pond Retrofits	1.26%	$0.86	68.0	B
Restore 20% Impervious Area with High Pollutant Removal Efficiency BMPs such as SPSC	6.59%	$31.70	481.1	B
Eliminate Household Illicit Connections	11.60%	$0.61	5.2	A
Abatement of SSOs	4.90%	$0.92	18.8	A
Septic Retirement/Connection	5.60%	$8.87	158.5	A
Riparian Buffer Education	2.99%	$0.06	2.0	B
Expanded Pet Waste Education	6.50%	$0.15	2.3	B
Expanded Goose Management Program	0.79%	$0.03	3.2	B
All Tier A Strategies:	**22.10%**			
All Tier B Strategies:	**18.13%**			
All Strategies:	**40.23%**			
Adjusted TMDL Required % Reduction:	**49.79%**			

Table 4-7C: Estimated Load Reductions for Proposed Strategies in the Furnace Creek and Marley Creek Watersheds

Proposed Strategy	Expected % Load Reduction	Total Estimated Cost in Millions	Cost-Benefit Ratio	Tiered Recommendation
TMDL Watershed: Patapsco River/Furnace Creek				
Pre-2002 Pond Retrofits	8.16%	$1.37	16.8	B
Restore 20% Impervious Area with High Pollutant Removal Efficiency BMPs such as SPSC	9.00%	$27.55	306.1	B
Eliminate Household Illicit Connections	7.72%	$0.61	7.8	A
Abatement of SSOs	3.50%	$2.19	62.5	A
Septic Retirement/Connection	3.38%	$12.85	380.2	A
Riparian Buffer Education	1.47%	$0.06	4.1	B
Expanded Pet Waste Education	7.35%	$0.15	2.0	B
Expanded Goose Management Program	4.98%	$0.03	0.5	B
All Tier A Strategies:	**14.60%**			
All Tier B Strategies:	**30.96%**			
All Strategies:	**45.56%**			
Adjusted TMDL Required % Reduction:	**72.94%**			
TMDL Watershed: Patapsco River/Marley Creek				
Pre-2002 Pond Retrofits	4.47%	$1.88	42.2	B
Restore 20% Impervious Area with High Pollutant Removal Efficiency BMPs such as SPSC	8.42%	$23.77	282.3	B
Eliminate Household Illicit Connections	10.82%	$0.61	5.6	A
Abatement of SSOs	2.04%	$1.56	76.4	A
Septic Retirement/Connection	N/A	N/A	N/A	A
Riparian Buffer Education	1.63%	$0.06	3.7	B
Expanded Pet Waste Education	8.65%	$0.15	1.7	B
Expanded Goose Management Program	4.08%	$0.03	0.6	B
All Tier A Strategies:	**12.86%**			
All Tier B Strategies:	**27.25%**			
All Strategies:	**40.11%**			
Adjusted TMDL Required % Reduction:	**70.03%**			

Table 4-7D: Estimated Load Reductions for Proposed Strategies in the Patuxent River Upper Watershed. Note that a Livestock Fencing Strategy is included since this Watershed Contains Some Agricultural Land.

Proposed Strategy	Expected % Load Reduction	Total Estimated Cost in Millions	Cost-Benefit Ratio	Tiered Recommendation
TMDL Watershed: Patuxent River Upper				
Pre-2002 Pond Retrofits	N/A	N/A	N/A	B
Restore 20% Impervious Area with High Pollutant Removal Efficiency BMPs such as SPSC	5.42%	$4.97	91.6	B
Eliminate Household Illicit Connections	0.85%	$0.61	71.2	A
Abatement of SSOs	N/A	N/A	N/A	A
Septic Retirement/Connection	16.45%	$14.74	89.6	A
Riparian Buffer Education	17.20%	$0.06	0.3	B
Expanded Pet Waste Education	4.50%	$0.15	3.3	B
Expanded Goose Management Program	4.58%	$0.03	0.5	B
Livestock Fencing	14.00%	$0.13	0.9	B
All Tier A Strategies:	**17.30%**			
All Tier B Strategies:	**45.70%**			
All Strategies:	**63.00%**			
Adjusted TMDL Required % Reduction:	**38.84%**			

Table 4-7E: Estimated Load Reductions for Proposed Strategies in the Bear Neck and Cadle Creek Watersheds

TMDL Watershed: Rhode River/Bear Neck Creek				
Proposed Strategy	**Expected % Load Reduction**	**Total Estimated Cost in Millions**	**Cost-Benefit Ratio**	**Tiered Recommendation**
Pre-2002 Pond Retrofits	N/A	N/A	N/A	B
Restore 20% Impervious Area with High Pollutant Removal Efficiency BMPs such as SPSC	6.82%	$1.27	18.6	B
Eliminate Household Illicit Connections	0.50%	$0.61	121.0	A
Abatement of SSOs	2.50%	$0.40	15.9	A
Septic Retirement/Connection	N/A	N/A	N/A	A
Riparian Buffer Education	0.11%	$0.06	54.5	B
Expanded Pet Waste Education	8.48%	$0.15	1.8	B
Expanded Goose Management Program	2.58%	$0.03	1.0	B
All Tier A Strategies:	**3.00%**			
All Tier B Strategies:	**17.98%**			
All Strategies:	**20.98%**			
Adjusted TMDL Required % Reduction:	**32.12%**			
TMDL Watershed: Rhode River/Cadle Creek				
Proposed Strategy	**Expected % Load Reduction**	**Total Estimated Cost in Millions**	**Cost-Benefit Ratio**	**Tiered Recommendation**
Pre-2002 Pond Retrofits	N/A	N/A	N/A	B
Restore 20% Impervious Area with High Pollutant Removal Efficiency BMPs such as SPSC	9.40%	$0.75	8.0	B
Eliminate Household Illicit Connections	0.30%	$0.61	201.7	A
Abatement of SSOs	8.40%	$0.50	6.0	A
Septic Retirement/Connection	N/A	N/A	N/A	A
Riparian Buffer Education	0.80%	$0.06	7.5	B
Expanded Pet Waste Education	20.05%	$0.15	0.7	B
Expanded Goose Management Program	2.55%	$0.03	1.0	B
All Tier A Strategies:	**8.70%**			
All Tier B Strategies:	**32.80%**			
All Strategies:	**41.50%**			
Adjusted TMDL Required % Reduction:	**68.73%**			

Table 4-7F: Estimated Load Reductions for Proposed Strategies in the Severn River Mainstem, Mill Creek, and Whitehall-Meredith Creek Watersheds

TMDL Watershed: Severn River Mainstem				
Proposed Strategy	**Expected % Load Reduction**	**Total Estimated Cost in Millions**	**Cost-Benefit Ratio**	**Tiered Recommendation**
Pre-2002 Pond Retrofits	3.10%	$2.23	71.8	B
Restore 20% Impervious Area with High Pollutant Removal Efficiency BMPs such as SPSC	3.90%	$56.59	1451.1	B
Eliminate Household Illicit Connections	19.02%	$0.61	3.2	A
Abatement of SSOs	0.36%	$2.39	655.9	A
Septic Retirement/Connection	10.56%	$279.23	2644.2	A
Riparian Buffer Education	1.56%	$0.06	3.8	B
Expanded Pet Waste Education	17.20%	$0.15	0.9	B
Expanded Goose Management Program	3.78%	$0.03	0.7	B
All Tier A Strategies:	**29.94%**			
All Tier B Strategies:	**29.54%**			
All Strategies:	**59.49%**			
Adjusted TMDL Required % Reduction:	**17.46%**			
TMDL Watershed: Severn River/Mill Creek				
Proposed Strategy	**Expected % Load Reduction**	**Total Estimated Cost in Millions**	**Cost-Benefit Ratio**	**Tiered Recommendation**
Pre-2002 Pond Retrofits	4.34%	$0.51	11.8	B
Restore 20% Impervious Area with High Pollutant Removal Efficiency BMPs such as SPSC	4.20%	$2.78	66.2	B
Eliminate Household Illicit Connections	1.54%	$0.61	39.3	A
Abatement of SSOs	0.20%	$0.26	130.3	A
Septic Retirement/Connection	34.70%	$59.57	171.7	A
Riparian Buffer Education	2.80%	$0.06	2.1	B
Expanded Pet Waste Education	9.50%	$0.15	1.6	B
Expanded Goose Management Program	7.72%	$0.03	0.3	B
All Tier A Strategies:	**36.44%**			
All Tier B Strategies:	**28.56%**			
All Strategies:	**65.00%**			
Adjusted TMDL Required % Reduction:	**81.70%**			

Table 4-7F Continued: Estimated Load Reductions for Proposed Strategies in the Severn River Mainstem, Mill Creek Southern, and Whitehall-Meredith Creek Watersheds

TMDL Watershed: Severn River/Whitehall and Meredith Creek				
Proposed Strategy	**Expected % Load Reduction**	**Total Estimated Cost in Millions**	**Cost-Benefit Ratio**	**Tiered Recommendation**
Pre-2002 Pond Retrofits	N/A	N/A	N/A	B
Restore 20% Impervious Area with High Pollutant Removal Efficiency BMPs such as SPSC	4.20%	$2.88	68.5	B
Eliminate Household Illicit Connections	0.90%	$0.61	67.2	A
Abatement of SSOs	N/A	N/A	N/A	A
Septic Retirement/Connection	21.10%	$16.32	77.3	A
Riparian Buffer Education	2.24%	$0.06	2.7	B
Expanded Pet Waste Education	6.50%	$0.15	2.3	B
Expanded Goose Management Program	9.29%	$0.03	0.3	B
All Tier A Strategies:	**22.00%**			
All Tier B Strategies:	**22.23%**			
All Strategies:	**44.23%**			
Adjusted TMDL Required % Reduction:	**83.12%**			

Table 4-7G: Estimated Load Reductions for Proposed Strategies in the South River Mainstem, Duvall Creek, Ramsey Lake, and Selby Bay Watersheds

TMDL Watershed: South River Mainstem				
Proposed Strategy	**Expected % Load Reduction**	**Total Estimated Cost in Millions**	**Cost-Benefit Ratio**	**Tiered Recommendation**
Pre-2002 Pond Retrofits	3.73%	$2.40	64.3	B
Restore 20% Impervious Area with High Pollutant Removal Efficiency BMPs such as SPSC	3.60%	$22.52	625.5	B
Eliminate Household Illicit Connections	11.30%	$0.61	5.4	A
Abatement of SSOs	0.30%	$1.55	516.6	A
Septic Retirement/Connection	15.60%	$86.39	553.8	A
Riparian Buffer Education	8.00%	$0.06	0.8	B
Expanded Pet Waste Education	10.83%	$0.15	1.4	B
Expanded Goose Management Program	4.44%	$0.03	0.6	B
All Tier A Strategies:	**27.20%**			
All Tier B Strategies:	**30.59%**			
All Strategies:	**57.79%**			
Adjusted TMDL Required % Reduction:	**37.85%**			
TMDL Watershed: South River/Duvall Creek				
Proposed Strategy	**Expected % Load Reduction**	**Total Estimated Cost in Millions**	**Cost-Benefit Ratio**	**Tiered Recommendation**
Pre-2002 Pond Retrofits	N/A	N/A	N/A	B
Restore 20% Impervious Area with High Pollutant Removal Efficiency BMPs such as SPSC	9.13%	$1.63	17.8	B
Eliminate Household Illicit Connections	0.65%	$0.61	93.1	A
Abatement of SSOs	6.40%	$0.26	4.1	A
Septic Retirement/Connection	N/A	N/A	N/A	A
Riparian Buffer Education	N/A	N/A	N/A	B
Expanded Pet Waste Education	17.00%	$0.15	0.9	B
Expanded Goose Management Program	2.16%	$0.03	1.2	B
All Tier A Strategies:	**7.05%**			
All Tier B Strategies:	**28.29%**			
All Strategies:	**35.34%**			
Adjusted TMDL Required % Reduction:	**41.79%**			

Table 4-7G Continued: Estimated Load Reductions for Proposed Strategies in the South River Mainstem, Duvall Creek, Ramsey Lake, and Selby Bay Watersheds

TMDL Watershed: South River/Ramsey Lake				
Proposed Strategy	**Expected % Load Reduction**	**Total Estimated Cost in Millions**	**Cost-Benefit Ratio**	**Tiered Recommendation**
Pre-2002 Pond Retrofits	N/A	N/A	N/A	B
Restore 20% Impervious Area with High Pollutant Removal Efficiency BMPs such as SPSC	2.90%	$0.88	30.2	B
Eliminate Household Illicit Connections	0.11%	$0.61	550.0	A
Abatement of SSOs	N/A	N/A	N/A	A
Septic Retirement/Connection	N/A	N/A	N/A	A
Riparian Buffer Education	0.14%	$0.06	42.9	B
Expanded Pet Waste Education	15.73%	$0.15	1.0	B
Expanded Goose Management Program	4.81%	$0.03	0.5	B
All Tier A Strategies:	**0.11%**			
All Tier B Strategies:	**23.58%**			
All Strategies:	**23.69%**			
Adjusted TMDL Required % Reduction:	**53.30%**			
TMDL Watershed: South River/Selby Bay				
Proposed Strategy	**Expected % Load Reduction**	**Total Estimated Cost in Millions**	**Cost-Benefit Ratio**	**Tiered Recommendation**
Pre-2002 Pond Retrofits	N/A	N/A	N/A	B
Restore 20% Impervious Area with High Pollutant Removal Efficiency BMPs such as SPSC	3.20%	$0.85	26.6	B
Eliminate Household Illicit Connections	0.16%	$0.61	378.1	A
Abatement of SSOs	N/A	N/A	N/A	A
Septic Retirement/Connection	N/A	N/A	N/A	A
Riparian Buffer Education	0.06%	$0.06	100.0	B
Expanded Pet Waste Education	15.68%	$0.15	1.0	B
Expanded Goose Management Program	4.58%	$0.03	0.5	B
All Tier A Strategies:	**0.16%**			
All Tier B Strategies:	**23.51%**			
All Strategies:	**23.67%**			
Adjusted TMDL Required % Reduction:	**27.20%**			

Table 4-7H: Estimated Load Reductions for Proposed Strategies in the Tracy and Rockhold Creek Watershed

TMDL Watershed: W. Chesapeake Bay/Tracy and Rockhold Creeks				
Proposed Strategy	**Expected % Load Reduction**	**Total Estimated Cost in Millions**	**Cost-Benefit Ratio**	**Tiered Recommendation**
Pre-2002 Pond Retrofits	N/A	N/A	N/A	B
Restore 20% Impervious Area with High Pollutant Removal Efficiency BMPs such as SPSC	2.60%	$4.79	184.1	B
Eliminate Household Illicit Connections	0.23%	$0.61	263.0	A
Abatement of SSOs	N/A	N/A	N/A	A
Septic Retirement/Connection	N/A	N/A	N/A	A
Riparian Buffer Education	8.20%	$0.06	0.7	B
Expanded Pet Waste Education	5.20%	$0.15	2.9	B
Expanded Goose Management Program	9.38%	$0.03	0.3	B
All Tier A Strategies:	**0.23%**			
All Tier B Strategies:	**25.38%**			
All Strategies:	**25.61%**			
Adjusted TMDL Required % Reduction:	**78.95%**			

Table 4-7l: Estimated Load Reductions for Proposed Strategies in the West River Mainstem and Parish Creek Watersheds. Note that a Livestock Fencing Strategy is included in the West River Mainstem Watershed since this Watershed Contains Some Agricultural Land.

TMDL Watershed: West River Mainstem				
Proposed Strategy	**Expected % Load Reduction**	**Total Estimated Cost in Millions**	**Cost-Benefit Ratio**	**Tiered Recommendation**
Pre-2002 Pond Retrofits	N/A	N/A	N/A	B
Restore 20% Impervious Area with SPSC	8.30%	$4.72	56.9	B
Eliminate Household Illicit Connections	1.21%	$0.61	50.0	A
Abatement of SSOs	N/A	N/A	N/A	A
Septic Retirement/Connection	N/A	N/A	N/A	A
Riparian Buffer Education	11.54%	$0.06	0.5	B
Expanded Pet Waste Education	3.93%	$0.15	3.8	B
Expanded Goose Management Program	3.51%	$0.03	0.7	B
Livestock Fencing	28.55%	$0.13	0.5	B
All Tier A Strategies:	**1.21%**			
All Tier B Strategies:	**55.82%**			
All Strategies:	**57.03%**			
Adjusted TMDL Required % Reduction:	**34.66%**			
TMDL Watershed: West River/Parish Creek				
Proposed Strategy	**Expected % Load Reduction**	**Total Estimated Cost in Millions**	**Cost-Benefit Ratio**	**Tiered Recommendation**
Pre-2002 Pond Retrofits	N/A	N/A	N/A	B
Restore 20% Impervious Area with SPSC	10.50%	$0.72	6.9	B
Eliminate Household Illicit Connections	0.19%	$0.61	318.4	A
Abatement of SSOs	12.90%	$0.40	3.1	A
Septic Retirement/Connection	N/A	N/A	N/A	A
Riparian Buffer Education	0.46%	$0.06	13.0	B
Expanded Pet Waste Education	10.05%	$0.15	1.5	B
Expanded Goose Management Program	7.72%	$0.03	0.3	B
All Tier A Strategies:	**13.09%**			
All Tier B Strategies:	**28.73%**			
All Strategies:	**41.82%**			
Adjusted TMDL Required % Reduction:	**53.04%**			

4.4 PROPOSED STRATEGIES WITH LARGEST IMPACT AND RECOMMENDED PRIORITIZATION OF STRATEGIES

The proposed Tier A strategies with the largest impacts are reducing the number of SSOs, retiring County septic systems, and eliminating household illicit connections to reduce human bacteria sources. The proposed Tier B strategies with the largest impacts are a pet waste education program and riparian buffer education program to reduce non-human bacteria sources.

In the 12 TMDL watersheds where SSO abatement is proposed, the bacteria load reductions ranged from 0.36 to 12.40 percent. In the 10 TMDL watersheds where County septic systems were identified for retirement based on County data, the bacteria load reductions ranged from 3.38 to 34.70 percent. Implementing a riparian buffer education program resulted in an estimated load reduction of 0.06 to 17.20 percent among 18 of the 19 TMDL watersheds where buffers occur.

Load reductions from implementing an expanded pet waste education program ranged from 4.50 to 21.45 percent in all 19 TMDL watersheds and were highest in the smaller watersheds with a large proportion of residential urban land, e.g., Forked Creek, Cadle Creek, and Duvall Creek, which have dense shoreline communities that could provide excellent case studies for implementing the pet waste education strategy. In addition, removal of pet waste from along or near the shoreline in these watersheds is likely to have an immediate impact on the water quality of the local impaired waterway due to the proximity of the bacteria sources to the receiving water body.

Prioritization of the proposed strategies considers that some are already part of existing County programs, such as eliminating illicit connections, urban stormwater management, and SPS upgrades, and retiring septic systems. The purpose of including these as strategies in this Bacteria TMDL Restoration Plan is to take advantage of the bacteria load reductions being achieved from the County's existing programs and operations, as well as future load reductions that will be achieved by these programs.

The magnitude of the TMDL required load reductions is such that many strategies will need to be implemented to restore TMDL water quality standards in the impaired waterways. In particular, implementation of a multi-media pet waste education program is strongly recommended due to the large bacteria load reductions that are likely to be achieved with this strategy. In addition, riparian buffer education is also recommended because it is also relatively cost-effective and has wide applicability.

Goose management and livestock fencing are generally cost-effective as well, but are not considered a priority since they have limited applicability, i.e., goose management is only relevant in small localized areas where geese are a nuisance and impact water quality, and livestock fencing is only applicable to the two TMDL watersheds where livestock occur (Patuxent River Upper and West River Mainstem).

The proposed strategies are prioritized as listed in Table 4-8 below. The priorities are based on whether the program is in place or not, the estimated magnitude of bacteria load reductions, the relative cost-effectiveness of the strategy, and the applicability of the strategy among the 19 TMDL watersheds.

Table 4-8: Priority of Proposed Strategies

Proposed Strategy	Tier (A or B)	Priority For Implementation	Relative Cost-Effectiveness	Current Status	Recommendation
Expanded Pet Waste Education Program	B - reduces non-human sources	1	High	Limited Implementation	Implement in all TMDL Watersheds
Riparian Buffer Education	B - reduces non-human sources	2	High	Limited Implementation	Implement in all TMDL Watersheds
Goose Management Program	B - reduces non-human sources	3	High	Limited Implementation	Implemented in Site-Specific Areas Only
Livestock Fencing	B - reduces non-human sources	4	High	Limited Implementation	Implemented in Two Pasture Watersheds Only[1]
Abatement of SSOs	A - reduces human bacteria sources	1 - already in place	Low	Being Implemented	Begin Accounting for Bacteria Load Reductions
Retirement of County Septic Systems	A - reduces human bacteria sources	1 - already in place	Low	Being Implemented	Begin Accounting for Bacteria Load Reductions
Eliminate Household Illicit Connections	A - reduces human bacteria sources	1 - already in place	Moderate	Being Implemented	Begin Accounting for Bacteria Load Reductions
Pre-2002 Pond Retrofits	B - reduces non-human sources	1 - already in place	Moderate	Being Implemented	Begin Accounting for Bacteria Load Reductions
Restore 20% Impervious Cover with SPSC	B - reduces non-human sources	1 - already in place	Moderate	Being Implemented	Begin Accounting for Bacteria Load Reductions

1-Patuxent River Upper and West River Mainstem

SECTION FIVE: PUBLIC AND STAKEHOLDER PARTICIPATION

Public participation and stakeholder engagement play an important role in the successful implementation of a TMDL restoration plan. As part of its NPDES MS4 permit, the County is required to engage the public in the TMDL restoration plan development, solicit their input, and incorporate any relevant ideas and program improvements that help achieve the TMDL goals (Part IV.E.3). According to the County's Phase II Watershed Implementation Plan (WIP; Anne Arundel County, 2012), approximately 64 percent of the land in the County is privately owned; therefore, increasing public awareness of TMDL impairment may result in fostering partnerships with private owners which would lead to greater pollutant load reductions. In addition, the participating public can offer useful on-the-ground information, such as confirmation of livestock and wildlife numbers (and locations where they occur), general knowledge of the local community (e.g., landowners' willingness to implement restoration projects), and information about the local impaired waterway (VA DEQ, 2011; EPA, 2013a).

According to the County, one of the major challenges to engaging the public is that "most citizens do not understand the degree that their individual actions affect waterway health and do not understand how they can be part of the solution" (Anne Arundel County, 2012). Specifically, many people are not aware that nonpoint source pollution can contribute to bacteria loads (WGCAC, 2011). Therefore, it is important to inform the public of the impacts of nonpoint source pollution, and to convey a sense of ownership so that individuals can be better stewards of the environment.

5.1 CURRENT OUTREACH PROGRAMS

The County currently directs several outreach programs led by various departments, including the Department of Public Works. These outreach programs are aimed at increasing public awareness on issues related to water quality and include activities such as conducting workshops and providing information through brochures, fliers, volunteer programs etc. The County is also promoting public awareness using social media such as Facebook. A list of current outreach programs is provided in the County's NPDES MS4 Annual Report (Anne Arundel County, 2014). Table 5-1 lists some of the County's current outreach programs that help increase public awareness related to bacteria impairment.

Table 5-1: Available County Outreach Programs/Materials that Promote Awareness Related to Bacteria Impairments

Department	Outreach Program/Outreach Materials	Media Type
Department of Public Works	• Rehabilitation and Maintenance of County Sewer Infrastructure • Information on Recent Wastewater Spills • Preventing Sewer Backups • Homeowner's Guide to Septic Tanks • Homeowner's Guide to Grinder Pumps • Recycling Programs/Waste Management • Watershed Stewards Academy • Stream Cleanups	Brochures, Fliers, Information Sessions, Presentation, Facebook, Workshops, Volunteer Programs
Department of Health	• Water Quality and Swimming or Fishing in Anne Arundel County Rivers and Creeks • On-Site Sewage Disposal Systems and Private Water Wells • Bay Restoration Fund (BRF) Program, for Nitrogen-Reducing Pretreatment Units for Septic Systems to Be Installed within the Chesapeake Bay Critical Area • Collapsed Septic Tanks, Overflowing Septic Systems and Failing Septic Systems Interim Health and Safety Requirements • Application Procedures for Property Improvements Where Well or On-Site Septic Systems are Utilized • Maryland Healthy Beaches Campaign	Factsheets, Brochures, Campaigns

5.2 POTENTIAL CHALLENGES AND SOLUTIONS TO IMPROVE THE COUNTY'S CURRENT OUTREACH PROGRAMS

Several agencies and jurisdictions have published cost-effective methods to engage the public and stakeholders in watershed restoration. Locally, the Watershed Steward Academy has been successful in training watershed stewards and implementing micro-scale stormwater practices, such as rain barrels, rain gardens, plantings, and forested buffers, and promoting pet waste management. However, they have had difficulty reaching the public on bacteria issues such as pet waste (Capital Gazette, 2014). Table 5-2 summarizes some of the challenges faced by the County's outreach programs and potential solutions for overcoming impediments to cooperative watershed restoration. This information was developed based on publications related to outreach from other jurisdictions and agencies. The proposed solutions apply to most types of watershed outreach and are recommended for this bacteria TMDL restoration plan.

Table 5-2: Challenges and Solutions to Public and Stakeholder Participation in the Watershed Restoration Process

Challenge	Solution
Loss of momentum	Setting small, achievable goals throughout the implementation process to show success and keep the project energized; keeping the public and stakeholders actively engaged by periodically checking in with them during slow times (EPA, 2010).
Poor coordination and planning	Conducting organizational planning activities prior to beginning implementation process. Clearly communicating goals and load reduction strategies to achieve those goals. Making sure that the public and stakeholders all agree on the Restoration Plan. Defining roles and responsibilities (EPA, 2010). Identifying the target audience and all stakeholders, and deciding what messages are to be conveyed and the appropriate conveyance method (i.e., type of media). Determining how success will be measured (e.g., website hits, surveys, water quality monitoring).
Lack of communication or infrequent communication	Keeping the public and stakeholders informed at all times. For example the public and stakeholders should be informed if any issues arise during the implementation process, if there are any changes to the original load reduction strategies, and if any lessons were learned along the way. Keeping the public and stakeholders informed of achievements, however small (e.g., website received 500 hits this week) (EPA, 2010). Making sure new information (e.g., technical reports) is conveyed to the technical team, County, public participation team, and stakeholders. When information becomes available, disseminating it quickly to keep participants informed and engaged (EPA, 2013a).
Political controversy	Avoiding heated political debate on controversial implementation projects. Working quietly with individual stakeholder groups to settle disagreements in a satisfactory manner (EPA, 2010).
Fear of the unknown	Accepting that there may be less data available than optimally preferred. Pursuing objectives aggressively despite lack of sufficient information and data (EPA, 2010).
Letting money drive the implementation process	Identifying types of restoration strategies first, and then pursuing funding to support the strategies. Avoiding pursuing funding opportunities for low-priority activities that may distract from the overall goals of the Restoration Plan (EPA, 2010).
Letting the implementation process bog you down	Keeping meetings short such that stakeholders who are usually volunteers can provide complete attention (EPA, 2013a). Avoiding situations where participants are spending more time on meetings than on actual watershed restoration work (EPA, 2010).
Not seeing any results/evaluation of effectiveness not showing anything	Considering different methods of communication. The County of Los Angeles (2002) recommends the following for effective communication: • Give specific, action-oriented messages (e.g., “do’s and don’ts”). • Emphasize personal responsibility and empowerment. Inspire and motivate people and convey that individuals can make a difference. • Emphasize aesthetic and health benefits of improving water quality (e.g., in the case of bacteria, removal of pet waste and other bacteria sources leads to cleaner neighborhoods and reduces health risk to children, swimmers, boaters). • Make information easily accessible on the Web so the public can follow up on initial interest. Alternatively, Bruce and Tiger (2009) suggest that the effectiveness of public outreach efforts may not be apparent immediately afterwards if the evaluation

Challenge	Solution
	method does not capture the full long-term effects. In general, outreach campaigns may result in only small, incremental behavior changes that are difficult to measure. Outreach programs should focus on changing behaviors rather than just raising awareness. Better knowledge about water quality issues is not well-correlated with better behavior (CWEP, 2009).

5.3 POTENTIAL NEW OUTREACH PROGRAMS

As described above, the County currently conducts numerous outreach/education programs. Additional outreach programs that can be considered to reduce bacteria loads include boater education with respect to marina pump out stations and reducing waste due to homelessness, via reduction in homeless populations or in providing routine cleanup of encampment areas. Estimating the bacteria load reductions due to these two programs is not possible at this time due to the limited amount of quantitative information available. However, based on other education and outreach programs, in general, these programs are likely to be relatively cost effective in terms of reducing bacteria loads.

A potential outreach program is education of boat owners to raise awareness about the importance of always using pump-out stations at marinas for proper sewage disposal. This would help reduce the amount of human bacteria discharged directly into waterways. In general, boat waste discharges can have a significant impact upon the aquatic environment, especially in small, poorly flushed waterways where pollutant concentrations may reach unusually high levels (Klein, 2007). It is estimated that a single weekend boater flushing untreated sewage into waterways produces the same amount of bacterial pollution as 10,000 people whose sewage passes through a treatment plant (CA DBW, 2014). Based on a survey of 227 Maryland boaters, Strand and Gibson (1990) determined that only 24.8% of boaters at marinas with pump-out facilities actually used the facility.

One of the best methods for conveying information about proper use of pump-out stations is posting signs, which are considered a more effective method of conveying information than distributing literature or conducting boater education workshops (EPA, 2014). Signs would be most beneficial at highly visible locations in marinas such as boat ramps, anchorages/moorings, fuel docks, and liveaboard docks. The cost of posting a sign is estimated to be $105 (RI Sea Grant, 1992). MD DNR currently conducts workshops and outreach for marina operators as a part of “Clean Marina Program” to promote environmentally friendly boating practices such as use of pump-outs for waste disposal, proper disposal of trash etc. County agencies can partner with MDDNR to promote environmentally friendly boating activities in watersheds with large number of community marinas such as Severn and South River watersheds. Additional boater outreach may also be conducted through the County’s social media and the County website. In addition to signage, installing additional pump-out facilities at marinas would help to reduce human bacteria discharges from vessels. Strand and Gibson (1990) found that the availability of a pump-out facility at a marina increased the likelihood of pumping by twofold.

Another potential outreach program is related to homeless populations in the County. Reducing homelessness helps to reduce human bacteria in runoff from homeless encampments. Based on a 2012 assessment of the County's homeless population, it was determined that 1,300 homeless individuals utilized existing emergency shelters, transitional housing, and permanent supportive housing during the 2012 Federal Fiscal Year (Anne Arundel County, 2012d). The MDE states that addressing homeless populations can take the form of surveys of other units of local government including social services, police, schools, the health department, and nongovernmental organizations, which also serve the purpose of educational outreach on the health concerns of bacteria (MDE, 2014b).

In other jurisdictions with similar bacteria TMDLs, homeless encampments are addressed by frequent river and green area clean-ups, enforcement by police and park rangers, and annual funding of social service programs that directly serve the local homeless population (CA Central Coast Regional Board, 2011). One local organization involved in ensuring the needs of persons who are homeless is the "Anne Arundel and Annapolis Coalition to End Homelessness," a community based planning and advocacy organization.

SECTION SIX: FUNDING SOURCES AND TECHNICAL ASSISTANCE

6.1 FUNDING SOURCES

Achieving proposed improvements to meet bacteria TMDLs requires adequate funding to cover the cost of project implementation, operating expenditures, administrative costs, and other programmatic costs. This section presents potential federal, state, and non-profit grants and loans that may be suitable for use for proposed restoration strategies. Many of the grant programs focus on reducing nonpoint source nutrients and sediment to improve general water quality, and a few of the programs include specific provisions for practices that address bacteria pollution. For example, the Maryland Department of Natural Resources has a grant program to fund installation of sewage pumpout stations at marinas, which reduce bacteria discharges from boats. Table 6-1 provides an overview of potential funding sources.

Table 6-1: Potential Funding Sources for Bacteria TMDL Implementation

Funding Type	Funding Agency	Restoration Activity	Purpose of Program	Available Funding
State	State Water Quality Revolving Loan Fund	Varies; implementation of NPS projects requiring capital investment, or replacement of failing septic tanks	To provide low interest loans to projects that improve water quality and public health	State allotments vary; in 2011, Maryland received $35.7 M
State	The Maryland Stormwater Pollution Control Cost-Share Program	Implementation of any urban stormwater BMPs	To fund the implementation of stormwater management retrofit projects to control pollutants from older developed areas	$20,000 - $500,000
Non-profit	Chesapeake Bay Trust	Varies: must contribute to the restoration of the Chesapeake Bay	To promote public awareness and participation in restoration and protection of the Chesapeake Bay	$2,000 - $50,000
State	Bay Restoration Fund - OSDS Grant Program	Sewer upgrades and connection of septic systems to public sewer	To upgrade septic systems with Nitrogen Reducing Units. Program has expanded to include connection of septic tanks to sewer system. Funding priority is given to Chesapeake Bay Critical Areas.	$5,000 - $15,000
Federal	EPA 319 Funds	Implementation of agricultural and residential BMPs	To restore impaired waters by implementing watershed-based plans	Varies
Federal	EPA Urban Waters Small Grants	Implementation of pet waste public education program	To help restore urban water quality and revitalize neighborhoods by engaging communities in activities that increase their connection to,	$40,000 - $60,000

Funding Type	Funding Agency	Restoration Activity	Purpose of Program	Available Funding
			understanding of, and stewardship of local urban waterways	
State	MACS Program	Installation of stream protection systems to limit livestock access to streams	To help farmers protect natural resources on their farms, maintain farm productivity, and comply with state and federal regulations	Provides farmers with grants to cover up to 87.5% of the cost to install conservation BMPs on their farms. More than 30 BMPs are currently eligible for MACS grants, including livestock exclusion fencing.
Federal	USDA EQIP (Cost-Share)	Installation of stream protection systems to limit livestock access to streams and reduce sediment into streams	To implement conservation BMPs on land used for livestock and crop production	Total payments not to exceed $10,000/year or $50,000 for length of contract; average payment is $15,000
Private Funds	National Fish and Wildlife Foundation/Wells Fargo Environmental Solutions for Communities	Implementation of local water quality improvement projects that encourage broad-based citizen participation in project implementation	To support projects linking economic development and community well-being to the stewardship and health of the environment	$25,000 - $100,000 (median: $40,000)
State	The Supplemental Assistance Program	OSDS upgrades, including connection of older OSDS to public sewers, correction of system deficiencies such as SSOs, excessive inflow and infiltration, or outdated pump stations	To fund local governments for planning, design, and construction of wastewater projects needed to address public health or water quality issues considered to be high priority to MDE	Varies
State	Linked Deposit Loan Program	OSDS upgrades or other NPS capital improvements on private lands	To provide a source of low-interest financing to encourage private landowners and water system owners to implement capital improvements that will reduce the delivery of nutrients to the Chesapeake Bay and its tributaries	Varies
State	Maryland DNR Boating Services Unit	Installation of marina pumpout stations	To reduce bacteria loads from marinas by providing boaters with a proper method of disposing of their sewage and thus prevent it from entering local waters	Up to $15,000

Funding Type	Funding Agency	Restoration Activity	Purpose of Program	Available Funding
State	Chesapeake and Coastal Bays 2010 Trust Fund Grants	Various restoration projects	To accelerate Chesapeake Bay restoration via innovative new technologies, by engaging the community, and accountability	$5,001 - $70,000 for Watershed Assistance Program grants; minimum $500,000 for Cost-Effective Non-Point Source Pollution Reduction grants (no maximum); up to $75,000 annually for *CoastSmart* Communities grants

BMP = Best management practice
CIP = Capital Improvement Program
DNR= Department of Natural Resources
EQIP = Environmental Quality Incentives Program
MACS = Maryland Agricultural Water Quality Cost-Share
MDE = Maryland Department of the Environment
NPS = Nonpoint source
OSDS = Onsite sewage disposal system (septic system)

Relatively recent changes to the legislative requirements for the Bay Restoration Fund allow the collected monies to be used to connect septic systems to public sewers. However, it is expected that use of this funding source will be limited because it is likely to cover only a portion of the cost (Anne Arundel County Phase II WIP, 2012). Therefore, additional funding sources will need to be identified to implement proposed restoration strategies for septic systems. An additional source of funding is the Maryland Supplemental Assistance Program administered by MDE, which finances repair and upgrade of existing septic systems.

For livestock source reduction practices, Maryland's Agricultural Water Quality Cost-Share, or MACS program, provides funding for various eligible agricultural BMPs, one of which is streamside livestock exclusion fencing (see MDA, 2013 and MDA, 2014). Funding source for improvements related to livestock are likely to have limited applicability in Anne Arundel County because livestock areas are limited in the TMDL watersheds and, further, agricultural land is increasingly being converted to residential uses.

Other grant programs are focused on community-based initiatives to improve water quality and are potentially applicable to pet waste outreach activities and associated installation of pet waste stations, doggy loos, etc. Two examples of community-based grant programs are EPA's Urban Waters Small Grants Program and the National Fish and Wildlife Foundation's Environmental Solutions for Communities. In addition, Chesapeake Bay Trust, a non-profit grant-making organization also awards funding for eligible restoration and outreach programs.

Implementing stormwater retrofits such as converting dry ponds to shallow marshes, or restoring degraded outfalls and stream channels with Step Pool Storm Conveyance (SPSC) systems are currently funded through the County CIP program. Funds are secured through revenue from the stormwater remediation fee that resulted from passage of County Bill 2-13. This provides a predictable source of dedicated funding for stormwater management purposes. Funding sources

such as the Chesapeake Bay Trust funds, may be used to supplement County funds for specific projects

Wastewater CIP projects implemented through the County DPW are currently funded through wastewater bonds and wastewater PayGo (i.e., pay-as-you-go funds from wastewater utility operations, as provided in the annual budget). Improvements to the sewer infrastructure that would abate SSOs are expected to continue to be funded through the County's wastewater CIP projects.

6.2 TECHNICAL ASSISTANCE

Technical assistance refers to staffing and resources needed to oversee and implement the TMDL restoration plan. Since the passage of the Chesapeake Bay TMDL in 2010, the County passed County Bill 2-13, which established the Watershed Protection and Restoration Fund to support Chesapeake Bay Restoration activities. As a result, the County has been aligning resources needed to meet the requirements of the Chesapeake Bay TMDL and individual TMDLs as required by the NPDES MS4 permit. The alignment consists of departmental reorganization, hiring additional County staff, and engaging consulting resources. This framework enables the County to move forward with design and installation of urban stormwater BMPs based on the Phase II WIP strategy proposed by the County. This includes pre-2002 dry pond retrofits, and especially SPSC retrofits that are likely to figure prominently in the County's restoration activities over the next decade, primarily in areas where degraded stream channels are observed.

The changes in the County's program will also support the implementation of restoration strategies to meet the bacteria TMDL. For example, County programs can be expanded to install and deploy the pet waste stations, doggy loos, etc. in the County park system; to ramp up outreach activities and notify owners of existing pet waste pick-up laws; and to engage specialized outreach personnel to develop videos, County website content, public service announcements for television, social media, etc. Expansion of the County's program can also include developing buffer education programs to instruct residential owners on acceptable and unacceptable practices in buffer areas, and developing educational materials and signage for posting in buffer zones.

SECTION SEVEN: IMPLEMENTATION SCHEDULE AND MILESTONES

Based on MDE's recommendations and published guidance document for developing restoration plans for bacteria impairment, TMDL restoration plans should begin by addressing controllable sources of bacteria in the watershed (e.g., from humans, livestock, and pets) (MDE, 2014b). Further, as mentioned previously, reductions in human sources are given a priority because they pose a greater public health risk than non-human sources. Even though wildlife is one of the contributing factors of bacteria impairment, elimination of wildlife is considered "undesirable and impracticable" by MDE and EPA and is not listed as an intended goal of the TMDL.

Load reduction strategies that address urban stormwater (Tier B) are structural in nature and are in line with the strategies proposed to meet the Chesapeake Bay TMDL. The County is required to meet the Chesapeake Bay TMDL requirements by 2025, therefore integrating bacteria Restoration Plan schedules with the Bay TMDL schedule has a beneficial impact on both programs. Adhering to the Bay TMDL schedule would result in 60 percent of the implementation efforts to reduce bacteria loads being implemented by 2017. Under this scenario, milestone review would occur every 2 years to determine whether the proposed strategies are being implemented, and to what extent.

A generalized implementation schedule is provided in Table 7-1. This schedule is based on implementing strategies incrementally to reduce bacteria loads with achievement of all of the TMDL required percent load reductions by 2025. Since all of the TMDLs require the same combination of load reduction strategies (i.e., highly cost-effective Tier B non-structural controls to reduce non-human bacteria sources, followed by less cost-effective Tier A structural controls to reduce human sources of bacteria), the schedule applies to all the bacteria TMDLs. The only watersheds where TMDLs need a slight adjustment to the strategies is Patuxent River Upper and West River mainstem, both of which have agricultural pastures that support livestock populations. In these cases, livestock fencing is recommended as a part of Tier B strategies. This is noted in the table below. In addition, there is considerable flexibility for conducting pet waste education. It is recommended that the County identify and prioritize specific high-density residential areas, especially those where the expected load reductions otherwise fall short of the TMDL (see Section 4.4).

Table 7-1: Bacteria TMDL Implementation Schedule by Milestone Year

Milestone Year	Programmatic Criteria
2015	• Begin securing any funding sources needed • Make programmatic adjustments and identify any additional staffing needs • Identify drainage areas for existing BMPs, as required • Begin planning and developing pet waste education program, prioritize watersheds, and identify funds needed • Conduct survey to determine pet waste education needs • Begin site identification and design process for new dry pond or SPSC retrofits (already underway)

Milestone Year	Programmatic Criteria
2017	• 25% of all planned SPS upgrades completed • 10% of impervious area managed with SPSC or other high-performing BMP • Continued triennial inspection and maintenance of constructed BMPs • 25% of planned septic systems connected to sewers, if funding allows • Pet waste education program fully planned and coordinated, begin media campaign via television PSAs, videos on County website, and social media • Implement livestock fencing in two agricultural watersheds*
2019 (end of NPDES permit cycle)	• 50% of all planned SPS upgrades completed • 20% of impervious area managed with SPSC or other high-performing BMP (meet NPDES/WIP goal) • Continued triennial inspection and maintenance of constructed BMPs • 50% of planned septic systems connected to sewers, if funding allows • Pet waste education program continues; implement additional television PSAs, videos, social media, etc. as funds allow • Streamside livestock fencing completed
2021	• 75% of all planned SPS upgrades completed • 30% of impervious area managed with SPSC or other high-performing BMP • Continued triennial inspection and maintenance of constructed BMPs • 75% of planned septic systems connected to sewers, if funding allows • Pet waste education program continues; implement additional television PSAs, videos, social media, etc. as funds allow • Maintain livestock fencing and inspect triennially
2023	• 100% of all planned SPS upgrades completed (wastewater CIP goals met) • 40% of impervious area managed (permit/WIP goal achieved) • 100% of planned septic systems connected to sewers, if funding allows (goal achieved) • Pet waste education program continues; implement additional television PSAs, videos, social media, etc. as funds allow
2025 (bacteria TMDLs achieved)	• 50% of impervious area managed (on track to meet 60% goal in 2027) • Conduct survey to evaluate effectiveness of pet waste education program • Continued triennial inspection of constructed BMPs/retrofits

*Patuxent River Upper and West River mainstem.

BMPs = best management practices
CIP = Capital Improvement Program
NPDES = National Pollutant Discharge Elimination System
PSAs = Public Service Announcements
SPS = Sewage Pump Station
SPSC= Step Pool Storm Conveyance
WIP = Watershed Implementation Plan

SECTION EIGHT: METHODS FOR EVALUATING PROGRESS

Establishing methods for tracking and evaluating progress toward TMDL water quality goals is important to determine whether the proposed restoration strategies are being implemented according to the stated schedule or if adjustments are required. The methods for evaluating progress vary depending on the restoration strategy. For strategies related to the NPDES MS4 permit program such as urban stormwater retrofits and Illicit Discharge Detection and Elimination (IDDE), it is recommended to use a water quality model that can estimate bacteria load reductions from proposed restoration strategies. Water quality models can also be used to estimate potential pollutant load reductions from SSO abatements and on-site disposal system (OSDS) retirements/connections. Potential options for water quality models include the WTM that was used to develop this restoration plan (see Section 4) or other water quality models that include bacteria loading. The County's Watershed Management Tool does not include a bacteria specific model module, so it is not proposed for use.

Data compiled for the NPDES MS4 annual report could be used to model the load reductions achieved over the previous year. Modeling the SSO abatement and septic system retirement would entail coordination with the County Department of Health to obtain the required information. Information on SSOs is compiled for Wastewater Capacity, Management, Operations, and Maintenance (CMOM) Program reports submitted to MDE.

Table 8-1 lists potential methods for tracking the progress of bacteria load reduction for each of the proposed strategies.

Table 8-1: Potential Methods to Evaluate Progress

Proposed Strategy	Potential Method to Evaluate Progress	Frequency	Data Source
Pre-2002 Pond Retrofits	Water Quality Modeling*	Annually	NPDES reporting
Restore 20% Impervious Area with SPSC	Water Quality Modeling*	Annually	NPDES reporting
Eliminate Illicit Connections (IDDE)	Water Quality Modeling*	Annually	NPDES reporting
Abatement of SSOs	Water Quality Modeling*	Annually	CMOM reporting
Septic Retirement/Connection	Water Quality Modeling*	Annually	Dept. of Health
Stricter Buffer Ordinance/Education	Walk-through of buffer area with adjacent homeowners	Annually	n/a
Expanded Pet Waste Education	Pre- and post-implementation surveys of residential pet owners	Would depend on implementation time frame, pre-implementation survey could occur in 2015	n/a
Expanded Goose Management Program	Annual survey of goose population by USFWS and Maryland DNR	Annually as part of waterfowl survey	USFWS/ Maryland DNR

Proposed Strategy	Potential Method to Evaluate Progress	Frequency	Data Source
Livestock Stream Exclusion Fencing	Pre- and post-implementation surveys of farmers	Annually	Soil Conservation District Office

*Watershed Treatment Model or other applicable water quality models
CMOM = Capacity, Management, Operations, and Maintenance
DNR = Department of Natural Resources
IDDE = Illicit Discharge Detection and Elimination
n/a = Not Applicable
NPDES = National Pollutant Discharge Elimination System
SSOs = Sanitary Sewer Overflows
USFWS = U.S. Fish and Wildlife Service

Because the proposed water quality models do not effectively capture restoration strategies related to non-human sources, alternative methods for evaluating progress of these strategies need to be developed.

The Tier B controls, including pet waste education, livestock fencing, buffer education, and goose management, are difficult to quantify in terms of load reductions. Some potential methods for tracking progress of each of these strategies include:

- Conduct pre- and post-implementation surveys of pet owners to determine how many people are picking up after their pets;
- Conduct pre- and post-implementation survey of farmers to determine if they have been successfully keeping livestock out of the stream and an annual walk-through of buffer areas to see if any improvements have occurred; and
- Review the annual waterfowl survey conducted by USFWS and Maryland DNR (Maryland DNR, 2014) to estimate the size of the local goose population.

Water Quality Monitoring

The above methods for evaluating TMDL Restoration Plan progress will provide a general measurement of the implementation progress and the resulting bacteria load reductions from the proposed strategies. However, to confirm whether on-the-ground actions in the watershed are leading to measurable water quality improvements in the impaired TMDL waterways, MDE recommends water quality monitoring.

The County's current NPDES MS4 permit-required monitoring at the Parole Plaza outfall and Church Creek in-stream station is designed to assess the cumulative effects of watershed restoration activities in this commercial and residential watershed. This could be a suitable starting point for the monitoring program, and monitoring could be expanded to capture the effects of the strategies in the other TMDL watersheds. Adding monitoring locations would require submitting the proposed monitoring program details to MDE for approval.

In general, water quality improvements related to watershed restoration can be difficult to detect due to such factors as potential time lags, wet and dry years, and uncertainty in the success of implementation (e.g., whether there is actual behavior change in dog owners leading to more pet

waste pickup). Therefore, EPA recommends at least 2 or more years of monitoring to acquire statistically significant results.

The proposed monitoring program would combine monitoring data from a number of existing sources/programs as a cost savings measure and to reduce duplication of effort among multiple organizations/agencies. It is recommended that the County conduct bacteriological monitoring of non-tidal waters in impaired TMDL watersheds. Monitoring can be conducted at representative stream locations to adequately characterize the bacteria loadings. Not all streams/watersheds would need to be monitored, only those with distinct differences in geographic setting and land use (see Section Two). Five years of monitoring is proposed during various conditions, including wet weather, dry weather, and different seasons to account for variations in flow and inter-annual changes related to wet years and dry years.

For tidal monitoring, it is proposed that the County utilize bacteriological monitoring data from the MDE's ongoing shellfish harvesting area monitoring program. Other sources of data include the County Health Department's monitoring of recreational beaches, and Operation Clearwater, another beach bacteria monitoring program. By integrating all of these programs, the County can leverage multiple monitoring efforts to save on costs while still gathering sufficient data to determine to what extent the implemented TMDL strategies are leading to actual water quality improvements in the impaired waterways.

Trend analysis is not required annually, as implementation of proposed restoration strategies is not likely to have an immediate impact on water quality. As an alternative, trend analysis should be conducted every 5 years, with 2015 as a baseline, 2020 as a mid-implementation assessment, and 2025 as a post-implementation assessment.

SECTION NINE: REFERENCES

Anne Arundel County. 2011. Patapsco Non-Tidal Watershed Assessment, Comprehensive Summary Report. Prepared by: Anne Arundel County Watershed Assessment & Planning Program, KCI Technologies, Inc., CH2M HILL. August 2011 Final.

Anne Arundel County. 2012. Chesapeake Bay TMDL Phase II Water Implementation Plan – FINAL. July 2, 2012.

Anne Arundel County. 2012b. Patapsco Tidal and Bodkin Creek Watershed Assessment – Comprehensive Summary Report. August.

Anne Arundel County. 2012c. RSC Fact Sheet. May. Available online at: http://www.aacounty.org/DPW/Watershed/StepPoolStormConveyance.cfm

Anne Arundel County. 2012d. Annual Homeless Assessment Report (2012). Available online at: http://www.aacounty.org/Homeless/Resources/Anne%20Arundel%20and%20Annapolis%20Annual%20Homeless%20Assessment%20Report%202012.pdf

Anne Arundel County. 2013. National Pollutant Discharge Elimination System Municipal Separate Storm Sewer System Discharge Permit 2012 Annual Report: Anne Arundel County, Maryland. Available online at: http://www.aacounty.org/DPW/Watershed/2012%20NPDES%20Documents/2012%20Anne%20Arundel%20Annual%20Report_No%20Appendices.pdf

Anne Arundel County. 2014. National Pollutant Discharge Elimination System Municipal Separate Storm Sewer System Discharge Permit 2013 Annual Report: Anne Arundel County, Maryland. Available online at: http://www.aacounty.org/DPW/Watershed/2012%20NPDES%20Documents/2012%20Anne%20Arundel%20Annual%20Report_No%20Appendices.pdf

Bruce, S. and M. Tiger. 2009. A Review of Research Relevant to Evaluating Social Marketing Mass Media Campaigns. Available online at: http://www.piedmontnutrientsourcebook.org/Assetts/outreach/evaluating-social-marketing-mass-media-campaigns.pdf

CA DBW (California Division of Boating and Waterways). 2014. Shipshape Sanitation, MSDS and Pumpouts. Available online at: http://www.dbw.ca.gov/pubs/sanitation/index.htm

CA (California) Central Coast Regional Board. 2011. Draft Comment Summary and Responses: Total Maximum Daily Loads (TMDLs) for Pathogens in the San Lorenzo River Watershed. February 1, 2011. Available online at: http://www.waterboards.ca.gov/water_issues/programs/tmdl/docs/sanlorenzo/comments010611/cmmnt_rpns010611.pdf

Capital Gazette. September 2, 2014 article by Brandi Bottalico. Watershed stewards find few takers for dog poop campaign. Available online at: http://www.capitalgazette.com/maryland_gazette/news/ph-ac-gn-poop-patrol-0903-20140902,0,6062570.story

Caraco, D. 2013. Watershed Treatment Model (WTM) 2013 "Custom" version. Center for Watershed Protection, Ellicott City, MD.

Caraco, D. 2013a. Watershed Treatment Model (WTM) 2013 Documentation. Center for Watershed Protection, Ellicott City, MD. Pages 1-114

Code of Maryland Regulations (COMAR). Critical Area Commission for the Chesapeake and Atlantic Coastal Bays. Available online at: http://www.dsd.state.md.us/comar/SubtitleSearch.aspx?search=27.02.01.*

County of Los Angeles. 2002. Department of Public Works, Storm Water/Urban Runoff, Public Education Model Program. Available online at: http://ladpw.org/wmd/npdes/Pipp/PIPP.pdf

CWEP (Clean Water Education Partnership). 2009. Pre- and Post-TV Campaign Surveys of Stormwater Awareness & Behavior in the Clean Water Education Partnership Service Area: Comparisons and Findings. Available online at: http://www.nccleanwater.org/pdf/cwep-final-survey-comparison-report.pdf

CWP (Center for Watershed Protection). 2004. Illicit Discharge Detection and Elimination – A Guidance Manual for Program Development and Technical Assessments. October. Available online at: http://www.cwp.org/online-watershed-library/cat_view/64-manuals-and-plans/79-illicit-discharge-detection-and-elimination

EPA (Environmental Protection Agency). 2001. National Menu of Best Management Practices for Storm Water Phase II, Public Education and Outreach on Storm Water Impacts. Available online at: http://www.georgiaplanning.com/watertoolkit/Documents/WaterProtectionIssues/PublicEdandOutreach.pdf

EPA. 2008. Decision Rationale: Total Maximum Daily Loads of Fecal Coliform for the Restricted Shellfish Harvesting Areas in Whitehall and Meredith Creeks, Mill Creek, and the Severn River Mainstem of the Severn River Basin in Anne Arundel County, Maryland. April 2008.

EPA. 2010. Getting in Step: A Guide to Conducting Watershed Outreach Campaigns, 3rd edition. Office of Water Nonpoint Source Control Branch (4503T), Washington, DC. November. Available online at: http://water.epa.gov/polwaste/npdes/stormwater/upload/getnstep.pdf

EPA. 2011. Decision Rationale: Total Maximum Daily Loads of Fecal Bacteria for the Patuxent River Upper Basin Anne Arundel and Prince George's Counties Maryland. August 9, 2011.

EPA. 2012. A: Pollution Prevention Management Measure. Available online at: http://water.epa.gov/polwaste/nps/czara/ch4-6.cfm

EPA. 2013a. Getting in Step: Engaging Stakeholders in your Watershed. 2nd edition. EPA 841-B-11-001. Office of Water, Nonpoint Source Control Branch (4503T) , Washington, DC 20460. May. Available online at: http://cfpub.epa.gov/npstbx/files/stakeholderguide.pdf

EPA. 2013b. Nonpoint Source Program and Grants Guidelines for States and Territories. US EPA Office of Water, Nonpoint Source Control Branch. April. Available online at: http://water.epa.gov/polwaste/nps/upload/319-guidelines-fy14.pdf

EPA. 2014. Search the NPS Outreach Toolbox. Available online at: http://cfpub.epa.gov/npstbx/index.cfm

French, L. and J. Parkhurst. 2009. Managing Wildlife Damage: Canada Goose (*Branta canadensis*). Virginia Cooperative Extension, publication 420-203.

King, D., and P. Hagan. 2011. Costs of Stormwater Management Practices In Maryland Counties – Draft Final Report. October 10.

Klein, R. 2007. The Effects of Marinas & Boating Activity Upon Tidal Waterways. July. Available online at: http://www.ceds.org/pdfdocs/Marinas.pdf

Maryland DNR (Department of Natural Resources). 2014. Maryland's Midwinter Waterfowl Survey Results Announced. March 7, 2014. Available online at: http://news.maryland.gov/dnr/2014/03/07/dnr-announces-midwinter-waterfowl-survey-results/

MDA (Maryland Department of Agriculture). 2013. MACS Manual 382 Fencing. October. Available online at: http://mda.maryland.gov/resource_conservation/Documents/macs_manual/2/382_fencing.pdf

MDA. 2014. Maryland Agricultural Water Quality Cost-Share Program. Available online at: http://mda.maryland.gov/resource_conservation/Pages/macs.aspx

MDE. 2005b. Comment Response Document (CRD) Regarding the Total Maximum Daily Loads of Fecal Coliform for Restricted Shellfish Harvesting Areas in Bear Neck Creek, Cadle Creek, West River, and Parish Creek for the West River Basin in Anne Arundel County, Maryland. July 25, 2005.

MDE. 2005c. Comment Response Document Regarding the Total Maximum Daily Loads of Fecal Coliform for Restricted Shellfish Harvesting Areas in Magothy River, Tar Cove, and Forked Creek and a Water Quality Analysis of Fecal Coliform for Deep Creek for Restricted Shellfish Harvesting Areas in the Magothy River Basin in Anne Arundel County, Maryland. July 25, 2005.

MDE. 2005d. Comment Response Document Regarding the Total Maximum Daily Loads of Fecal Coliform for the Restricted Shellfish Harvesting Areas in Tracy and Rockhold Creeks of the Other West Chesapeake Bay Drainages Basin in Anne Arundel County, Maryland. August 24, 2005.

MDE. 2005e. Total Maximum Daily Loads of Fecal Coliform for Restricted Shellfish Harvesting Areas in Magothy River, Tar Cove, and Forked Creek and a Water Quality Analysis of Fecal Coliform for Deep Creek of the Magothy River Basin in Anne Arundel County, Maryland. August.

MDE. 2005f. Total Maximum Daily Loads of Fecal Coliform for Restricted Shellfish Harvesting Areas in the South River, Duvall Creek, Selby Bay, and Ramsey Lake of the South River Basin in Anne Arundel County, Maryland. June.

MDE. 2005g. Total Maximum Daily Loads of Fecal Coliform for Restricted Shellfish Harvesting Areas in Bear Neck Creek, Cadle Creek, West River, and Parish Creek for the West River Basin in Anne Arundel County, Maryland. August.

MDE. 2005h. Total Maximum Daily Loads of Fecal Coliform for Restricted Shellfish Harvesting Areas in Tracy and Rockhold Creeks of the Other West Chesapeake Bay Drainages Basin In Anne Arundel County, Maryland. August.

MDE. 2006. Maryland's 2006 TMDL Implementation Guidance for Local Governments. May 24.

MDE. 2008. Total Maximum Daily Loads of Fecal Coliform for the Restricted Shellfish Harvesting Areas in Whitehall and Meredith Creeks, Mill Creek, and the Severn River Mainstem of the Severn River Basin in Anne Arundel County, Maryland. April.

MDE. 2009b. Total Maximum Daily Loads of Fecal Bacteria for the Patapsco River Lower North Branch Basin in Anne Arundel, Baltimore, Carroll, and Howard Counties, and Baltimore City, Maryland. August.

MDE. 2010a. Comment Response Document Regarding the Total Maximum Daily Loads of Bacteria for the Impaired Recreational Areas in Marley Creek and Furnace Creek of Baltimore Harbor Basin in Anne Arundel County, Maryland. July 27, 2010.

MDE. 2010b. Comment Response Document Regarding the Total Maximum Daily Load of Fecal Bacteria for the Patuxent River Upper Basin in Anne Arundel and Prince George's Counties, Maryland. September 16, 2010.

MDE. 2010c. Total Maximum Daily Loads of Bacteria for Impaired Recreational Areas in Marley Creek and Furnace Creek of Baltimore Harbor Basin in Anne Arundel County, Maryland. July.

MDE. 2010d. Total Maximum Daily Loads of Fecal Bacteria for the Patuxent River Upper Basin in Anne Arundel and Prince George's Counties, Maryland. September.

MDE. 2014a. General Guidance for Developing a Stormwater Wasteload Allocation (SW-WLA) Implementation Plan - Final. May.

MDE. 2014b. Guidance for Developing a Stormwater Wasteload Allocation Implementation Plan for Bacteria Total Maximum Loads –Final. May.

MDE. 2014c. Guidance for Developing Stormwater Wasteload Allocation Implementation Plans for Nutrient and Sediment Total Maximum Daily Loads – Final. November.

MDE. 2014d. Accounting for Stormwater Wasteload Allocations and Impervious Acres Treated. August.

MDE. 2014e. Maryland Shellfish Harvesting and Closure Area Map. Available online at: http://www.mde.state.md.us/programs/Marylander/CitizensInfoCenterHome/Pages/citizensinfocenter/fishandshellfish/pop_up/shellfishmaps.aspx

RIDEM (Rhode Island Department of Environmental Management). 2014. Pollution Prevention: Animal Waste Collection. Available online at: http://www.dem.ri.gov/programs/benviron/water/permits/ripdes/stwater/t4guide/fact1.htm

RI (Rhode Island) Sea Grant. 1992. Environmental Guide for Marinas: Fact Sheets. University of Rhode Island Bay Campus, Narragansett, RI. Available on-line at: http://seagrant.gso.uri.edu

Strand, I.E and G.R. Gibson. 1990. The Use of Pump-Out Facilities by Recreational Boaters in Maryland. *Estuaries*, Vol. 13, No. 3 (Sep., 1990), pp. 282 – 286. Available online at: http://www.beamreach.org/data/101/Science/processing/Kathryn/BEAM%20REACH/Sustainability%20Project/pump%20outs.pdf

Swann, C. 1999. A Survey of Residential Nutrient Behaviors in the Chesapeake Bay. Widener Burrows, Inc. Chesapeake Research Consortium. Center for Watershed Protection. Ellicott City, MD. 112 pp.

VA DEQ (Virginia Department of Environmental Quality). 2011. Bacterial Implementation Plan Development for the James River and Tributaries – City of Richmond Technical Report. Final Submitted: December.

Van der Wel, B. 1995. Dog Pollution. The Magazine of the Hydrological Society of South Australia. 2(1)1.

WGCAC (Wildcat Glades Conservation & Audubon Center). 2011. Connections. Summer 2011, Volume 5, Number 2. Available online at: http://www.wildcatglades.audubon.org/connections_v5no2.pdf

Winters, J. 2015. Annapolis and Anne Arundel County Pet Walks. Available online at: http://www.imrivers.org/annapolispetwalk/

Zeckoski, R., B. Benham, C. Lunsford. 2012. Streamside Livestock Exclusion: a tool for increasing farm income and improving water quality. December.

Appendix A: Watershed Treatment Model Methodology

A.1 INTRODUCTION

As a part of the development of the Total Maximum Daily Load (TMDL) Restoration Plan for bacteria impairments for the nineteen approved TMDLs in Anne Arundel County (County), the URS/ESA team developed water quality models for each of the 19 TMDL watersheds. The Watershed Treatment Model (WTM), a spreadsheet-based model developed by the Center for Watershed Protection (Caraco, 2013) was used to characterize and quantify the bacteria loads for existing conditions and estimate the pollutant load reductions from future Best Management Practices (BMPs) to meet the TMDL requirements.

The WTM is a planning level model that quantifies bacteria loads based on both point and non-point sources of pollution. The model calculates the fate and transport of bacteria from pollutant sources to the receiving water bodies. In addition to the bacteria loads, the model also has the capability to estimate annual loads for total nitrogen (TN), total phosphorus (TP), and total suspended solids (TSS). The model has several tabs where pollutant sources and treatment options can be input. The Pollutant Sources tabs estimate the pollutant loads from primary sources such as land use and secondary sources such as channel erosion, illicit connections etc. The Treatment Options tabs of the model estimate the pollutant load reductions from structural and non-structural treatment options for existing and future conditions.

The URS/ESA team used the Maryland Department of Environment (MDE)-provided watershed boundaries, County geographic information system (GIS) data, and additional information on County operations to develop the baseline models for the study watersheds. The sections below provide a detailed description of the inputs and the methodology adopted in developing the WTM models for the study watersheds.

A.2 EXISTING CONDITIONS MODELING

An existing conditions model was developed to estimate the pollutant loads from primary sources such as existing land use and secondary sources such as illicit discharges, on-site sanitary disposal systems, and sanitary sewer overflows and the current pollutant reductions from existing BMPs. The data that were used in the model to estimate the current pollutant loads were based on the following:

Primary Sources

The Primary Sources tab of the WTM estimates pollutant loads in the stormwater runoff from land uses such as residential, commercial, industrial, rural, forest, and water. It also has an option to include acreage of land under active construction as one of the land uses. The model uses Simple Method (Schueler, 1987) to estimate the annual pollutant loads from different type of land uses based on their event mean concentrations (EMCs) and impervious cover, annual rainfall, and runoff coefficients. A description of the input information for primary sources is provided below.

- **Land use:** GIS data for existing land cover and impervious cover developed by the County in 2011 was used to identify the acreage of each land use type in the study watersheds. The default impervious cover percentage per land use type was adjusted in the WTM model to reflect existing watershed conditions by intersecting the land use and impervious cover GIS data. The default EMCs for TN, TP, TSS, and bacteria for each land use category were modified in the WTM model based on literature review of the watershed management plans developed by the County. Land cover categories with similar runoff characteristics and EMC values were grouped for the model input. Table A-1 below provides information on the land use and the EMCs used in the model.

Table A-1: Land Use Classification and EMCs

County Land Cover Classification	WTM Land Use Category	Event Mean Concentration (EMC)			
		TN (mg/l)	TP (mg/l)	TSS (mg/l)	Bacteria (MPN/100 ml)
Airport	Airport	2.24	0.30	99	4500
Commercial	Commercial	2.24	0.30	43	4500
Forested Wetland	Forest	1.00	0.11	34	500
Industrial	Industrial	2.22	0.19	77	2614
Open Space	Open Space	1.15	0.15	34	3100
Open Wetland	Forest	1.00	0.11	34	500
Pasture/Hay	Pasture/Hay	7.83	2.09	341	500
Residential 1- acre	Medium Density Residential (1-4 DU)	2.74	0.32	43	7750
Residential 1/2-acre	Medium Density Residential (1-4 DU)	2.74	0.32	43	7750
Residential 1/4-acre	Medium Density Residential (1-4 DU)	2.74	0.32	43	7750
Residential 2-acre	Low Density Residential (<1DU)	2.74	0.32	43	7750
Residential 1/8-acre	High Density Residential (>4 DU)	2.74	0.32	43	7750
Row Crops	Row Crops	16.06	2.63	1,046	500
Transportation	Transportation	2.59	0.43	99	1400
Utility	Open Space	1.15	0.15	34	3100
Water	Water	1.20	0.03	43	500
Woods	Forest	1.00	0.11	34	500

DU-Dwelling Units
mg/l-milligrams per liter
MPN/100 ml = most probably number per 100 milliliters

- **Annual rainfall:** The average annual rainfall recorded the by National Oceanic and Atmospheric Administration at the Baltimore-Washington International Thurgood

Marshall Airport (BWI) was used as the input. An average annual rainfall of 42 inches was observed at BWI based on 143 years of recorded precipitation data.

- **Streams:** The stream GIS data obtained from the County website was used as the source to input stream length in miles in the study watersheds. The GIS data were analyzed, and features such as shoreline and pipes were not included in estimating the total stream length per watershed.
- **Soils:** The soils data downloaded from the U.S. Department of Agriculture (USDA) Natural Resources Conservation Service were used to estimate the percentage of each hydrologic soil groups in the study watersheds. The downloaded soils data was also used to determine hydric soils in the watershed to classify average depth to groundwater.

Secondary Sources

The input information for secondary sources was obtained from County GIS data, operations information, and research. The secondary sources are as follows:

- **Onsite sewage disposal system (OSDSs):** The model estimates the loads from OSDSs to surface water and groundwater based on the volume and concentration of pollutants in wastewater (Table A-2). The obtained pollutant loads are further adjusted based on several factors such as efficiency of the OSDSs, percent of OSDSs that are less than 100 feet away from any water bodies, general soil types, level of maintenance, and their density in the watershed. Based on the County-provided information, the following data were used as input for wastewater characteristics:

Table A-2: WTM Pollutant Concentration in Wastewater

Water Use (gallons/capita/day)	Wastewater Characteristics			
	TN (mg/l)	TP (mg/l)	TSS (mg/l)	Bacteria (MPN/100 ml)
75	60	10	400	10,000,000

mg/l-milligrams per liter
MPN-most probable number

- The Anne Arundel County Department of Health developed GIS coverage of all the properties in the County that have an OSDS, and this information was used to identify properties in the study watersheds with no sewer connection. The GIS data also categorized the OSDSs as Best Available Technology (BAT) and Engineering (ENG) Nitrogen Removal Units (NRUs). The performance efficiency of both the type of NRUs (Table A-3) was obtained based on research and WTM literature. Properties that were not categorized as an NRU type were assumed to have a conventional system. Based on the spatial analysis of the GIS stream layer with the OSDS properties, 10 percent of the properties were assumed to have an OSDS less than 100 feet from a waterway. A 5-foot separation from groundwater was assumed for all the systems. Based on research on the

Anne Arundel County website, a medium level of septic system management that includes inspection at installation and education to encourage ongoing maintenance were factored in to adjust the obtained pollutant loads through OSDSs.

Table A-3: Bacteria Pollutant Removal Efficiency of OSDSs

Nitrogen Removal Unit (NRU) Type	Bacteria Log Reduction
Conventional System	3.5
ENG	2.9
BAT	3.0

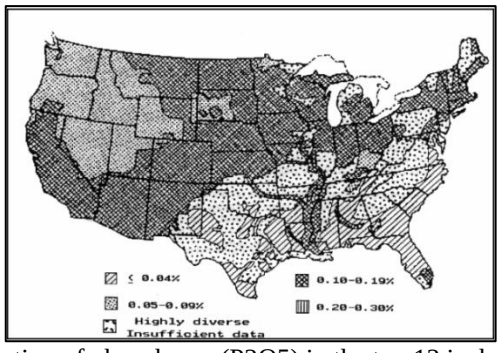
- **Sanitary sewer overflows (SSOs):** Pollutant loads due to SSOs are estimated based on total SSO volume and effluent concentration (Table A-2). Based on County-provided information, a volume of 55,650 gallons per SSO, which is the County-wide average, was used to estimate the loads, and approximately 30 SSOs were assumed to occur for every 1,000 miles of sewer line. The sanitary sewer GIS data obtained from the County website was used to estimate the total length in miles of the sewer system in each study watershed.
- **Combined sewer overflows:** None of the study watersheds have any combined sewer outfalls.
- **Illicit connections:** Pollutant loads due to illicit connections of residences and businesses were estimated based on the County's National Pollutant Discharge Elimination System (NPDES) MS4Annual Reports. According to the NPDES MS4 reports and illicit discharge detection and elimination annual report (IDDE, 2013), the County-wide detection rate of illicit connections is approximately 2 percent (29 cases out of 1,350 outfalls surveyed from 2005 to 2013). This detection rate was proportioned to each TMDL watershed based on the amount of impervious cover in the watershed relative to the total impervious area in the County. This obtained percent of illicit connections for each watershed was distributed equally among residential and commercial illicit connections. Among the percent of businesses illicitly connected, the majority (90 percent) was assumed to be illicit wash water connections, and 10 percent of the businesses were assumed to be illicit waste water connections. The concentrations of pollutants for business illicit connections used in the model are provided in Table A-4 below. The pollutant concentration of residential illicit connections is the same as that of wastewater (Table A-3).

Table A-4: Pollutant Concentrations for Illicit Business Connections

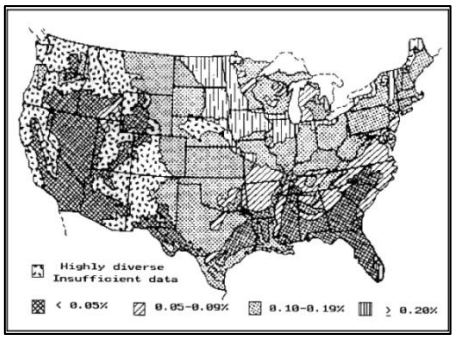
Pollutant	Pollutant Concentration	
	Wash Water	Wash Water and Wastewater
TN (mg/l)	15	30
TP (mg/l)	10	10
TSS (mg/l)	150	225
Bacteria (MPN/100ml)	0	3,300,000

mg/l-milligrams per liter
MPN-maximum probable number

- **Urban channel erosion:** Urban channel erosion is a required input parameter in the model, however it only affects nutrients and sediment, not bacteria. The sediment loads due to urban channel erosion in each study watersheds were assumed to be a fraction of total sediment loads from other urban sources in the watershed. Moderate rates of erosion (50 percent of total watershed sediment loads) in the channel were assumed to estimate the sediment loads for all the study watersheds. Phosphorus and nitrogen concentrations of 0.064 percent and 0.07 percent, respectively, were used to estimate the nutrient loads due to channel erosion. These are default percentages for the State of Maryland and were obtained using Figures 4.1 and 4.2 of the Watershed Treatment Model (Caraco, 2013a) documentation.



Distribution of phosphorus (P2O5) in the top 12 inch of soil
(Source: Figure 4.1, CWP 2013)



Distribution of nitrogen in the top 12 inch of soil
(Source: Figure 4.2, CWP 2013)

- **Livestock:** USDA's 2012 farm censuses were used to get the count of livestock such as horses, cattle (dairy and beef), broilers, turkeys, hogs, and pigs. The livestock numbers were associated with the County's rural land use (crops and pastures/hay). Based on the acreage of rural land use in the study watersheds, the livestock numbers were estimated proportionally. Table A-5 lists the census data obtained from USDA. The estimated bacteria loads per animal type were obtained from TMDL plans developed by MDE for various impaired watersheds.

Table A-5: Livestock Census Data for Anne Arundel County (USDA, 2012) and Associated Bacteria Loads (MDE)

Animal	Census Data for County	Fecal Coliform Production (count/animal/day)	Percent Manure Available for Washoff (%)
Dairy	586	1.01+10	40
Beef	584	1.20+10	40
Horse	1,791	4.20+08	40
Sheep	316	1.20+08	40
Broilers	300[1]	1.36+08	10
Turkeys	34	9.30+07	10
Chicken and Layers	1,133	1.36+08	10
Hogs and Pigs	42	1.08+10	40

1- 2007 data used as 2012 data was unavailable in the USDA Report

- **Marinas:** Pollutant loads from marinas were estimated based on the number of boats, flow rates, and number of boating days per year. The County-published document *Marinas of Anne Arundel County* (2010) was used to obtain information on type of marina and number of slips in each marina. For the model, 50 percent of the slips were assumed to be occupied during a 5-month boating season. The Maryland Department of Natural Resources' (DNR's) website was used to obtain information on the number of pumpouts in each TMDL watershed. Note that the model does not have a parameter for estimating bacteria load reductions due to educational outreach to the boating community about proper disposal of onboard sewage. Therefore, marinas are included as a source in the model, but not as a load reduction. Educational outreach is discussed in Section 5.3 of the main report.
- **Road sanding:** Based on County provided information; road sanding is not performed by the County.
- **Non-stormwater point sources:** Based on research and County-provided information, one of the seven County-owned water reclamation facilities (WRFs), Annapolis WRF, discharges to the TMDL watershed. The remaining WRFs do not discharge to any of the TMDL watersheds. In addition to the County-owned WRF, two other point sources listed in the MDE-published TMDL documents with permitted discharges for bacteria were included in the models. Table A-6 below lists all the point sources in the study watersheds with permitted discharges for bacteria that were included in the models.

Table A-6: Permitted Discharges of Non-stormwater Point Sources in the Study Watersheds

TMDL Watershed	Facility	Design Flow (MGD)	Permitted Bacteria Loads (MPN/100 ml)
Severn (Mainstem, Mill, Meredith and Whitehall Creeks)	Annapolis Water Reclamation Facility	13	14
Severn (Mainstem, Mill Southern, Meredith-Whitehall Creeks)	U.S. Naval Academy	1	14
Patapsco River Lower North Branch	Holiday Mobile Estates Wastewater Treatment plan	0.108	3.0

MGD = million gallons per day
MPN-maximum probable number

Existing Management Practices

Input data for existing management practices were developed based on County-provided information, research and GIS data, and other management practices data related to County operations.

- **Turf condition and management practices in residential and other land uses:** As field reconnaissance was not included as a part of this study, it was assumed that approximately 10 percent of the lawns in the watershed are bare or compacted and 10 percent were assumed to be highly managed as a result of excess fertilization to estimate the annual TN and TP loads. The turf management for other land uses such as commercial, transportation, and industrial was also assumed to be managed at the same level as residential areas.
- **Erosion and sediment control:** Active construction sites were not included as a part of the model input; therefore, sediment load reduction due to the County's existing erosion and sediment control program was not estimated in the model.
- **Pet waste education:** Based on the WTM documentation, bacteria loads from pet waste are calculated based on the assumption that 40 percent of the homeowners in a study area have dogs, and approximately 50 percent of the dog owners walk their dogs. Approximately 60 percent of the dog owners who walk their dogs are assumed to clean up after their pets. The pollutant load reductions achieved by a pet waste education program in the model are calculated based on its effectiveness in educating the pet owners. Table A-7 lists various media outlets used for educating the pet owners and their effectiveness in reducing the bacteria loads from pets.

Table A-7: Effectiveness of Media for Pet Waste Education Program

Media Outlet	Effectiveness (%)
Television	40
Radio	25
Newspaper	30
Billboard	13
Brochure	8
Workshop	7

- Based on research of current County outreach programs, it was observed that the County currently provides information on pet waste management through its website and that it includes some educational brochures. A corresponding effectiveness of 8 percent was used in the model to estimate the reduction in bacteria loads through pet waste education.
- **Street sweeping:** The model estimates the load reductions in TSS, TN, and TP that would be achieved by street sweeping based on acreage of streets swept and the type of street sweeping technique used. The pollutant load reductions are further adjusted by factoring in efficiency of the street sweeping program. According to the County, arterial, collector, and roads in business districts are swept four times a year. The County GIS data were used to input the acres of roads swept in each study watershed. A program efficiency of 75 percent was used in the model based on the assumption that operators are not effectively trained and that parking restrictions are in place during the street sweeping period.
- **Structural stormwater management (SWM) practices:** Information on existing structural SWM practices was obtained from County stormwater management GIS data and the BMP database and input in the model. The County is in the process of compiling the drainage areas for all the BMPs, and as result, drainage areas and impervious areas associated for some of the BMPs were not populated. The pollutant removal efficiencies of the practices were modified in the model to match the bacteria removal efficiencies listed in the County's NPDES MS4 Annual Report (2012) (Anne Arundel County, 2013). The pollutant load reductions achieved by structural SWM practices were further adjusted based on the assumptions that 90 percent of annual rainfall is captured by the structures (0.9), the County has design criteria that will result in high pollutant removal efficiencies for practices (1.2), and that regular maintenance of the practices is enforced and conducted by the County (0.9). Table A-8 shows the bacteria pollutant removal efficiencies of BMPs input into the model. Most of the TMDLs in the study watersheds were developed in the early 2000s. Therefore, the baseline WTM included BMPs that were implemented only until the year 2000 to account for load reductions that would be achieved from BMPs at the time of TMDL development.

Table A-8: Anne Arundel County BMPs and Pollutant Removal Efficiencies

BMP Type	Bacteria Pollutant Removal Efficiency (%)
Attenuation Trench	0
Bioretention	90
Check Dam	0
Disconnection of Non Roof-top runoff	75
Disconnection of Roof-top Runoff	75
Dry Pond	0
Dry Wells	75-90
Environmental Site Design	75
Extended Detention	50
Extended Detention Structure-Dry	50
Extended Detention Structure-Wet	75
Forestation on Pervious Urban	0
Infiltration Trench with Complete Exfiltration Microbasin	90
Infiltration Basin	90
Infiltration Berms	75
Infiltration Trench	90
Infiltration Trench with Partial exfiltration	90
Infiltration Trench with Water Quality Exfiltration	90
Landscape Infiltration	75
Level Spreader	0
Micro Pool	75
Micro-Bioretention	75
Oil-Grit Separator	50
Other	0
Permeable Pavement	75
Porous Pavement	90
Rain Gardens	75-80
Rainwater Harvesting	75
Regenerative Step Pool Storm Conveyance	90
Sand Filter	0
Shallow Marsh	75
Sheetflow to conservation areas	75
Submerged Gravel Wetlands	75
Swales	75
Underground Storage	50
Vegetated Buffer	80
Wet Pond	75

BMP Type	Bacteria Pollutant Removal Efficiency (%)
Wet Structure	75

- **Riparian buffers:** The effectiveness of riparian buffers in reducing pollutant loads is estimated based on stream length and buffer width. The County 2011 land cover data downloaded from the County website was used to identify all the forested areas in the study watersheds. A GIS analysis was conducted to identify stream length in study watersheds that had 100 feet and 50 feet of riparian buffers on either side. The default pollutant removal efficiencies in the model were modified to match the County-approved pollutant removal efficiencies for vegetated buffers (Table A-8). The estimated pollutant load reductions were further adjusted (to 60 percent) based on the assumption that the County does not have effective signage at all places that specify acceptable and unacceptable activities.
- **Catch basin cleanouts:** The model estimates the pollutant load reductions achieved by catch basin cleanouts based on the number of impervious acreage captured by the inlets. Based on the Phase II WIP developed by the County for the Chesapeake Bay TMDL, approximately 5,281 acres of impervious area was captured by cleaning 12,625 of the 34,095 inlets in the County. This data was used to find the proportion of inlets cleaned in each study watershed and to obtain the approximate impervious area captured by them. The County GIS data was used to identify the number of inlets in each study watershed.

The bacteria pollutant loads contributing to surface water from primary and secondary sources and subsequent load reductions from existing management practices for all the study watersheds is provided in Table A-9.

Table A-9: Baseline Bacteria Loads Contributing to Surface Water for Study Watersheds

Bacteria TMDL Watershed	Local Waterway	Bacteria Loads (billion/year)	Bacteria Loads (billion/day)
Chesapeake Bay Mainstem	Tracy and Rockhold Creeks	563,451	1,544
Magothy River	Forked Creek	78,605	215
Magothy River	Magothy River Mainstem	1,793,426	4,913
Magothy River	Tar Cove	262,717	720
Patapsco River Lower North Branch	Patapsco River Lower North Branch	1,207,758	3,309
Patapsco River	Furnace Creek	1,162,324	3,184
Patapsco River	Marley Creek	1,028,407	2,818
Severn River	Mill Creek	235,329	645
Severn River	Severn River Mainstem	5,034,108	13,792
Severn River	Whitehall and Meredith Creeks	182,911	501
South River	Duvall Creek	68,159	187
South River	Ramsey Lake	109,113	299
South River	Selby Bay	104,777	287
South River	South River Mainstem	2,105,817	5,769
Upper Patuxent River	Upper Patuxent River	1,688,688	4,627
West River and Rhode River	Bear Neck Creek	68,501	188
West River and Rhode River	Cadle Creek	32,488	89
West River and Rhode River	Parish Creek	22,862	63
West River and Rhode River	West River Mainstem	201,795	553

A.3 ESTIMATION OF LOAD REDUCTIONS FROM PRIOR MANAGEMENT MEASURES

Based on the MDE's TMDL guidance document, *Guidance for Developing a Stormwater Wasteload Allocation Implementation Plan for Bacteria Total Maximum Daily Loads* (May 2014), load reductions from prior management measures should be estimated to account for progress towards TMDL goals at the time the TMDL Restoration Plan is developed. Most of the TMDLs for bacteria in Anne Arundel County were developed in the early 2000s. The County has since implemented several BMPs. Additionally, based on the County-provided GIS data, several OSDS have also been retired in the TMDL watersheds since development of the TMDLs by MDE 15 years ago. Potential credits from both these management measures were estimated by developing a WTM using the TMDL data. This method was developed based on correspondence with MDE.

For the prior-load reductions WTM model, the 2000 land use data used by MDE to develop the TMDLs was input as the primary source. The secondary sources in the model remained unchanged. The annual bacteria loads in the model were calibrated such that the baseline loads from the WTM matched the MDE-published TMDL baseline loads.

Credits from Post-TMDL BMPs

The potential credits that would be achieved from the "Post-TMDL" BMPs were calculated by including all the BMPs that were implemented after the TMDL was published by MDE. Since the majority of the TMDLs were developed in the early 2000s, 2000 was used as the cut-off year to estimate the number of post-TMDL BMPs for each watershed. The drainage area and impervious cover for all the post-TMDL BMPs were obtained from the County-provided GIS data and IMP database. All the Post-TMDL BMPs were not accounted in the WTM as drainage area and impervious area information was not available for some of the BMPs. This is because the County is in the process of updating this information for the County wide BMPs. Impervious area treated was not available for some BMPs in the County IMP database. In such cases, it was assumed that 50 percent of the treated drainage area was impervious. The bacteria removal efficiencies provided in Table A-8 were used for the post-TMDL BMPs as well.

Credits from Retired Septic Systems

The County provided a GIS coverage of all the OSDS that were retired or connected to a public sewer from 2008 to 2013. The County-provided GIS data were clipped to the TMDL watersheds to obtain the number of retired OSDS in each watershed. The obtained numbers were input into the calibrated WTM to estimate the credits that would be achieved towards meeting the TMDL goals for all the study watersheds.

Table A-10 shows the TMDL credits that would be achieved for all the study watersheds from post-TMDL BMPs and retired septic systems.

Table A-10: Septic Systems Identified by the County to Be Connected to a Public Sewer System

Bacteria TMDL Watershed	Prior Load Reductions Since 2000		TMDL Targets	
	Post-TMDL BMPs	Post-TMDL Septic System Retirement	TMDL Required % Reduction	Adjusted TMDL Required % Reduction
Magothy Mainstem	3.30%	0.61%	54.00%	50.09%
Magothy River/Forked Creek	4.91%	None	26.27%	21.36%
Magothy River/Tar Cove	2.44%	None	32.66%	30.22%
Patapsco River/Furnace Creek	4.47%	0.38%	77.79%	72.94%
Patapsco River LNB	3.70%	2.61%	56.1%	49.79%
Patapsco River/Marley Creek	5.41%	0.26%	75.70%	70.03%
Patuxent River Upper	8.36%	None	47.2%	38.84%
Rhode River/Bear Neck Creek	11.96%	None	43.32%	31.36%
Rhode River/Cadle Creek	3.43%	None	72.16%	68.73%
Severn River Mainstem	1.19%	0.35%	19.00%	17.46%
Severn River/Mill Creek	4.30%	None	86.00%	81.70%
Severn River/Whitehall and Meredith Creek	6.45%	0.43%	90.00%	83.12%
South River/Duvall Creek	3.77%	None	45.56%	41.79%
South River Mainstem	8.09%	0.06%	46.00%	37.85%
South River/Ramsey Lake	6.00%	None	59.30%	53.30%
South River/Selby Bay	1.20%	None	28.4%	27.20%
W. Chesapeake Bay/Tracy and Rockhold Creeks	0.35%	2.70%	82.00%	78.95%
West River Mainstem	0.27%	0.48%	35.41%	34.66%
West River/Parish Creek	None	None	53.04%	53.04%

A.4 PROPOSED CONDITIONS MODELING

A proposed conditions model was developed to estimate the potential reductions in baseline loads that could be achieved from implementation of certain future management practices in the TMDL watersheds. The goal of this modeling was to identify and prioritize the most effective strategies. These strategies were categorized into Tier A and Tier B strategies.

Tier A included strategies such as elimination of illicit discharges, abatement of sanitary sewer overflows, and retirement of septic systems which addressed human sources of bacteria. Pollutant load reductions that would be achieved by implementing Tier A strategies were quantified using the WTM.

Tier B strategies were recommended to address non-human sources of bacteria and included strategies such as urban stormwater retrofits, improvement of the riparian buffer ordinance/education program, expanded pet waste education program, livestock stream exclusion fencing, and Canada goose management. Load reductions that would be achieved by implementing Tier B strategies were quantified using WTM and available literature. Load reductions from urban stormwater retrofits and a riparian buffer ordinance/education program were calculated using WTM, as it effectively captures loads from urban sources. As WTM does not effectively capture load reductions from an expanded pet waste education program, livestock stream exclusion fencing, and Canada goose management were quantified using available literature. Based on MDE's recommendations, Tier A strategies were given higher priority than Tier B strategies because they address human sources of bacteria.

Tier A Strategies

- **Retirement of County septic systems:** This Tier A strategy proposes retirement of existing septic systems in the TMDL watersheds and connecting them to public sanitary systems to reduce the bacteria loads from OSDSs. The County provided County-wide GIS coverage of all the OSDSs that would be retired to be connected to a WRF or to a cluster treatment system. This GIS coverage was based on the County's OSDS Evaluation Study (2008). The County-provided GIS layer was clipped to the TMDL watersheds to obtain the number of septic systems that are proposed to be retired in each watershed. Thus obtained data was entered into the future management practices of WTM under "Septic System Retirement (Convert to WWTP)" option to calculate the load reductions that would be achieved from this strategy. The table below (Table A-11) provides information on the number of septic systems proposed to be retired in each watershed.

Table A-11: Septic Systems Identified by the County to Be Connected to a Public Sewer System

TMDL Watershed ID	No. of Septic Systems Identified to Be Connected to Sewer	Portion in Each Watershed (%)
Magothy Mainstem	4,814	71
Magothy River/Forked	113	88
Magothy River/Tar Cove	1,708	94
Patapsco River Lower North Branch	174	15
Patapsco River/Furnace Creek	252	37
Patapsco River/Marley Creek	0	0
Patuxent River Upper	289	24
Rhode River/Bear Neck Creek	0	0
Rhode River/Cadle Creek	0	0
Severn River Mainstem	5,475	55
Severn River/Mill Creek	1,168	76
Severn River/Whitehall and Meredith Creek	320	45
South River Mainstem	1,694	20
South River/Duvall Creek	0	0
South River/Ramsey Lake	0	0
South River/Selby Bay	0	0
W. Chesapeake Bay/Tracy and Rockhold Creeks	0	0
West River Mainstem	0	0
West River/Parish Creek	0	0

- **Abatement of sanitary sewer overflows:** This strategy involved minimizing the volume of SSOs discharging to the waterways after a storm event. The County provided historic SSO data that included approximately 500 SSOs documented since 2001. Based on the County-provided information, the majority of the SSOs were primarily caused by sewage pump station (SPS) failure. The proposed strategy to reduce the SSOs included SPS "upgrades," which involves projects such as improving SPS operations and relieving capacity problems, and replacing SPS generators. Based on the County-provided capital improvement projects (CIP) for wastewater, approximately 35 projects related to SPS upgrades were identified in 12 of the 19 TMDL watersheds. The obtained information was entered in the future management practices under the "SSO Repair/Abatement" options to estimate the load reductions that would be achieved from the County CIP projects. The number of SPS upgrades in each TMDL watershed based on the County CIP data is provided in the table below (Table A-12).

Table A-12: List of SPS Upgrades in the TMDL Watersheds

Bacteria TMDL Watershed	No. of SPS Upgrades	SSO Goal Reduction (%)
Magothy Mainstem	6	27
Magothy River/Forked	1	100
Magothy River/Tar Cove	N/A	N/A
Patapsco Lower North Branch	3	75
Patapsco River/Furnace Creek	5	63
Patapsco River/Marley Creek	3	25
Patuxent River Upper	N/A	N/A
Rhode River/Bear Neck Creek	1	17
Rhode River/Cadle Creek	1	50
Severn River Mainstem	8	14
Severn River/Mill Creek	1	10
Severn River/Whitehall and Meredith Creek	0	0
South River Mainstem	6	9
South River/Duvall Creek	1	50
South River/Ramsey Lake	0	0
South River/Selby Bay	0	0
W. Chesapeake Bay/Tracy and Rockhold Creeks	0	0
West River Mainstem	0	0
West River/Parish Creek	1	100

- **Elimination of illicit connections:** The County currently conducts field screening of outfalls to identify illicit connections from residences and businesses. This is required to meet the County's NPDES MS4 permit requirement. As a part of this program, approximately 150 outfalls are sampled every year, and all identified illicit connections are enforced/eliminated immediately. Based on the County-provided data from 2005 to 2013, the rate of illicit connections detection/elimination is approximately 2 percent (29 cases out of 1,350 outfalls surveyed). Assuming the County will continue the illicit detection/elimination program at the same rate in the future, an average of 41 percent of outfalls would be surveyed by 2020 in all the TMDL watersheds, and all identified illicit connections are assumed to be eliminated. This proposed rate was input into the "Illicit Connection Removal" option under the future management practices of the WTM to quantify the load reductions from this strategy.

Tier B Strategies

Urban stormwater retrofits in Tier B strategies were categorized into: Restoration of 20 Percent of Currently Unmanaged impervious Cover and Retrofit of Pre-2002 Ponds to Meet Current MDE Stormwater Criteria. This strategy was developed based on the Anne Arundel County's Urban Phase II Watershed Implementation Plan (2012) and requirements of the current NPDES MS4 Permit. The current NPDES MS4 Permit requires the County to treat 20% of the impervious area that currently has limited/no stormwater management. Even though the impervious areas draining to pre-2002 ponds can be categorized under impervious area with limited stormwater management and can be counted towards the NPDES MS4 impervious area restoration goals, they are not merged with the "Restoration of 20 Percent of Currently Unmanaged Impervious Cover" strategy in this restoration plan. This was done so that cost-benefits of retrofitting ponds and implementing new practices in untreated areas can be compared and a combination of options can be selected by the County to meet the TMDL goals.

- **Restoration of 20 Percent of Currently Unmanaged Impervious Cover:** This Tier B strategy included implementing stormwater management practices to restore 20% of the impervious area that currently does not have adequate stormwater controls. Stormwater management practices with high bacteria removal efficiency such SPSCs and infiltration practices are proposed to be implemented. This proposed restoration measure is based on the County's NPDES MS4 permit requirements that require restoration of 20% of untreated impervious area by the end of the permit term i.e. 2019. Table A-13 provides information on the 20% of the untreated impervious cover that is proposed to be treated by this strategy.
- **Retrofit of Pre-2002 Ponds to Meet Current MDE Stormwater Criteria:** This strategy involved retrofitting all the pre-2002 dry ponds with more than 10 acres of drainage area to meet the current Maryland Stormwater Design criteria, thereby improving their bacteria removal efficiency to 75%-90%. This strategy is concurrent with the County's Phase II WIP (2012). The dry ponds are proposed to be upgraded to practices such as wetlands or step pool conveyance systems (SPCS). The drainage area for the dry ponds was obtained from the County GIS and IMP database. Based on County's direction, an impervious cover of 50% was assumed for all the drainage areas that were missing impervious cover information. The IMP database included several dry ponds in the TMDL watersheds where the drainage area was not populated. These ponds were not included in the restoration strategy. Table A-13 provides information on the number of dry pond retrofits proposed in each watershed and the area that would be treated.

The two proposed urban stormwater retrofit strategies were input in the "Retrofit Worksheet" of the WTM to estimate the load reductions that would be achieved from this strategy. The load reductions were further adjusted based on the assumptions that the proposed practices would capture 90 percent of annual rainfall, the County has design criteria that will result in

high pollutant removal efficiencies for practices (1.2), and that regular maintenance of the practices will be enforced and conducted by the County (0.9).

Table A-13: Proposed Urban Stormwater Retrofits in the TMDL Watersheds

Bacteria TMDL Watershed	No. of Dry Ponds	Impervious Area Treated by Dry Pond Retrofits (acres)	Impervious Area Treated by NPDES Requirement (acres)
Magothy Mainstem	8	255.4	351.6
Magothy River/Forked	0	0	25.5
Magothy River/Tar Cove	0	0	51.5
Patapsco Lower North Branch	5	51.9	491.5
Patapsco River/Furnace Creek	8	301.4	427.1
Patapsco River/Marley Creek	11	128.6	368.5
Patuxent River Upper	0	0	77.0
Rhode River/Bear Neck Creek	0	0	19.7
Rhode River/Cadle Creek	0	0	11.6
Severn River Mainstem	13	559.1	877.4
Severn River/Mill Creek	3	35.5	43.1
Severn River/Whitehall and Meredith Creek	0	0	44.6
South River Mainstem	14	293.4	349.1
South River/Duvall Creek	0	0	25.2
South River/Ramsey Lake	0	0	13.6
South River/Selby Bay	0	0	13.2
W. Chesapeake Bay/Tracy and Rockhold Creeks	0	0	74.2
West River Mainstem	0	0	73.2
West River/Parish Creek	0	0	11.2

- **Riparian Buffer Education:** This Tier B strategy aims at improving the buffer areas along the stream by implementing a riparian buffer education program for private property owners adjacent to buffer areas. The education programs will include buffer enhancement components such as no mow areas, planting trees and shrubs and promoting growth of native vegetation. The pollutant load reductions from this strategy were obtained by adjusting the buffer maintenance factor to 0.9 in future management practices of WTM indicating the County would have implemented a buffer education program.

The expected pollutant load reductions from Tier A and Tier B strategies that were quantified using WTM are provided in Table A-14 below.

Table A-14: Bacteria Load Reductions from Proposed Tier A and Tier B Strategies that Were Quantified Using WTM

Bacteria TMDL Watershed	Expected % Load Reduction					
	Septic Retirement/ Connection	Abatement of SSOs	Urban Stormwater Retrofits (Pre 2002-Pond Retrofits)	Urban Stormwater Retrofits (Restore 20% Untreated Impervious Area)	Eliminate Illicit Connections	Buffer Ordinance/Education
Magothy Mainstem	13.55	1.12	4.7	4.48	8.74	0.91
Magothy River/Forked	6.14	12.40	-	7.02	1.13	1.93
Magothy River/Tar Cove	25.25	-	-	3.76	0.67	1.02
Patapsco Lower North Branch	5.60	4.90	1.26	6.59	11.60	2.99
Patapsco River/Furnace Creek	3.38	3.5	8.16	9.00	7.72	1.47
Patapsco River/Marley Creek	-	2.04	4.47	8.42	10.82	1.63
Patuxent River Upper	16.45	-	-	5.42	0.85	17.20
Rhode River/Bear Neck Creek	-	2.50	-	6.82	0.50	0.11
Rhode River/Cadle Creek	-	8.40	-	9.40	0.30	0.80
Severn River Mainstem	10.56	0.36	3.10	3.90	19.02	1.56
Severn River/Mill Creek	34.70	0.20	4.34	4.20	1.54	2.80
Severn River/Whitehall and Meredith Creek	21.10	-	-	4.20	0.9	2.24
South River Mainstem	15.60	0.30	3.73	3.60	11.30	8.00
South River/Duvall Creek	-	6.40	-	9.13	0.65	-
South River/Ramsey Lake	-	-	-	2.90	0.11	0.14
South River/Selby Bay	-	-	-	3.20	0.16	0.06
W. Chesapeake Bay/Tracy and Rockhold Creeks	-	-	-	2.60	0.23	8.20
West River Mainstem	-	-	-	8.30	1.21	11.54
West River/Parish Creek	-	12.90	-	10.50	0.19	0.46

A.5 REFERENCES

Anne Arundel County. 2010. Marinas of Anne Arundel County.

Anne Arundel County. 2013. National Pollutant Discharge Elimination System Municipal Separate Storm Sewer System Discharge Permit 2012 Annual Report: Anne Arundel County, Maryland. Available online at: http://www.aacounty.org/DPW/Watershed/2012%20NPDES%20Documents/2012%20Anne%20Arundel%20Annual%20Report_No%20Appendices.pdf

Anne Arundel County. 2014. National Pollutant Discharge Elimination System Municipal Separate Storm Sewer System Discharge Permit 2013 Annual Report: Anne Arundel County, Maryland. Available online at: http://www.aacounty.org/DPW/Watershed/2012%20NPDES%20Documents/2012%20Anne%20Arundel%20Annual%20Report_No%20Appendices.pdfMaryland Department of the Environment. 2014. *MDE Guidance for Developing a Stormwater Wasteload Allocation Implementation Plan for Bacteria Total Maximum Daily Loads*.

Caraco, D. 2013. Watershed Treatment Model (WTM) 2013 "Custom" version. Center for Watershed Protection, Ellicott City, MD.

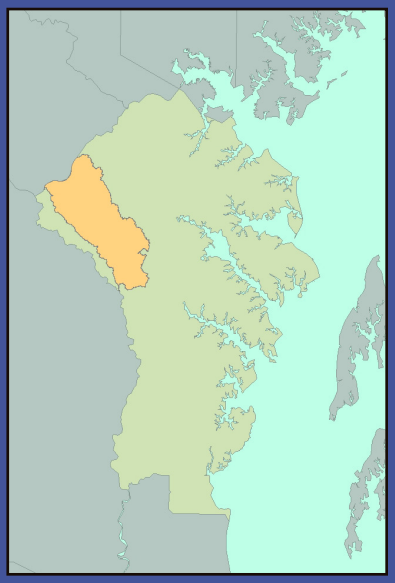
Caraco, D. 2013a. Watershed Treatment Model (WTM) 2013 Documentation. Center for Watershed Protection, Ellicott City, MD. Pages 1-114

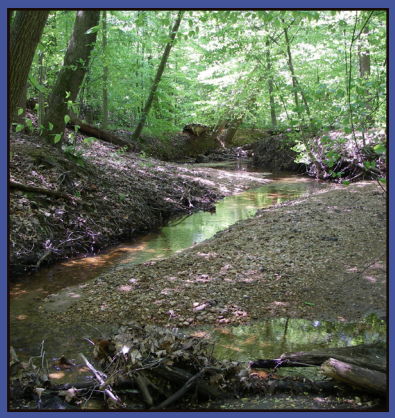
Maryland Department of Natural Resources (MD DNR), Pumpout Locations in Maryland http://www.dnr.state.md.us/boating/pumpout/locations.asp (visited November 2014)

Natural Resources Conservation Services (NRCS), US Department of Agriculture, (USDA) *Soil Survey Geographic (SSURGO)* database. 2014.

Schueler, T. 1987. Controlling Urban Runoff: A Practical Manual for Planning and Designing Urban Best Management Practices. Metropolitan Washington Council of Governments. Washington, D.C.









Little Patuxent River Sediment TMDL Restoration Plan

Anne Arundel County, Maryland
February 2015

Anne Arundel County WATERSHED Protection & Restoration PROGRAM

Little Patuxent River
Sediment TMDL Restoration Plan

February 2015

Prepared for:

Anne Arundel County
Department of Public Works
Watershed Protection and Restoration Program
2662 Riva Road, P.O. Box 6675
Annapolis, Maryland 21401

Prepared by:

KCI Technologies, Inc.
936 Ridgebrook Road
Sparks, Maryland 21152

Table of Contents

1 Introduction 4
1.1 Background and Purpose 4
1.2 TMDL Allocated and Planned Loads Summary 5
1.3 Restoration Plan Elements and Structure 6
2 Watershed Characteristics 8
2.1 Watershed Delineation 8
2.2 Little Patuxent River 8
2.3 Land Use/Land Cover 12
2.3.1 Existing Land Use/Land Cover 12
2.3.2 Impervious Surfaces 13
2.4 Water Quality 17
2.4.1 Use Designations 17
2.4.2 303(d) Impairments 17
2.4.3 TMDLs 17
2.4.4 NPDES 18
3 Causes and Sources of Impairment (a) 19
3.1 Impairments 19
3.2 Sources 20
3.2.1 Urban Stormwater Runoff 20
3.2.2 In-stream Sources 21
3.3 Anticipated Growth 23
4 Management Measures (c) 26
4.1 Modeling Approach 26
4.2 Best Management Practices 27
4.3 Offsetting Sediment Loads from Future Growth 30
5 Expected Load Reductions (b) 30
5.1 2013 Progress – Actual Implementation 31
5.2 Planned Implementation 32
6 Technical and Financial Assistance Needs (d) 34
6.1 Funding Sources 36
7 Public Participation / Education (e) 36
8 Implementation Schedule and Milestones (f & g) 38
8.1 Loading Allocations and Milestone Targets 38
8.2 Implementation Milestones 39
8.3 Implementation Priorities 40
8.3.1 Stream Reach Restoration 40
8.3.2 Subwatershed Restoration 44
8.3.3 Prioritization of Strategy Implementation 46
9 Load Reduction Evaluation Criteria (h) 46
9.1 Tracking Implementation of Management Measures 46
9.2 Estimating Load Reductions 48
9.3 Tracking Overall Program Success through Monitoring 49

10 Monitoring (i) 49
11 References 53

List of Tables

Table 1: Little Patuxent Local TMDL Allocated and Planned Loads 6
Table 2: Little Patuxent River Watershed Drainage Area and Stream Miles 8
Table 3: 2011 Land Use / Land Cover 12
Table 4: Little Patuxent River Watershed Percent Impervious Cover 13
Table 5: Use Designations of the Little Patuxent River 17
Table 6: Erosion Inventory and Severity per Subwatershed (Anne Arundel County, 2014 DRAFT) 22
Table 7: Linear Feet of Erosion per Subwatershed (Anne Arundel County, 2014 DRAFT) 23
Table 8: Typical Sediment Reduction from Stormwater BMPs 29
Table 9: Sediment Loads Required for the Little Patuxent River Local TMDL Anne Arundel County Phase I MS4 Source 31
Table 10: Current BMP Implementation through 2013 for Little Patuxent River 31
Table 11: 2013 Progress Reductions Achieved 32
Table 12: BMP Implementation - Current 2013 and Planned 2025 Levels for the Little Patuxent River 32
Table 13: 2025 Planned Reductions 33
Table 14: Little Patuxent River Cost Over Milestone Periods 35
Table 15: Little Patuxent Planning and Target Loads (edge-of-stream loads) 39
Table 16: Little Patuxent Planning Milestones for Implementation 39
Table 17: Stream Restoration Assessment Indicators (Anne Arundel, 2014 DRAFT) 41
Table 18: Stream Restoration Assessment Results (Anne Arundel County, 2014 Draft) 41
Table 19: Subwatershed Priority Rating Indicators for Restoration (Anne Arundel, 2014 DRAFT) 44
Table 20: Countywide Biological Monitoring Results for Little Patuxent River 51

List of Figures

Figure 1: Little Patuxent River Watershed 10
Figure 2: Little Patuxent River Subwatershed Location 11
Figure 3: Little Patuxent River Watershed Aerial Imagery (2014) 15
Figure 4: Little Patuxent River Watershed Land Cover (2011) 16
Figure 5: Total Suspended Solids Load from Runoff Based on Existing Conditions - Includes BMP Reductions (Anne Arundel County, 2014 Draft) 21
Figure 6: Modeled and Projected Land Use Loads 25
Figure 7: Total Suspended Solids Loads from Runoff Based on Future Conditions - Includes BMP Reductions (Anne Arundel County, 2014 Draft) 26
Figure 8: Progress and Planned Reductions in the Little Patuxent River Watershed 34
Figure 9: Stream Reach Priorities for Restoration (Anne Arundel County, 2014 Draft) 43
Figure 10: Subwatershed Priorities for Restoration (Anne Arundel County, 2014 Draft) 45

List of Acronyms

AAWSA	Anne Arundel Watershed Stewards Academy
BMP	Best Management Practices
BSID	Biological Stressor Identification
CBP	Chesapeake Bay Program
CIP	Capital Improvement Program
EOS	Edge of Stream
H&H	Hydrologic and Hydraulic
LULC	Land use / Land cover
MAST	Maryland Assessment Scenario Tool
MDE	Maryland Department of the Environment
MS4	Municipal Separate Storm Sewer System
NPDES	National Pollutant Discharge Elimination System
OSDS	On-site Disposal Systems
SPSC	Step Pool Storm Conveyance
SW to MEP	Stormwater to the Maximum Extent Practicable
TMDL	Total Maximum Daily Load
TSS	Total Suspended Solids
USEPA	United States Environmental Protection Agency
WIP	Watershed Implementation Plan
WPRP	Watershed Protection and Restoration and Program

1 Introduction

1.1 Background and Purpose

The Anne Arundel County Department of Public Works (DPW) Watershed Protection and Restoration Program (WPRP) is developing restoration plans to address local water quality impairments for which a Total Maximum Daily Load (TMDL) has been established by the Maryland Department of the Environment (MDE) and approved by the U.S. Environmental Protection Agency (EPA). A TMDL establishes a maximum load of a specific single pollutant or stressor that a waterbody can assimilate and still meet water quality standards for its designated use class.

Under the Federal Clean Water Act (CWA), the State of Maryland is required to assess and report on the quality of waters throughout the state. Where Maryland's water quality standards are not fully met, Section 303(d) requires the state to list these water bodies as impaired waters. States are then required to develop a TMDL for pollutants of concern for the listed impaired waters. The Little Patuxent River watershed has several impaired waters listings in Maryland's Integrated Report of Surface Water Quality [303(d) list and 305(b) Report] including nutrients, sediment, heavy metals, *Escherichia coli*, and polychlorinated biphenyls (PCBs). There are currently three final approved TMDLs within the Little Patuxent; a total suspended solids (TSS; sediment) TMDL from urban stormwater sources approved in 1996, a sedimentation/siltation TMDL from agricultural sources approved in 1998, and a phosphorus TMDL from agricultural sources approved in 1998. These TMDLs apply to several jurisdictions including Howard, Prince Georges, and Anne Arundel Counties. This plan will specifically address the Little Patuxent sediment TMDL under the responsibility of Anne Arundel County. The sedimentation/siltation and phosphorus TMDLs are being addressed by Anne Arundel County in separate plans.

Responsibility for Little Patuxent sediment reduction is divided among the contributing jurisdictions, listed above. The TMDL loading targets, or allocations, are also divided among the pollution source categories, which in this case includes non-point sources (termed load allocation or LA) and point sources (termed waste load allocation or WLA). The WLA consists of loads attributable to regulated process water or wastewater treatment, and to regulated stormwater. For the purposes of the TMDL and consistent with implementation of the National Pollutant Discharge Elimination System (NPDES) Municipal Separate Storm Sewer System Discharge Permit (MS4), stormwater runoff from MS4 areas is considered a point source contribution.

Anne Arundel County's current MS4 permit (11-DP-3316, MD0068306) issued in its final form by the MDE in February of 2014 requires development of restoration plans for each stormwater WLA approved by EPA prior to the effective date of the permit (permit section IV.E.2.b). This plan satisfies this permit requirement and provides the loading target, recommended management measures, load reduction estimates, schedule, milestones, cost estimates and funding sources, and the tracking and monitoring approaches to meet the stormwater WLA (SW-WLA).

It is noted that TMDL restoration plans are an important first step. The MS4 permit calls for an iterative and adaptive plan for implementation. If new methods of stormwater treatment are identified, or better approaches to source control are found, the plans can be extended and updated to take the changes into account. Similarly, if some elements of the plans are not as successful as expected, adaptations and improvements will be incorporated in future updates.

This plan demonstrates that Anne Arundel County will meet its sediment SW-WLA for the Little Patuxent River Watershed by 2025. The strategies proposed will provide treatment to reduce current sediment loads while also accounting for expected additional loads due to growth in the urban stormwater sector.

1.2 TMDL Allocated and Planned Loads Summary

The following Restoration Plan only addresses loads allocated to Anne Arundel County NPDES regulated stormwater point source sediment. Additional SW-WLAs for the Little Patuxent watershed TMDL assigned to Howard County, Maryland State Highway Administration, and other NPDES regulated stormwater are not the responsibility of Anne Arundel County and will not be addressed in this plan. A large section of Fort George G. Meade, a federal property owned by the U.S. Army, is located in the central portion of the watershed. Pollutant loads from Fort Meade are the responsibility of the federal government and are not addressed in this plan.

The Little Patuxent watershed TMDL requires a 20.5% reduction of sediment loads from 2005 baseline levels to achieve the target SW-WLA for Anne Arundel County NPDES regulated stormwater. A planning horizon of 2025 will be used as the date to achieve these load reductions with a proposed 2017 interim milestone.

This section of the plan, including Table 1, provides a concise summary of the loads and reductions at important timeline intervals including the 2005 baseline, 2013 progress, 2017 milestone and 2025 final planning intervals. These terms and dates are used throughout the plan and explained in more detail in the following sections. They are presented here to assist the reader in understanding the definitions of each, how they were derived, and to provide an overall summary demonstrating the percent reduction required and percent reduction achieved through full implementation of this plan. Sediment loads and wasteload allocations are presented as tons/year in the local TMDL but will be discussed as lbs/year in this restoration plan.

- **2005 Baseline Loads**: Baseline levels (i.e., land use loads with baseline BMPs) from 2005 conditions in the Little Patuxent watershed using the Maryland Assessment Scenario Tool (MAST) Chesapeake Bay Program Phase 5.3.2 (CBP P5.3.2) model. Baseline loads were used to calculate the stormwater allocated sediment loads, or SW-WLA.
- **2013 Progress Loads and Reductions**: Progress loads and load reductions achieved from stormwater best management practice (BMP) implementation through 2013.
- **2017 Interim Milestone Goal Loads and Planned Loads and Reductions**: 2017 Interim Milestone loads were calculated by subtracting 60% of the absolute reduction goal from 2005 baseline loads. Planned 2017 loads and reductions will result from implementation of strategies through 2017.
- **2025 Allocated Load**: Allocated loads are calculated from the 2005 baseline levels, calibrated to CBP P5.3.2 as noted above, using the following calculation: 2005 Baseline – (2005 Baseline x 0.222); or, 2005 Baseline x (1 – 0.222)
- **2025 Planned Loads and Planned Reductions**: Loads and reductions that will result from implementation of this plan.

Table 1: Little Patuxent Local TMDL Allocated and Planned Loads

	Sediment (tons/year)	Sediment (lbs/year)
2005 Baseline Loads	638	1,275,211
2013 Progress Loads	600	1,200,569
2013 Progress Reductions	37	74,642
2017 Interim Milestone Loads	559	1,118,360
2017 Planned Loads*	572	1,144,851
2017 Planned Reductions	65	130,359
2025 TMDL Allocated Loads	507	1,013,792
2025 Planned Loads*	506	1,011,161
2025 Planned Reductions	132	264,049
Required Percent Reduction	20.5%	20.5%
Planned Percent Reduction Achieved	20.7%	20.7%

*2017 and 2025 planned loads include additional projected land use loading from new development through 2025. It is assumed that all new development will be treated with SW to the MEP implementation to achieve 90% sediment removal.

1.3 Restoration Plan Elements and Structure

This plan is developed within in the context of on-going watershed management planning, restoration, and resource protection being conducted by Anne Arundel County. The County initiated comprehensive watershed assessment and management plans in 2000 and has currently completed plans for seven of the 12 major watersheds. A draft comprehensive watershed assessment for the Little Patuxent watershed is currently underway with expected completion at the beginning of 2015. The County also prepared a Phase II Watershed Implementation Plan (WIP) in 2012 in response to requirements set forth in the Chesapeake Bay TMDL for nitrogen, phosphorus and sediment. Information synthesized and incorporated into this plan for the Little Patuxent watershed draws upon these sources with updates and additions where necessary to meet the specific goals of the SW-WLA. The TMDL analyses and reports developed by MDE are also referenced. These primary sources include:

- Little Patuxent River Watershed Assessment Comprehensive Summary Report (Anne Arundel County, 2014 DRAFT)
- Chesapeake Bay TMDL, Phase II Watershed Implementation Plan, Final (Anne Arundel County, 2012)
- Total Maximum Daily Load of Sediment in the Little Patuxent River Watershed, Howard and Anne Arundel Counties, Maryland (MDE, 2011a)

MDE has prepared several guidance documents to assist municipalities with preparation of TMDL restoration plans. This plan is developed following the guidance detailed in the following documents with modifications as necessary:

- General Guidance for Developing a Stormwater Wasteload Allocation (SW-WLA) Implementation Plan (MDE, May 2014)

- Guidance for Using the Maryland Assessment Scenario Tool to Develop Stormwater Wasteload Allocation Implementation Plans for Local Nitrogen, Phosphorus, and Sediment TMDLs (MDE, June 2014)
- Guidance for Developing Stormwater Wasteload Allocation Implementation Plans for Nutrient and Sediment Total Maximum Daily Loads (MDE, November 2014)
- Accounting for Stormwater Wasteload Allocations and Impervious Acres Treated (MDE, August 2014)

The Little Patuxent plan has been prepared in accordance with the EPA's nine essential elements for watershed planning. These elements, commonly called the 'a through i criteria' are important for the creation of thorough, robust, and meaningful watershed plans and incorporation of these elements is of particular importance when seeking implementation funding. The EPA has clearly stated that to ensure that Section 319 (the EPA Nonpoint Source Management Program) funded projects make progress towards restoring waters impaired by nonpoint source pollution, watershed-based plans that are developed or implemented with Section 319 funds to address 303(d)-listed waters must include at least the nine elements.

The Little Patuxent watershed restoration plan is organized based on these elements. A modification to the order has been incorporated such that element c., a description of the management measures, is included before element b., the expected load reductions. We feel this modified approach is easier to follow. The letters (a. through i.) are included in the headers of the plan's major sections to indicate to the reader the elements included in that section. The planning elements are:

a. An identification of the causes and sources that will need to be controlled to achieve the load reductions estimated in the plan and to achieve any other watershed goals identified in the plan, as discussed in item (b) immediately below. (Section 3)

b. An estimate of the load reductions expected for the management measures described under paragraph (c) below, recognizing the natural variability and the difficulty in precisely predicting the performance of management measures over time. (Section 5)

c. A description of the management measures that will need to be implemented to achieve the load reductions estimated under paragraph (b) above as well as to achieve other watershed goals identified in the plan, and an identification of the critical areas in which those measures will be needed to implement this plan. (Section 4)

d. An estimate of the amount of technical and financial assistance needed, associated costs, and/or the sources and authorities that will be relied upon, to implement this plan. (Section 6)

e. An information/education component that will be used to enhance public understanding of the project and encourage their early and continued participation in selecting, designing, and implementing the recommended management measures. (Section 7)

f. A schedule for implementing the management measures identified in this plan that is reasonably expeditious. (Section 8)

g. A description of interim, measurable milestones for determining whether management measures or other control actions are being implemented. (Section 8)

h. A set of criteria that can be used to determine whether loading reductions are being achieved over time and substantial progress is being made towards attaining water quality standards and, if not, the criteria for determining whether the plan needs to be revised. (Section 9)

i. A monitoring component to evaluate the effectiveness of the implementation efforts over time, measured against the criteria established under item (h) immediately above. (Section 10)

The outcomes of the planning effort are to provide guidance for the strategic implementation of watershed protection and restoration efforts that will advance progress toward meeting Anne Arundel County's local TMDLs pollutant loading allocations, and ultimately meeting water quality standards. Successful implementation of the plan will lead to improvements in local watershed conditions and aquatic health.

2 Watershed Characteristics

2.1 Watershed Delineation

The Little Patuxent is one of 12 major watersheds in Anne Arundel County, Maryland, and is situated in the western portion of the County (Figure 1). The watershed shares political boundaries with Howard County. The Little Patuxent watershed is a part of the Chesapeake Bay watershed with the Little Patuxent mainstem joining the Patuxent River just southeast of the Patuxent Research Refuge before discharging to the tidal portions of the Patuxent River in Calvert County before entering the Chesapeake Bay.

2.2 Little Patuxent River

The Little Patuxent watershed is approximately 27,752 acres (43.4 square miles) in area and contains approximately 1,200 total miles of stream reaches. The watershed includes several named streams including Dorsey Run, Midway Branch, Towsers Branch, and the mainstem of the Little Patuxent River. These named streams are distributed among 21 subwatersheds, as shown below in Table 2 and on Figure 2. These subwatersheds were used as planning units for the watershed assessment and management plan completed for this watershed by the County in 2014 (Draft). Although the average subwatershed size is 1,321 acres, the subwatersheds range in size from 485 in LPH to 2,646 in LPI. The channel length in each subwatershed also varies similarly.

Communities within the Little Patuxent include Gambrills and Crofton. A large section of Fort George G. Meade, a U.S. Army owned installation, and approximately half of the Patuxent Research Refuge North, a federal property owned and operated by the Fish and Wildlife Service of the U.S. Department of Interior, are located in the central portion of the watershed (Figure 2).

Table 2: Little Patuxent River Watershed Drainage Area and Stream Miles

Subwatershed Code	Subwatershed Name	Drainage Area (Acres)	Drainage Area (Square Miles)	Stream Miles
LP0	Little Patuxent 2	670	1.0	6.3
LP1	Dorsey Run 1	621	1.0	6.0
LP2	Dorsey Run 3	876	1.4	8.7
LP3	Towsers Branch 1	1,334	2.1	6.1
LP4	Rogue Harbor 1	1,902	3.0	11.3
LP5	Little Patuxent 1	1,158	1.8	8.7
LP6	Towsers Branch 2	1,013	1.6	2.4
LP7	Little Patuxent 5	1,701	2.7	10.2

Subwatershed Code	Subwatershed Name	Drainage Area (Acres)	Drainage Area (Square Miles)	Stream Miles
LP8	Little Patuxent 4	1,096	1.7	8.2
LP9	Rogue Harbor 2	2,287	3.6	12.1
LPA	Oak Hill	1,031	1.6	7.9
LPB	Dorsey Run 6	1,732	2.7	12.8
LPC	Towsers Branch 3	1,954	3.1	8.3
LPD	Dorsey Run 4	1,592	2.5	10.0
LPE	Piney Orchard	932	1.5	7.0
LPF	Little Patuxent 6	1,503	2.3	13.4
LPG	Crofton Golf	1,690	2.6	10.0
LPH	Little Patuxent 3	485	0.8	3.7
LPI	Dorsey Run 5	2,660	4.2	153.0
LPJ	Dorsey Run 2	919	1.4	299.6
LPK	Jessup	594	0.9	593.3
Little Patuxent River Total		**27,752**	**43.4**	**1,198.8**

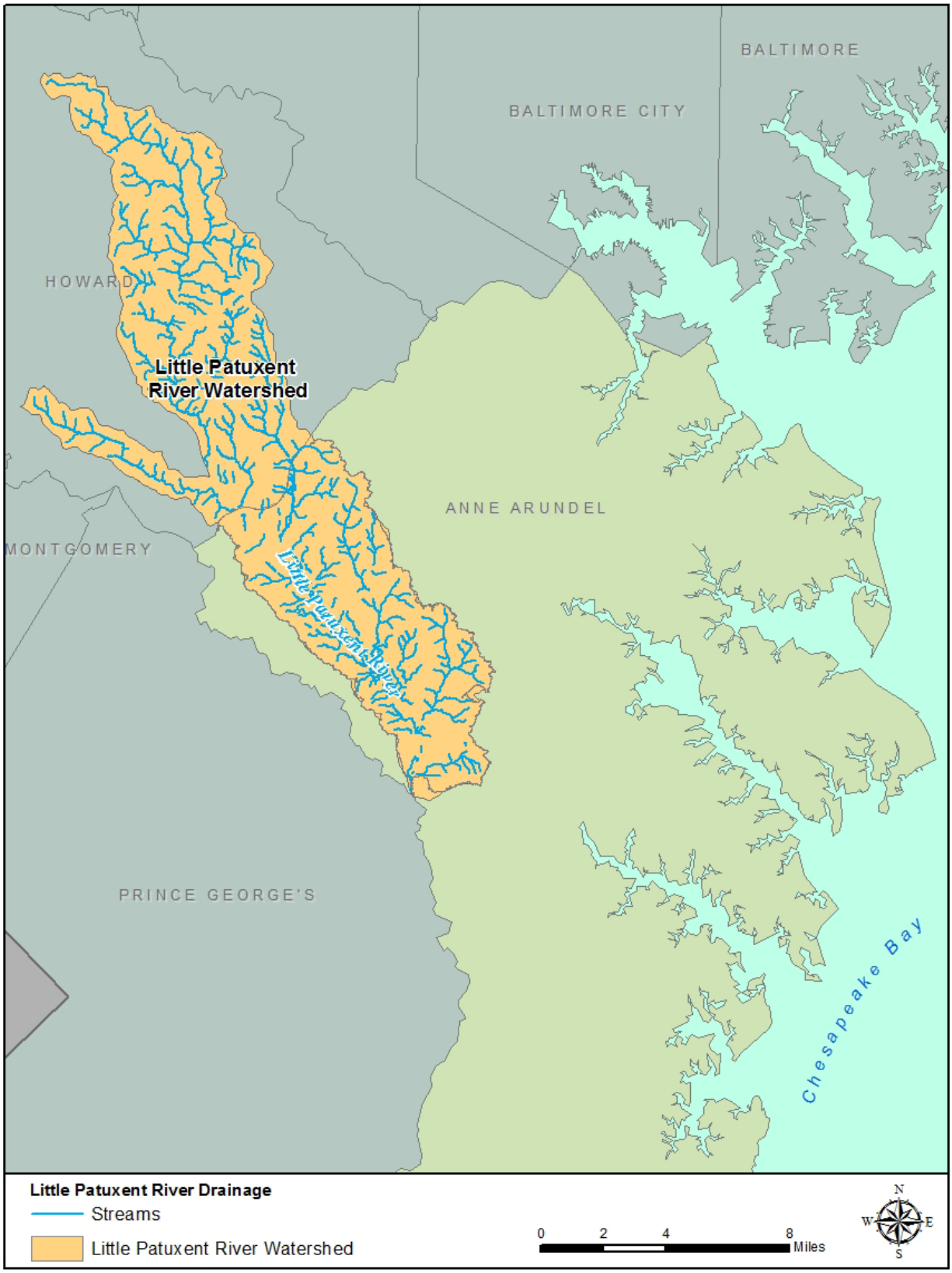
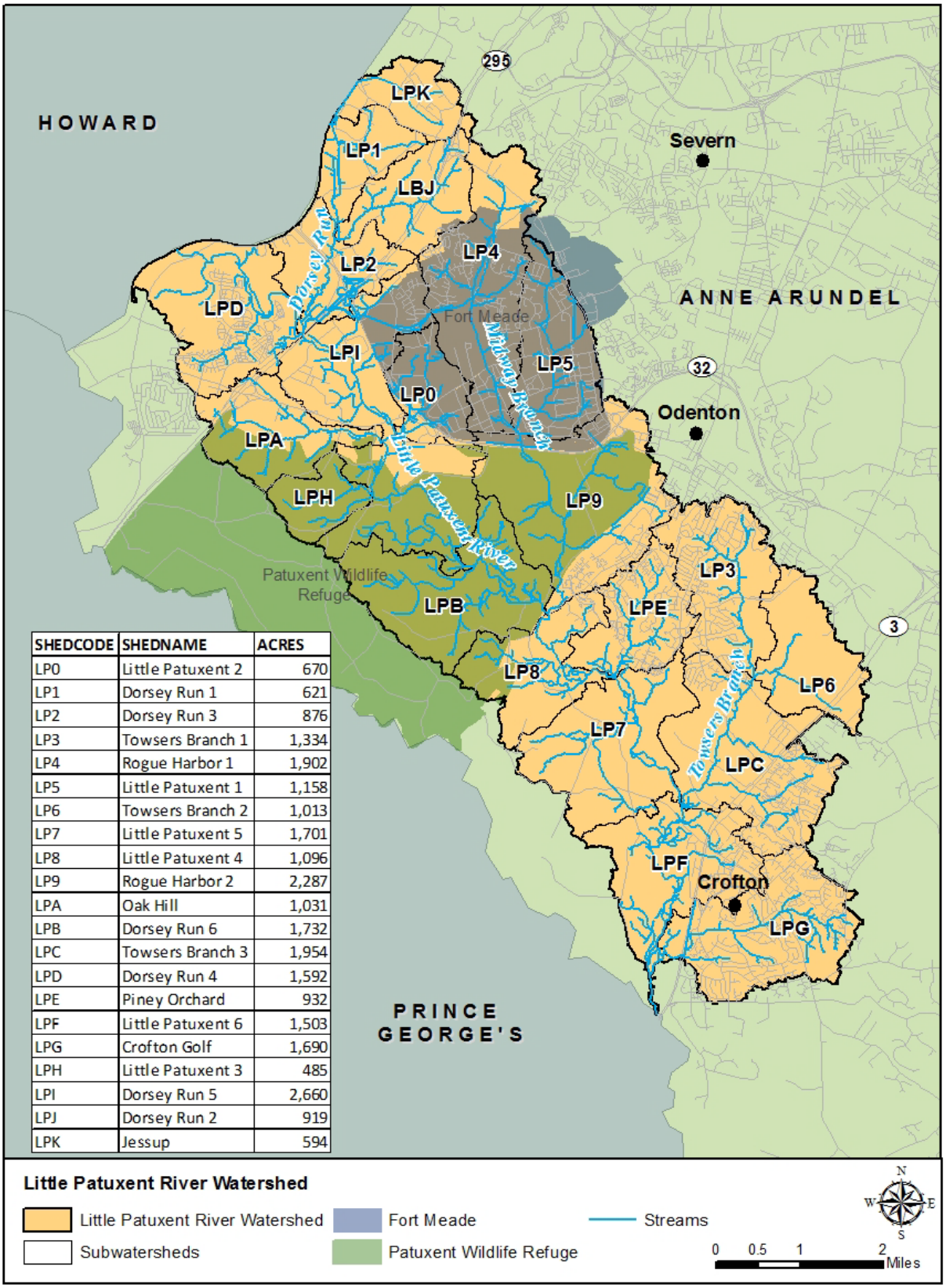


Figure 1: Little Patuxent River Watershed



SHEDCODE	SHEDNAME	ACRES
LP0	Little Patuxent 2	670
LP1	Dorsey Run 1	621
LP2	Dorsey Run 3	876
LP3	Towsers Branch 1	1,334
LP4	Rogue Harbor 1	1,902
LP5	Little Patuxent 1	1,158
LP6	Towsers Branch 2	1,013
LP7	Little Patuxent 5	1,701
LP8	Little Patuxent 4	1,096
LP9	Rogue Harbor 2	2,287
LPA	Oak Hill	1,031
LPB	Dorsey Run 6	1,732
LPC	Towsers Branch 3	1,954
LPD	Dorsey Run 4	1,592
LPE	Piney Orchard	932
LPF	Little Patuxent 6	1,503
LPG	Crofton Golf	1,690
LPH	Little Patuxent 3	485
LPI	Dorsey Run 5	2,660
LPJ	Dorsey Run 2	919
LPK	Jessup	594

Figure 2: Little Patuxent River Subwatershed Location

2.3 Land Use/Land Cover

The type and density of various land uses can have a dramatic effect on water quality and stream habitat. Forested areas slow stormwater flow and allow water to gradually seep into soils and drain into streams. Vegetation and soils bind nutrients and pollutants found within stormwater—improving water quality as it infiltrates the ground. Developed areas, with a high percentage of impervious surfaces (buildings, paved roads, parking lots, etc.), do not reduce either the volume or flow of stormwater—increasing the amount of pollutants entering streams. Increased stormflow affects stream habitat negatively by increasing bank erosion and decreasing instream and riparian habitat. Agricultural land, if managed incorrectly, can also impair streams with increases nutrients and bacteria.

See Figure 3 for aerial imagery of the Little Patuxent River watershed. Land use / land cover (LULC) data from the Anne Arundel County Office of Information Technology (2011) is presented in Figure 4. Data presented in the figures below were used to characterize the watershed and show potential pollution sources. These LULC data were not used in the calculations of loads and load reduction, which were based instead on the land-river segment scale from the Chesapeake Bay Program Partnership Watershed Model.

2.3.1 Existing Land Use/Land Cover

According to 2011 LULC data (Table 3), the largest category in the Little Patuxent is forested land, or woods (45.9%) followed by open space (11.8%). Developed land accounts for 36.6% of the watershed and largely consists of residential (1/8 acre 10.2%, 1/4 acre 6.2%), and commercial (8.4%). Residential areas as a total make up 19.6% of the watershed.

Table 3: 2011 Land Use / Land Cover

Land Use / Land Cover	Acres	Percent of Watershed
Airport	66	0.2%
Commercial	2,323	8.4%
Forested Wetland	52	0.2%
Industrial	756	2.7%
Open Space	3,274	11.8%
Open Wetland	100	0.4%
Pasture/Hay	454	1.6%
Residential 1/2-acre	154	0.6%
Residential 1/4-acre	1,723	6.2%
Residential 1/8-acre	2,836	10.2%
Residential 1-acre	169	0.6%
Residential 2-acre	568	2.0%
Row Crops	471	1.7%
Transportation	1,179	4.2%
Utility	384	1.4%
Water	503	1.8%
Woods	12,740	45.9%
Total	**27,752**	**100.0%**

2.3.2 Impervious Surfaces

Impervious surfaces concentrate stormwater runoff, accelerating flow rates and directing stormwater to the receiving stream. This accelerated, concentrated runoff can cause stream erosion and habitat degradation. Runoff from impervious surfaces picks up and washes off pollutants and is usually more polluted than runoff generated from pervious areas. In general, undeveloped watersheds with small amounts of impervious cover are more likely to have better water quality in local streams than urbanized watersheds with greater amounts of impervious cover. Impervious cover is a primary factor when determining pollutant characteristics and loadings in stormwater runoff.

The degree of imperviousness in a watershed also affects aquatic life. There is a strong relationship between watershed impervious cover and the decline of a suite of stream indicators. As imperviousness increases the potential stream quality decreases with most research suggesting that stream quality begins to decline at or around 10 percent imperviousness (Schueler, 1994; CWP, 2003). However, there is considerable variability in the response of stream indicators to impervious cover observed from 5 to 20 percent imperviousness due to historical effects, watershed management, riparian width and vegetative protection, co-occurrence of stressors, and natural biological variation. Because of this variability, one cannot conclude that streams draining low impervious cover will automatically have good habitat conditions and a high quality aquatic life.

Impervious surfaces make up 15.7% of the overall Little Patuxent drainage (Table 4; impervious surfaces data obtained from Anne Arundel County Office of Information Technology - 2011). Impervious surface is highest in areas surrounding Odenton and Crofton.

Table 4: Little Patuxent River Watershed Percent Impervious Cover

Subwatershed Code	Subwatershed Name	% Impervious Cover
LP0	Little Patuxent 2	31.5%
LP1	Dorsey Run 1	14.2%
LP2	Dorsey Run 3	20.5%
LP3	Towsers Branch 1	21.3%
LP4	Rogue Harbor 1	21.0%
LP5	Little Patuxent 1	24.5%
LP6	Towsers Branch 2	12.4%
LP7	Little Patuxent 5	4.6%
LP8	Little Patuxent 4	4.8%
LP9	Rogue Harbor 2	14.3%
LPA	Oak Hill	6.7%
LPB	Dorsey Run 6	0.4%
LPC	Towsers Branch 3	22.6%
LPD	Dorsey Run 4	21.6%
LPE	Piney Orchard	22.5%
LPF	Little Patuxent 6	18.3%
LPG	Crofton Golf	26.5%
LPH	Little Patuxent 3	0.1%

Subwatershed Code	Subwatershed Name	% Impervious Cover
LPI	Dorsey Run 5	12.4%
LPJ	Dorsey Run 2	12.1%
LPK	Jessup	14.0%
Little Patuxent River Total		**15.7%**

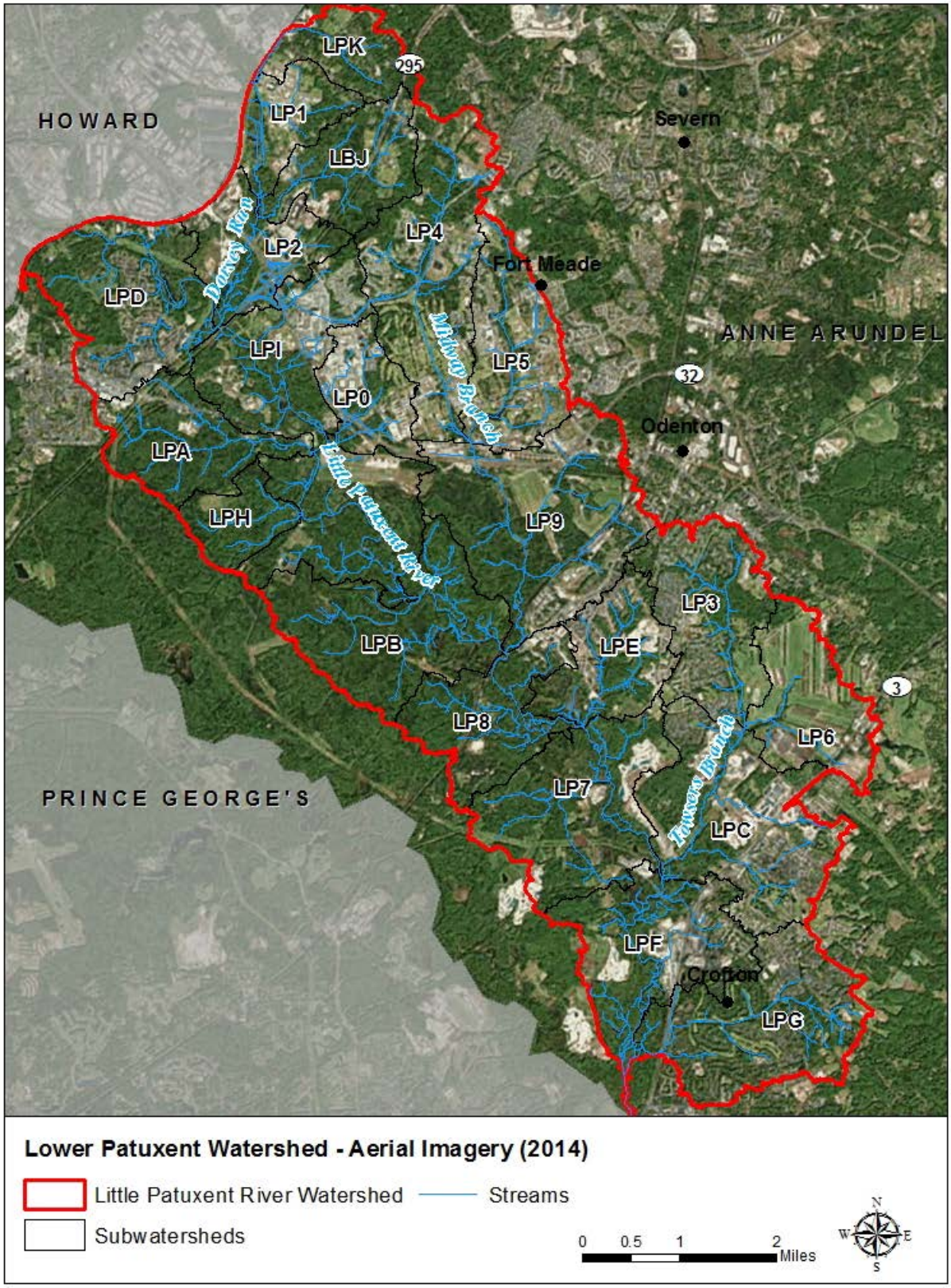


Figure 3: Little Patuxent River Watershed Aerial Imagery (2014)

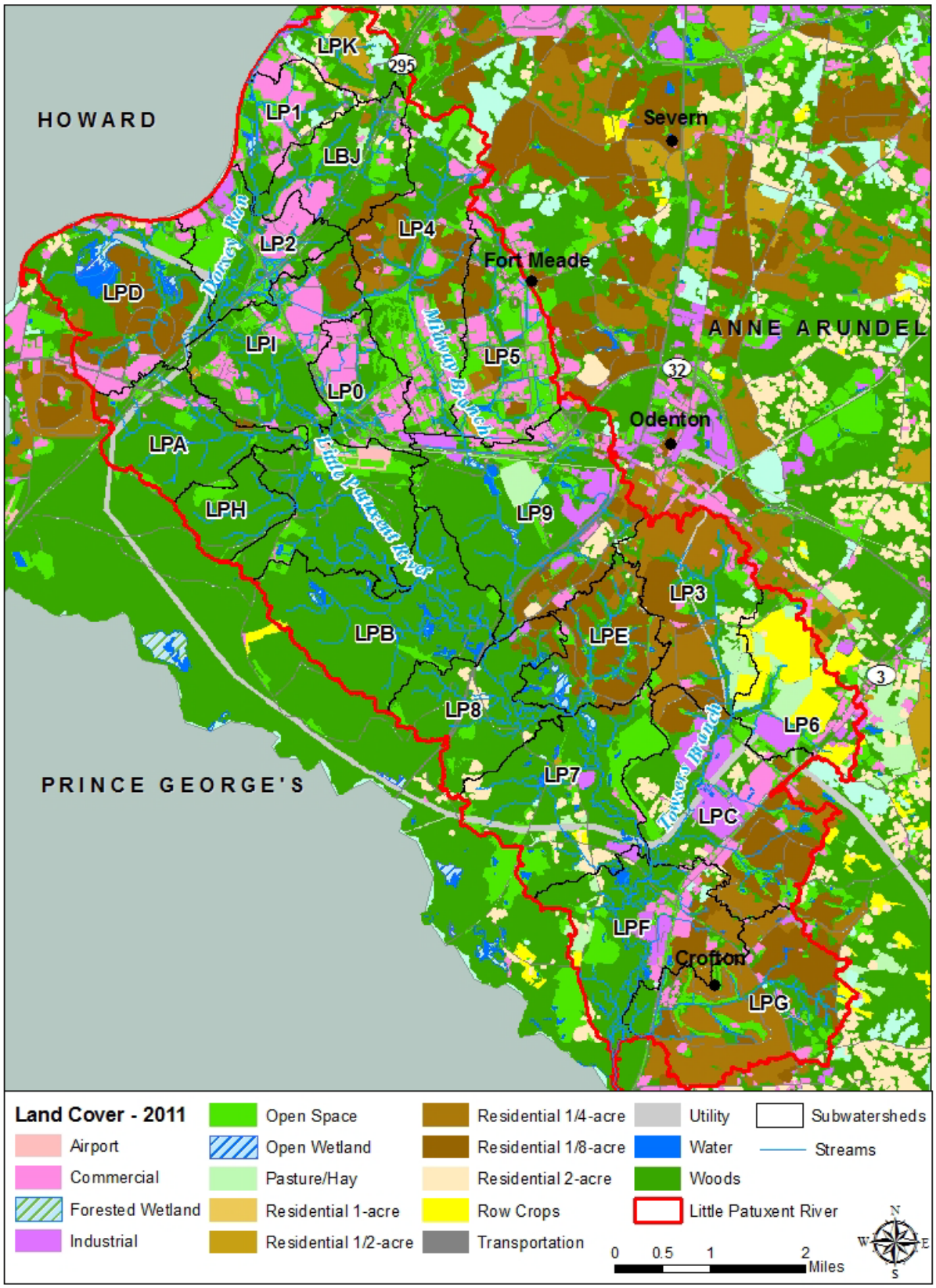


Figure 4: Little Patuxent River Watershed Land Cover (2011)

2.4 Water Quality

2.4.1 Use Designations

According to water quality standards established by MDE in the Code of Maryland Regulations (COMAR) 26.08.02.03-.03 - Water Quality, Little Patuxent is classified as Use I waters which are designated to support water contact recreation, and protection of non-tidal warmwater aquatic life. Designations include recreation; industrial and agricultural water supply; and fish, aquatic life, and wildlife (Table 5).

Table 5: Use Designations of the Little Patuxent River

Designated Uses	Little Patuxent
Growth and propagation of fish (not trout), other aquatic life and wildlife	X
Water contact sports	X
Leisure activities involving direct contact with surface water	X
Fishing	X
Agricultural water supply	X
Industrial water supply	X
Propagation and harvesting of shellfish	-
Seasonal migratory fish spawning and nursery use	-
Seasonal shallow-water submerged aquatic vegetation use	-
Open-water fish and shellfish use	-
Seasonal deep-water fish and shellfish use	-
Seasonal deep-channel refuge use	-
Growth and propagation of trout	-
Capable of supporting adult trout for a put and take fishery	-
Public water supply	-

Source: http://www.mde.state.md.us/programs/Water/TMDL/Water%20Quality%20Standards/Pages/programs/waterprograms/ tmdl/wqstandards/wqs_designated_uses.aspx

2.4.2 303(d) Impairments

According to Maryland's final 2012 and draft 2014 303(d) list of impaired waters (MDE, 2012a; MDE, 2014a), several segments within the Little Patuxent watershed are listed for water quality impairments. The Little Patuxent watershed contains three Category 4a stream segments which include those waters that are not meeting their use designation but for which a TMDL has been developed to address the impairments. Category 4a waters include the entire watershed listed for sediment from urban runoff sources and two listings from agricultural sources for Centennial Lake in Howard County, one for sedimentation/siltation and another for phosphorus. Category 5 waters for the Little Patuxent watershed, which include those waters that are not meeting their use designation and require a TMDL, include the entire watershed for chlorides.

2.4.3 TMDLs

Total Maximum Daily Loads (TMDLs) are established for waterbodies on Maryland's 303(d) integrated list of impaired waterbodies to set pollutant limits to achieve attainment of the designated use. For each combination of waterbody and pollutant, the State must estimate the maximum allowable pollutant load, or TMDL, that the waterbody can receive and still meet water quality standards. TMDLs are required by Clean Water Act.

Category 4a of the 303(d) list describes impaired waters with a TMDL or other reduction measure in place. Category 5 lists impaired waters in need of a TMDL. One listing for chlorides in the Little Patuxent is currently in need of a TMDL.

The Little Patuxent currently has three final TMDLs completed - one for sediment from urban runoff sources (approved 2011), a second for sediment from agricultural sources (approved 2002), and a third for phosphorus from agricultural sources (approved 2002). This Restoration Plan focuses on implementing strategies to address the sediment TMDL which requires a 20.5% reduction of Anne Arundel County NPDES regulated stormwater point source sediment.

In addition to local TMDLs in the Little Patuxent, the County must also meet WLAs allocated from the *Chesapeake Bay Total Maximum Daily Loads for Nitrogen, Phosphorus, and Sediment* (USEPA, 2010). The Bay TMDL is a result of requirements under the CWA to meet water quality standards and executive order 13508 signed by President Barack Obama in 2009 that put a renewed emphasis and focus on the Chesapeake Bay. The local sediment TMDL for the Little Patuxent is more geographically specific than the Bay-wide allocated loads assigned in the Bay TMDL. However, all load reductions achieved from implementation efforts described in this plan will help support the County's Bay TMDL goals.

2.4.4 NPDES

Section 402(p) of the Clean Water Act required the EPA to add Municipal Separate Storm Sewer System (MS4) discharges to the NPDES permit program. In 2002, EPA directed permit writers to include WLA requirements in NPDES permits, including those for MS4 discharges. Anne Arundel County holds a Phase I – Large Jurisdiction (greater than 250,000 population) MS4 permit (11-DP-3316, MD0068306) issued by the MDE. The County's first generation permit was issued in 1993. The current fourth generation permit was issued in February of 2014.

TMDL Permit Requirements

The objective of this plan is to meet the County's MS4 NPDES permit requirement to develop restoration plans for local TMDLs per permit condition IV.E.2.b. Plans must be developed within the first year of permit issuance. Anne Arundel County's final permit was issued on February 12, 2014 therefore the restoration plans must be complete by February 11, 2015.

The permit states the County must submit "…a restoration plan for each stormwater Waste Load Allocation (WLA) approved by EPA prior to the effective date of the permit." For each WLA, the County is required to:

PART IV. Standard Permit Conditions
E. Restoration Plans and Total Maximum Daily Loads
2. Restoration Plans
b. Within one year of permit issuance, Anne Arundel County shall submit to MDE for approval a restoration plan for each stormwater WLA approved by EPA prior to the effective date of the permit. The County shall submit restoration plans for subsequent TMDL WLAs within one year of EPA approval. Upon approval by MDE, these restoration plans will be enforceable under this permit. As part of the restoration plans, Anne Arundel County shall:

i. Include the final date for meeting applicable WLAs and a detailed schedule for implementing all structural and nonstructural water quality improvement projects,

enhanced stormwater management programs, and alternative stormwater control initiatives necessary for meeting applicable WLAs;

ii. Provide detailed cost estimates for individual projects, programs, controls, and plan implementation;

iii. Evaluate and track the implementation of restoration plans through monitoring or modeling to document the progress toward meeting established benchmarks, deadlines, and stormwater WLAs; and

iv. Develop an ongoing, iterative process that continuously implements structural and nonstructural restoration projects, program enhancements, new and additional programs, and alternative BMPs where EPA approved TMDL stormwater WLAs are not being met according to the benchmarks and deadlines established as part of the County's watershed assessments.

Further, the permit requires continual outreach to the public regarding the development of its watershed assessments and restoration plans and requires public participation in the TMDL process (permit section IV.E.3.a-d).

The permit requires an annual progress report presenting the assessment of the NPDES stormwater program based on the fiscal year. A TMDL assessment report to include complete descriptions of the analytical methodology used to evaluate the effectiveness of the County's restoration plans and how these plans are working to achieve compliance with EPA approved TMDLs is a component of the annual report. The assessment will include: estimated net change in pollutant load reductions from water quality improvement projects; a comparison of the net change to targets, deadlines, and applicable WLAs; cost data for completed projects; cost estimates for planned projects; and a description of a plan for implementing additional actions if targets, deadlines, and WLAs are not being met (permit section IV.E.4.a-e).

Impervious Surface Permit Requirements

The County's permit requires implementation of restoration efforts for 20% of the County's impervious surface area that has not already been restored to the maximum extent practicable (MEP) (permit section (IV.E.2.a). Though projects and strategies outlined in this plan will certainly add treatment of impervious surfaces, accounting for impervious treatment is not included in this report.

3 Causes and Sources of Impairment (a)

3.1 Impairments

Elevated levels of sediment currently impair the Little Patuxent watershed as evident through the 303(d) listings and local TMDL requirement. Sediment, both from upland and in-stream sources, can impact in-stream habitat by covering and filling gravelly and rocky substrate, which is a preferred substrate habitat for some aquatic organisms (fish and benthic community) and necessary for some fish species for spawning. Finer clays, silts and sands associated with sediment as a pollutant are more mobile and transient and provide less liveable space for more sensitive benthic macroinvertebrate species by filling the interstitial spaces between larger substrate particles in the channel bottom. Increases in sediment loads in channels that cannot adequately transport the load can lead to deposition and aggrading streams. These factors often negatively impact channel flow, causing additional erosion and increases in flooding, particularly if road crossing capacity is limited by sediment accumulation. Suspended sediment

in the water column may limit light penetration and prohibit healthy propagation of algae and submerged aquatic vegetation. Suspended sediments can cause gill abrasion in fish and can limit clarity which impacts aquatic species that rely on sight for feeding.

3.2 Sources

The majority of sediment loads in the Little Patuxent originate from urban stormwater runoff from development and in-stream sources related to channel erosion.

3.2.1 Urban Stormwater Runoff

The contribution of urban stormwater to sediment loading was analyzed in the Little Patuxent Watershed Assessment (Anne Arundel County, 2014 Draft). Figure 5 presents the annual total suspended solids runoff load as the relative quantity of sediment contributed from each subwatershed (i.e., lowest to highest). The water quality model used for the assessment was based on EPA's Simple Method (Schueler, 1987) and PLOAD models (EPA, 2001) using event mean concentrations (EMCs) for each LULC type. The results presented here are only the sediment associated with runoff, and do not reflect in-stream sources. The most significant contributing LULC categories related to urban stormwater in terms of loading rates include airport, transportation, and commercial and industrial areas. Residential development, while a lower loading rate, makes up a large portion of the watershed (19.6%) and is therefore also a significant contributor.

Subwatersheds contributing the lowest amount of existing sediment loads include LP8, LPA, LPB, LPH, and LPK. Subwatersheds contributing the highest amount of existing sediment loads include LP4, LP6, LP9, LPG, and LPI and to a lesser extent, subwatersheds LP3, LPC, LPD, and LPF. Management measures targeted in subwatersheds with high existing sediment loads will be the priority of this restoration plan to ensure required reductions are achieved and maintained.

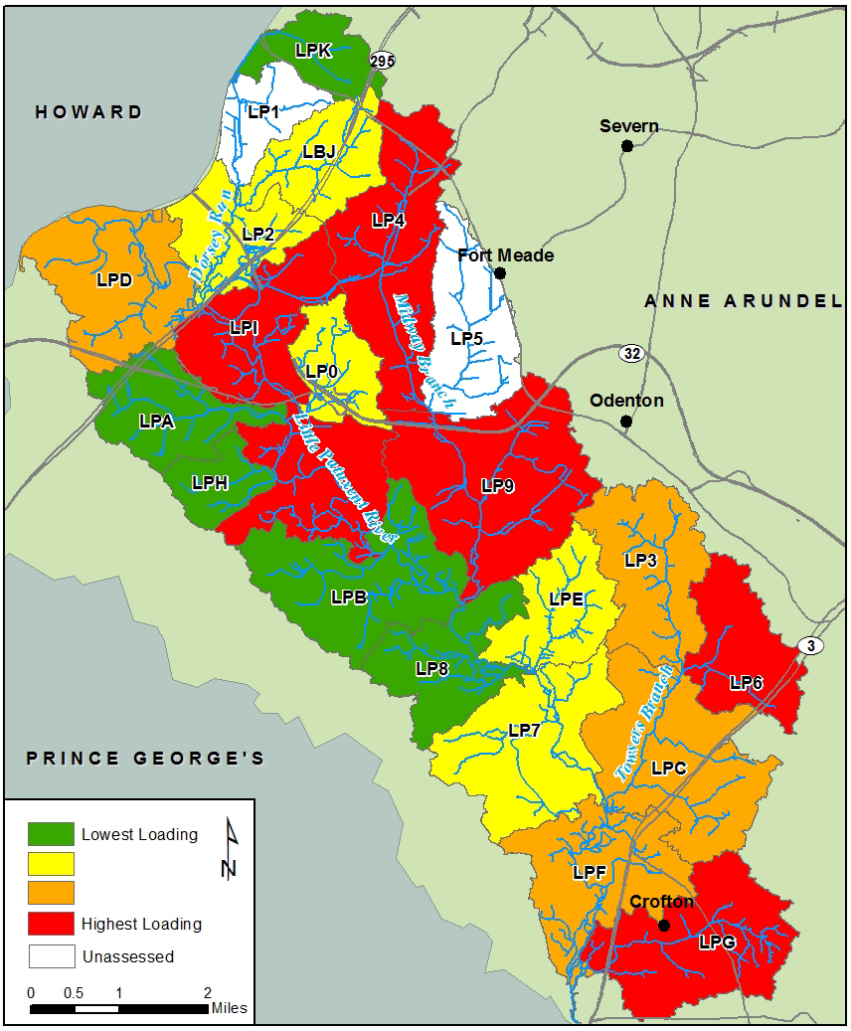


Figure 5: Total Suspended Solids Load from Runoff Based on Existing Conditions - Includes BMP Reductions (Anne Arundel County, 2014 Draft)

3.2.2 In-stream Sources

Although channel bed and bank erosion occurs naturally as streams work to maintain a state of dynamic equilibrium, excessive erosion can occur due to increased stream velocities associated with development activities that increase imperviousness within the watershed. Channel erosion can deliver excessive pollutants, such as sediment and phosphorus, downstream, where water quality can be impacted and important habitat for fish spawning and benthic invertebrates can be smothered. Excessive erosion can also threaten the stability of other nearby built infrastructure. The Biological Stressor Identification Analysis (BSID; MDE, 2011b) for the Little Patuxent has determined that biological communities in this watershed are likely degraded due to flow/sediment related stressors. These stressors often result from altered hydrology and increased runoff from impervious area, specifically from channel erosion and subsequent elevated suspended sediment transport through the watershed. Thus, suspended sediment was identified as a probable cause and confirmed the 2008 Category 5 listing for total suspended sediment as an impairing substance in this watershed.

Approximately 116 miles of streams were assessed and characterized for the Little Patuxent Watershed Assessment (Anne Arundel County, 2014 Draft). Streams located on Fort Meade and Jessup Correctional Institute property were not assessed, which included the majority of streams within subwatersheds LP1

and LP5 and portions of subwatersheds LP0, LP4, LP9, and LPI. Collected data included stream classifications, physical habitat condition assessment, inventory of infrastructure and environmental features, habitat scores, channel geomorphology, road crossing flood potential, bioassessments, and aquatic resource indicators. Within each perennial reach, channel erosion was assessed and scored based on severity. A score of 5 was considered Moderate impact, a score of 7 was considered Severe, and a score of 10 was considered an Extreme condition. A total of 431 erosion locations impacting approximately 49,000 linear feet of stream reaches were cataloged in the Little Patuxent with the majority of points scored as moderate or severe erosion (Table 6 and Table 7). Over half of the erosion sites (53.3%) were located in Towsers Branch (LP3 and LPC), Dorsey Run (LPD and LPJ), and Oak Hill (LPA).

Table 6: Erosion Inventory and Severity per Subwatershed (Anne Arundel County, 2014 DRAFT)

Subwatershed and stream	miles assessed	Number of Erosion Impacts			Total
		5	7	10	
LP0	1.2	3	1		4
LP1	0.1				0
LP2	3.7	12	1		13
LP3	6.1	19	14	2	35
LP4	1.8	4			4
LP5	0.0	Not Assessed			
LP6	2.3	6	1		7
LP7	7.8	16	13		29
LP8	6.9	20	1		21
LP9	7.1	9			9
LPA	7.0	44	15		59
LPB	10.6	10	1		11
LPC	7.0	25	4	4	33
LPD	8.6	19	7	4	30
LPE	6.1	22	14	3	39
LPF	10.7	11	5		16
LPG	8.7	20	5	3	28
LPH	3.7	22	5		27
LPI	10.3	8	2	2	12
LPJ	4.0	19	15		34
LPK	2.0	17	3		20
Total number per rating		**306**	**107**	**18**	
Total number per type		**413**			

Gray =<5 sites Green = 5-10 sites Yellow = 11-20 sites Orange = 21-50 sites

Table 7: Linear Feet of Erosion per Subwatershed (Anne Arundel County, 2014 DRAFT)

Subwatershed	Erosion Impacts and Linear Feet			Total Linear Feet
	5	7	10	
LP0	110	15	0	125
LP1	Not Assessed			
LP2	1,360	120	0	1,480
LP3	3,565	4,020	140	7,725
LP4	200	0	0	200
LP5	Not Assessed			
LP6	1,870	50	0	1,920
LP7	2,000	825	0	2,825
LP8	3,040	100	0	3,140
LP9	370	0	0	370
LPA	2,825	1,180	0	4,005
LPB	2,025	100	0	2,125
LPC	2,160	510	405	3,075
LPD	1,211	1,845	185	3,241
LPE	4,940	3,640	130	8,710
LPF	1,550	280	0	1,830
LPG	1,320	395	500	2,215
LPH	1,655	260	0	1,915
LPI	950	100	250	1,300
LPJ	805	885	0	1,690
LPK	1,075	90	0	1,165
Total	**33,031**	**14,415**	**1,610**	**49,056**

An assessment of channel geomorphology utilizing Rosgen Level I geomorphic classifications was also administered for each single-threaded, perennial reach throughout the watershed as part of the Little Patuxent Watershed Assessment (Anne Arundel County, 2014 Draft). An assessment of channel geomorphology is useful to better understand the stability of a stream and its associated behaviors including channel entrenchment. The Rosgen classification system has four levels. The Level I classification is a geomorphic characterization that groups streams as Types A through G based on aspects of channel geometry, including water surface slope, entrenchment, width/depth ratio, and sinuosity. Over half of the assessed perennial streams (54%) in the Little Patuxent watershed were Type C channels, which exhibit a well-developed floodplain, higher sinuosity, and susceptibility to de-stabilization when flow regimes are altered. Approximately one-quarter of streams (21%) were Type B channels, which are very stable, moderate gradient channels with low sinuosity and low erosion rates. Sixteen percent were Type F and G channels (7% and 9%, respectively), which are generally low gradient, entrenched channels with high erosion rates.

3.3 Anticipated Growth

The Anne Arundel County General Development Plan was finalized April 2009 and was adopted in October 2009 (Bill No. 64-09; Anne Arundel County, 2009). The next update of the plan is due by 2019. Anne Arundel County is considered one of the fastest growing counties in the region with 14.6%

population growth (427,239 to 489,656 persons) over 1990-2000 compared to 6.9% growth in the Baltimore region and 10.8% growth throughout the State of Maryland (Anne Arundel County, 2009). The population in Anne Arundel County is projected to increase to 564,925 persons by 2025, which is an increase of 15.4% from 2000 data and to 579,137 persons by 2035, an increase of 18.3% from 2000 data.

The primary developed areas located in Little Patuxent watershed are Crofton and the outer limits of Odenton, which includes various commercial developments, specifically the shops at Waugh Chapel Towne Centre. Portions of the Little Patuxent, including Crofton and Piney Orchard, are a part of the County's Priority Funding Areas which are areas where the County directs new growth. Anne Arundel County continues to utilize strategies such as promoting low impact development and implementing stormwater BMPs for water quality treatment. However, increased urban stormwater related loads will inevitably occur as growth continues.

To account for growth and increases in loads over time, an analysis was completed using a combination of MAST modeled loading estimates, and estimates based on recent growth patterns. Figure 6 shows initial conditions loads without BMPs as modeled in MAST (grey bars) at the Little Patuxent 8-digit subwatershed scale as well as projected loads with (blue bars) and without (orange bars) the application of stormwater BMPs to the maximum extent practicable (SW to the MEP). Projected loads were calculated by applying the average percent change observed between MAST loading results from 2010 through 2015 (2.0%) to loads of the previous year. In this manner a 2.0% annual increase in loads would be expected from 2015 to 2025 if development were to occur at the same rate and be implemented without BMPs. Because in actuality new development will follow Maryland's stormwater regulations, the resultant loading increases were reduced by 90% based on the MAST removal rates for sediment treated by stormwater treatment to the maximum extent practicable (SW to the MEP). The results are shown as the blue bars in Figure 6. Additional projected loads without the application of SW to the MEP sediment removal rates are shown as the orange bars in Figure 6.

Projected loading in 2025 with the application of SW to the MEP, will be incorporated in TMDL modeling efforts to account for growth in the watershed.

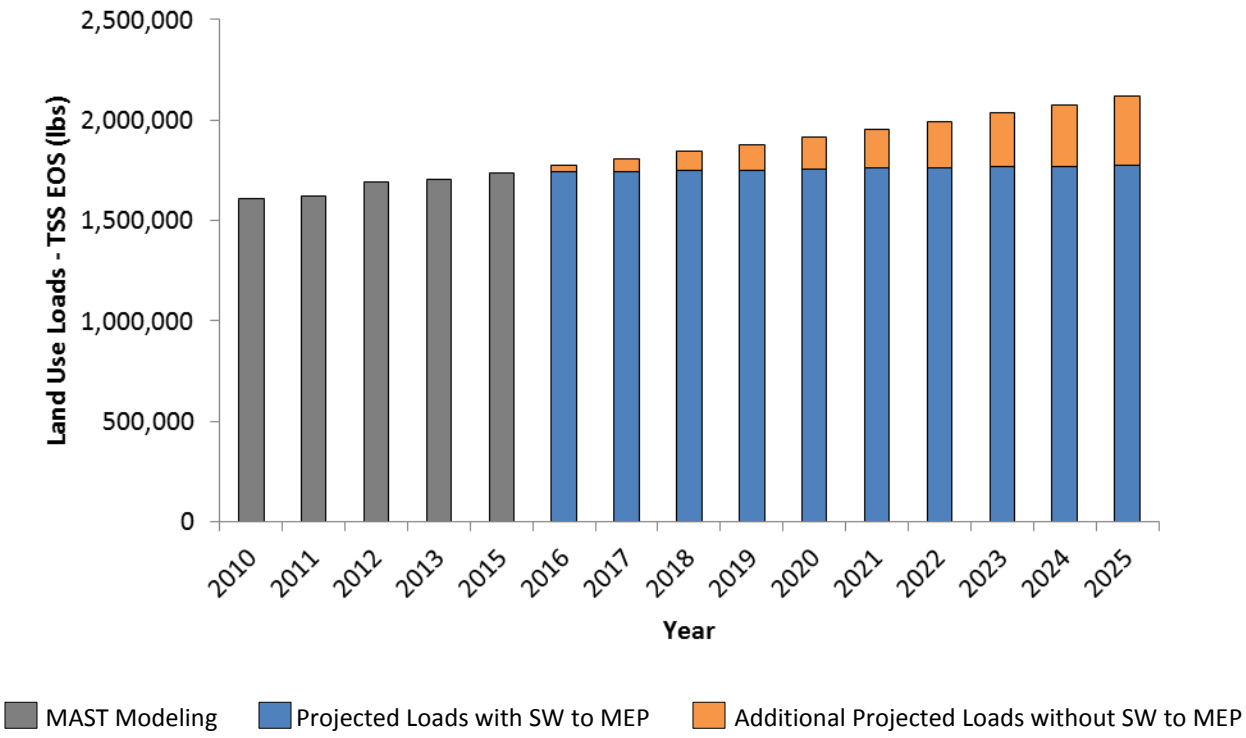


Figure 6: Modeled and Projected Land Use Loads

Figure 7 depicts sediment runoff loading by subwatershed based on a future conditions modeling scenario with the implementation of projects funded in the County's Capital Improvement Program (CIP) as recommended in the Little Patuxent Watershed Assessment (Anne Arundel County, 2014 Draft) and discussed further in Section 4: Management Measures. In general, future sediment loading is projected to be highest in the Rogue Harbor and Towsers Branch subwatersheds (LP4, LP6, LP9, LPC) in addition to the Crofton Golf subwatershed (LPG).

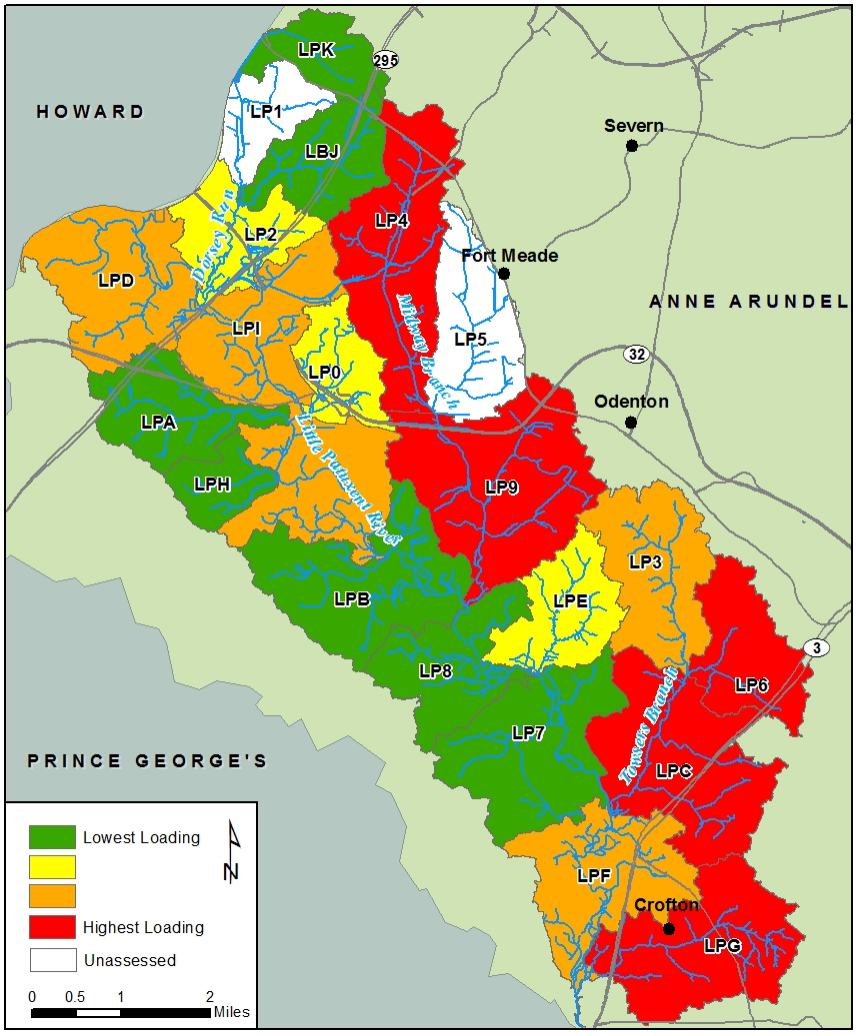


Figure 7: Total Suspended Solids Loads from Runoff Based on Future Conditions - Includes BMP Reductions (Anne Arundel County, 2014 Draft)

4 Management Measures (c)

Best management practices (BMPs) are either already implemented or are planned for implementation to achieve and maintain the Little Patuxent local TMDL load reductions. This section serves to describe the types of BMPs and management measures being implemented in the watershed. Load reductions that result from these measures are discussed in the following section, Section 5: Expected Load Reductions.

4.1 Modeling Approach

Each BMP provides a reduction for nitrogen, phosphorus, and sediment, along with other pollutants. The pollutant load for the Little Patuxent watershed was determined using MAST, which calculates pollutant loads and reductions calibrated to the Chesapeake Bay Program Partnership Watershed Model. MAST, created by Devereux Environmental Consulting for MDE, is a web-based pollutant load

estimating tool that streamlines environmental planning. Users specify a geographic area (e.g., County, watershed) and then select BMPs to apply on that area. MAST builds the scenario and provides estimates of pollutant load reductions and allows users to understand which BMPs provide the greatest load reduction benefit and the extent to which these BMPs can be implemented. Based on the scenario outputs, users can refine their BMP choices in their planning. MAST facilitates an iterative process to determine if TMDL allocations are met. Scenarios may be compared to each other, to TMDL allocations, or to the amount of pollutants reduced by current BMP implementation.

MAST estimates of load reductions for point and nonpoint sources include: agriculture, urban, forest, and septic loading. Load reductions are not tied to any single BMP, but rather to a suite of BMPs working in concert to treat the loads. Both MAST and the Watershed Model calculate reductions from all BMPs as a group, much like a treatment train. Reductions are processed in order, with land use change BMPs first, load reduction BMPs next, and BMPs with individual effectiveness values at the end. The overall the load reduction can vary depending on which BMPs are implemented.

Pollutant load reductions achieved by maintenance efforts (e.g., street sweeping and inlet cleaning) are calculated outside of MAST. As discussed in the following section 4.2: Best Management Practices, inlet cleaning and street sweeping will be practiced in the Little Patuxent watershed. Sediment reduction credit for street sweeping and inlet cleaning is calculated following methods described in MDE (2014b). Vacuum-assisted street sweeping at a rate of 2 times per month reduces the load on the swept area by 25%. Inlet cleaning receives credit based on the mass of material collected, at the rate of 420 lb TSS per ton of wet material.

Both the Watershed Model and MAST provide loads at two different scales: Edge-of-Stream (EOS) and Delivered (DEL). Delivered loads show reductions based on in-stream processes, such as nutrient uptake by algae or other aquatic life. This TMDL plan focuses on reducing load on the land, so EOS estimates are more appropriate and were used for all the modeling analysis.

This section presents the level of BMP implementation. Section 9 presents information on how progress toward load reductions will be evaluated and management plans adapted on an on-going basis.

4.2 Best Management Practices

Many stormwater BMPs address both water quantity and quality, however, some BMPs are more effective at reducing sediment than others. The stormwater practices listed below keep the focus on "green technology" to reduce the impacts of stormwater runoff from impervious surfaces. These BMPs were selected specifically for three reasons: 1) effectiveness for water quality improvement, 2) willingness among the public to adopt, and 3) implementable in multiple facility types without limitations by zoning or other controls.

These practices are consistent with those currently being implemented by Anne Arundel County DPW as water quality improvement projects. The County has the technical expertise, operational capacity, and system resources in place to site, design, construct and maintain these practices.

The recommended practices are also consistent with those proposed in the County's Phase II WIP for the Chesapeake Bay TMDL and in the County's comprehensive watershed planning efforts. Exceptions to this are dry ponds which include dry detention ponds and dry extended detention ponds. These practices are no longer considered for future implementation; however, there are many existing

facilities that are still actively treating runoff throughout the County so they are described here as well. The practices include:

- **Bioretention** — An excavated pit backfilled with engineered media, topsoil, mulch, and vegetation. These are planting areas installed in shallow basins in which the storm water runoff is temporarily ponded and then treated by filtering through the bed components, and through biological and biochemical reactions within the soil matrix and around the root zones of the plants. Rain gardens may be engineered to perform as a bioretention.
- **Bioswales** —An open channel conveyance that functions similarly to bioretention. Unlike other open channel designs, there is additional treatment through filter media and infiltration into the soil.
- **Dry Detention Ponds** – Depressions or basins created by excavation or berm construction that temporarily store runoff and release it slowly via surface flow MAST modeling includes hydrodynamic structures in this category. These devices are designed to improve quality of stormwater using features such as swirl concentrators, grit chambers, oil barriers, baffles, micropools, and absorbent pads to remove sediments, nutrients, metals, organic chemicals, or oil and grease from urban runoff.
- **Dry Extended Detention Ponds** - Depressions created by excavation or berm construction that temporarily store runoff and release it slowly via surface flow or groundwater infiltration following storms. They are similar in construction and function to dry detention basins, except that the duration of detention of stormwater is designed to be longer, allowing additional wet sedimentation to improve treatment effectiveness.
- **Impervious Surface Reduction** - Reducing impervious surfaces to promote infiltration and percolation of runoff storm water. Disconnection of rooftop and non-rooftop runoff, rainwater harvesting (e.g., rain barrels), and sheetflow to conservation areas are examples of impervious surface reduction.
- **Infiltration** — A depression or trench to form a shallow basin where sediment is trapped and stormwater infiltrates into the soil. No underdrains are associated with infiltration basins and trenches, because by definition these systems provide complete infiltration. Design specifications require infiltration basins and trenches to be built in good soil; they are not constructed on poor soils, such as C and D soil types. Yearly inspections to determine if the basin or trench is still infiltrating runoff are planned. Dry wells, infiltration basins, infiltration trenches, and landscaped infiltration are all examples of this practice type.
- **Outfall Enhancement with Step Pool Storm Conveyance (SPSC)** – The SPSC is designed to stabilize outfalls and provide water quality treatment through pool, subsurface flow, and vegetative uptake. The retrofits promote infiltration and reduce stormwater velocities. This strategy is modeled in MAST as bioswales.
- **Permeable Pavement -** Pavement or pavers that reduce runoff volume and treat water quality through both infiltration and filtration mechanisms. Water filters through open voids in the pavement surface to a washed gravel subsurface storage reservoir, where it is then slowly infiltrated into the underlying soils or exits via an underdrain.
- **Stream Restoration -** Stream restoration in urban areas is used to restore the urban stream ecosystem by restoring the natural hydrology and landscape of a stream, help improve habitat and water quality conditions in degraded streams.
- **Stormwater Retrofits –** Anne Arundel County plans to construct a variety of retrofits throughout the County. Stormwater retrofits may include converting dry ponds, dry extended detention

ponds, or wet extended detention ponds into wet pond structures, wetlands, infiltration basins, or decommissioning the pond entirely to install SPSC (step pool storm conveyance).

- **Urban Filtering** - Practices that capture and temporarily store runoff and pass it through a filter bed of either sand or an organic media. There are various sand filter designs, such as above ground, below ground, perimeter, etc. An organic media filter uses another medium besides sand to enhance pollutant removal for many compounds due to the increased cation exchange capacity achieved by increasing the organic matter. These systems require yearly inspection and maintenance to receive pollutant reduction credit.
- **Urban Tree Plantings** - Urban tree planting is planting trees on urban pervious areas at a rate that would produce a forest-like condition over time. The intent of the planting is to eventually convert the urban area to forest. If the trees are planted as part of the urban landscape, with no intention to covert the area to forest, then this would not count as urban tree planting
- **Vegetated Open Channels** - Open channels are practices that convey stormwater runoff and provide treatment as the water is conveyed, includes bioswales. Runoff passes through either vegetation in the channel, subsoil matrix, and/or is infiltrated into the underlying soils.
- **Wet ponds or wetlands** — A water impoundment structure that intercepts stormwater runoff then releases it at a specified flow rate. These structures retain a permanent pool and usually have retention times sufficient to allow settlement of some portion of the intercepted sediments and attached pollutants. Until 2002 in Maryland, these practices were generally designed to meet water quantity, not water quality objectives. There is little or no vegetation within the pooled area nor are outfalls directed through vegetated areas prior to open water release. Nitrogen reduction is minimal, but phosphorus and sediment are reduced.

The measured effectiveness for each of these practices may be found in Table 8.

Table 8: Typical Sediment Reduction from Stormwater BMPs

BMP	Sediment Reduction
Bioretention	55 – 80%
Bioswales	80%
Dry Detention Ponds	10%
Dry Extended Detention Ponds	60%
Impervious Surface Reduction*	-
Infiltration	95%
Outfall Enhancement with SPSC**	80%
Stream Restoration	15.13 lbs/linear ft
Urban Filtering	80%
Urban Tree Plantings*	-
Vegetated Open Channels	70%
Wet Ponds or Wetlands	60%

Sources: Simpson and Weammert, 2009; and Maryland Assessment Scenario Tool (MAST) documentation
* Calculated as a land use change to a lower loading land use
**Outfall enhancement with SPSC modeled as bioswales in MAST

Along with the structural BMPs listed above, treatment will also be provided through non-structural measures. These are treatments that rely on programs that continue throughout the year and are repeated annually.

- **Inlet Cleaning -** Storm drain cleanout practice ranks among the oldest practices used by communities for a variety of purposes to provide a clean and healthy environment, and more recently to comply with their NPDES stormwater permits. Sediment reduction credit is based on the mass of material collected, at the rate of 420 lb TSS per ton of wet material (MDE, 2014b).
- **Street sweeping** — Starting Fiscal Year 2015, Anne Arundel County has enhanced their street sweeping program which now includes sweeping curb-miles and parking lots within the Little Patuxent (Anne Arundel County DPW, 2015). This enhanced program targets impaired watersheds and curbed streets that contribute trash/litter, sediment, and other pollutants. For full credit by MDE, street sweeping should occur twice a month or 26 times a year on urban streets. This frequent sweeping of the same street will reduce nitrogen and phosphorus as well as sediment. Under the enhanced street sweeping program Anne Arundel County is sweeping arterial streets within the Little Patuxent watershed on a bi-weekly basis (26 times a year) and collector and local streets on a monthly basis (12 times a year). Vacuum-assisted street sweeping at a rate of 2 times per month reduces the load on the swept area by 25%. In order to quantify sediment load reductions from monthly sweeping efforts, the removal rate of 22% for vacuum-assisted monthly sweeping was applied to total sediment collected from collector and local streets (CWP, 2008).

4.3 Offsetting Sediment Loads from Future Growth

Growth and development is expected to occur throughout Anne Arundel County, and depending on when and where this growth occurs, pollutant loading from urban stormwater sources may also increase. It is anticipated that new development will make use of ESD stormwater treatment according to MDE's Stormwater Regulations.

Maryland's 2007 Stormwater Management Act went into effect in October of 2007, with resulting changes to COMAR and the 2000 Maryland Stormwater Design Manual in May of 2009. The most significant changes relative to watershed planning are in regard to implementation of ESD. The 2007 Act defines ESD as "using small-scale stormwater management practices, nonstructural techniques, and better site planning to mimic natural hydrologic runoff characteristics and minimize the impact of land development on water resources." As such Anne Arundel County has updated Articles 16 and 17 of the County Code to incorporate the requirements for ESD. Anne Arundel County finalized the *Anne Arundel County Stormwater Management Practices and Procedures Manual* to incorporate criteria specific to the County that are not addressed within the Maryland Design Manual (Anne Arundel County, 2010).

Figure 6 in Section 3.3: Anticipated Growth shows projected land use loads with and without the application of stormwater BMPs to the maximum extent practicable (SW to the MEP). TMDL modeling efforts include the application of SW to the MEP to represent ESD treatment for new development in the watershed. SW to the MEP will control 90% of sediment loads for that new development; therefore the plan is to address the residual 10% of the load that is uncontrolled.

5 Expected Load Reductions (b)

WLAs in the sediment TMDL were developed using the Chesapeake Bay Program Phase 5 (CBP P5) watershed model. Currently, MAST is using a computational framework that is compatible with an updated version of the model: CBP P5.3.2. Because the TMDL was developed under an older version of the model, the TMDL WLA needed to be translated into a MAST-compatible target load. In order to do

this, the 2005 baseline sediment load was re-calculated in MAST with the 8-digit county split geography (Little Patuxent 02131105, Anne Arundel County). The required reduction percent assigned to the Anne Arundel County Phase I MS4 source (20.5%) in the local TMDL regulation was then applied to the new baseline load to calculate required sediment reduction. The required sediment reduction was then subtracted from the new baseline load to calculate the MAST-compatible target TMDL WLA. Sediment loads required for the Little Patuxent Anne Arundel County Phase I MS4 source are shown in Table 9.

Table 9: Sediment Loads Required for the Little Patuxent River Local TMDL Anne Arundel County Phase I MS4 Source

2005 Baseline Load (lbs/yr)	Required Reduction %	Required Reductions (lbs/yr)	TMDL Load Allocation (lbs/yr)
1,275,211	20.5%	261,418	1,013,792

5.1 2013 Progress – Actual Implementation

Anne Arundel County maintains an extensive geodatabase of stormwater urban BMP facilities and water quality improvement projects (WQIP). Approximately 2,630 acres of County Phase I MS4 land has been treated through 2013 in addition to 10,504 linear feet of stream restoration and the implementation of other non-structural BMPs (source: WPRP urban BMP and WQIP database, 2014). Current BMP implementation through 2013 in the Little Patuxent is shown in Table 10.

Table 10: Current BMP Implementation through 2013 for Little Patuxent River

BMP	Unit	2013 Current Implementation
Bioretention	acre	70.9
Bioswale	acre	3.6
Dry Ponds	acre	655.6
Extended Detention Dry Ponds	acre	552.1
Impervious Surface Reduction	acre	11.8
Infiltration	acre	228.5
Inlet Cleaning	no. of inlets	202
Stormwater Retrofits[1]	acre	15.2
SW to the MEP	acre	0.1
Urban Filtering	acre	17.8
Urban Tree Plantings	acre	1.5
Urban Stream Restoration	linear feet	10,504.0
Vegetated Open Channels	acre	21.8
Wet Ponds or Wetlands	acre	1,067.7

Source: WPRP urban BMP and WQIP database

[1]Includes projects that will convert dry ponds into wet ponds. Stormwater retrofits are modeled by decreasing acreage for dry ponds and increasing acreage for wet ponds.

2013 Progress results are shown in Table 11.

Table 11: 2013 Progress Reductions Achieved

Baseline Load and TMDL WLA	TSS-EOS lbs/yr
2005 Baseline Scenario Load	1,275,211
Required Percent Reduction	20.5%
Required Reduction	261,418
Local TMDL WLA	1,013,792
2013 Progress Results	**TSS-EOS lbs/yr**
2013 Progress Scenario Load	1,200,569
2013 Progress Reduction Achieved	74,642
2013 Percent Reduction Achieved	5.9%

5.2 Planned Implementation

Table 12 compares implementation of existing BMPs with planned levels of implementation. This increase in implementation will achieve the loads required in the local TMDL and ensure that future growth (through 2025) is treated. These loads meet the TMDL required reductions for the Little Patuxent (Table 13).

The majority of 2025 planned management strategies incorporate CIP stormwater retrofits and outfall enhancement projects. Feasibility studies of the planned strategies may reveal that some existing structures identified for retrofitting or enhancement may not be feasible candidates for future projects and may be eliminated from consideration. The County will take an adaptive management approach and will reevaluate treatment needs as feasibility studies progress. The County will continue to track the overall effectiveness of the various BMP strategies and will adapt the suite of solutions based on the results. In addition, new technologies are continuously evaluated to determine if the new technologies allow more efficient or effective pollution control.

Figure 8 shows baseline and progress loads (green bars) and planned loads (yellow bars) compared to milestone goal loads (red bars and red line) and background land use loads (grey bars). As discussed in Section 3.3: Anticipated Growth, initial conditions loads (2011 – 2015) without BMPs were modeled in MAST at the Little Patuxent 8-digit subwatershed scale. To account for growth and increases in loads over time, loads were projected (2017 – 2025) with the application of SW to the MEP. This comparison shows that all background loads will be treated to the required TMDL allocated load with current and future BMP implementation.

Table 12: BMP Implementation - Current 2013 and Planned 2025 Levels for the Little Patuxent River

BMP	Units	2013 Current Implementation	2025 Planned Implementation
Bioretention	acre	70.9	-
Bioswale	acre	3.6	-
Dry Ponds	acre	655.6	-
Extended Detention Dry Ponds	acre	552.1	-
Impervious Surface Reduction	acre	11.8	-

BMP	Units	2013 Current Implementation	2025 Planned Implementation
Infiltration	acre	228.5	-
Inlet Cleaning	no. of inlets	202	1,602
Outfall Enhancement with SPSC	acre	0.0	612.8
Stormwater Retrofits[1]	acre	15.2	257.5
Street Sweeping (parking lots)	acres	0.0	0.7
Street Sweeping (roads)[2]	curb-miles	0.0	61.0
SW to the MEP	acre	0.1	-
Urban Filtering	acre	17.8	-
Urban Tree Plantings	acre	1.5	-
Urban Stream Restoration	linear feet	10,504.0	-
Vegetated Open Channels	acre	21.8	-
Wet Ponds or Wetlands	acre	1,067.7	-

[1]Includes projects that will convert dry ponds or dry extended detention ponds into wet ponds.
[2]Includes curb-miles for arterial, collector, and local streets. Arterial streets swept bi-weekly (26 times a year) and collector and local streets swept monthly (12 times a year).

Table 13: 2025 Planned Reductions

Baseline Load and TMDL WLA	TSS-EOS lbs/yr
2005 Baseline Scenario Load	2,032,381
Required Percent Reduction	22.2%
Required Reduction	451,189
Local TMDL WLA	1,581,193
2025 Planned Results	**TSS-EOS lbs/yr**
2025 Planned Load[1]	1,011,161
2025 Planned Reduction Achieved	264,049
2025 Percent Reduction Achieved	20.7%

[1]2025 Planned load includes additional projected land use loading from new development through 2025. It is assumed that all new development will be treated with SW to the MEP implementation to achieve 90% sediment removal.

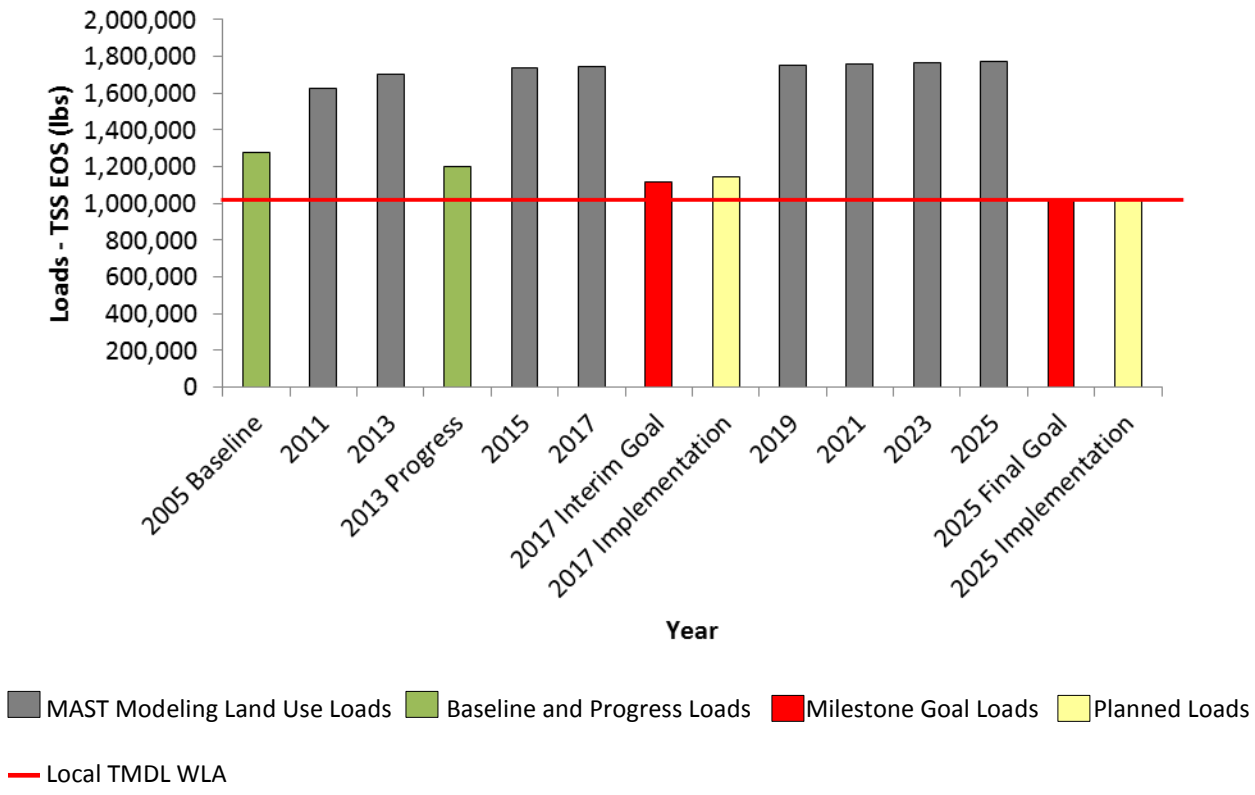


Figure 8: Progress and Planned Reductions in the Little Patuxent River Watershed

6 Technical and Financial Assistance Needs (d)

Technical Needs

Technical assistance to meet the reductions and goals of a TMDL takes on many forms including MDE assistance to local governments, state and local partner assistance to both MDE and municipalities, and technical consultants contracted to provide support across a wide variety of service areas related to BMP planning and implementation.

MDE has and will provide technical assistance to local governments through training, outreach and tools, including recommendations on ordinance improvements, technical review and assistance for implementation of BMPs at the local level, and identification of potential financial resources for implementation (MDE, 2014b).

Anne Arundel County DPW contracts with consultants through several contract vehicles including open-end task based assignments, to provide a variety of technical services. These services, provided by planners, engineers, environmental scientists and GIS specialists, include watershed assessment and management, stream monitoring, stormwater planning and design, stream restoration design, outfall enhancement, and environmental permitting, among others. The County itself has complementary staff in DPW and other County departments to manage contracts, provide review and approval of planning and design work, conduct assessments, and develop and administer planning and progress tracking tools.

Anne Arundel County has many partners that provide outreach to homeowners and communities in the form of technical assistance, education, and funding for implementation of best management practices within local communities. The Watershed Stewards Academy, further discussed in Section 7: Public Participation/Education, routinely engages and informs the public on reducing pollution sources and employing stormwater/rainscaping retrofits to reduce their impacts.

Technical assistance for Public Participation and Education and for Monitoring will also be necessary to fully implement and track progress towards meeting the goals of the local TMDL. These elements are discussed in sections 7 and 10 of this plan.

Financial Needs

The total projected cost to implement the County's CIP projects described in this plan for the Little Patuxent watershed is $22,438,745 including $14,945,417 towards outfall enhancements with SPSC, $4,677,801 towards stormwater pond retrofits, $1,522,400 for inlet cleaning, and $1,293,127 for street sweeping. Structural BMP project costs are estimated based on the average cost per pound of nitrogen removed based on a group of completed projects consisting of various BMP types. Since these practices reduce nitrogen and phosphorus as well as sediment, costs derived from this method translate for sediment removal. This approach was used to calculate structural BMP costs in the County's Phase II WIP. Non-structural BMP costs for inlet cleaning and street sweeping were derived from historic County data and include equipment, operations, and maintenance costs.

Table 14 includes a summary of funding need per CIP project BMP type and project phase. Project cost is split throughout the implementation timeframe with design and land ROW estimated costs to occur the first year of the project, construction costs to occur in the second year, and overhead costs split between the first and second year.

Table 14: Little Patuxent River Cost Over Milestone Periods

BMP	2014-2015	2016-2017	2018-2019	2020-2021	2022-2025	Total Cost
Outfall Stabilization	**$532,944**	**$6,939,765**	**$7,472,709**			**$14,945,417**
Design	$289,015	$470,098	$759,113			$1,518,226
Land ROW	$57,803	$94,020	$151,823			$303,645
Construction		$6,072,904	$6,072,904			$12,145,808
Overhead	$186,126	$302,743	$488,869			$977,738
SWM Pond Retrofit	**$1,521,576**			**$1,578,113**	**$1,578,113**	**$4,677,801**
Design	$158,004			$160,312	$160,312	$478,628
Land ROW	$0			$32,062	$32,062	$64,125
Construction	$1,264,030			$1,282,497	$1,282,497	$3,829,024
Overhead	$99,542			$103,241	$103,241	$306,024
Inlet Cleaning	**$80,800**	**$80,800**	**$360,000**	**$360,000**	**$640,800**	**$1,522,400**
Street Sweeping	**$168,106**	**$168,106**	**$281,255**	**$281,255**	**$394,404**	**$1,293,127**

6.1 Funding Sources

Prior to the passage of Maryland House Bill 987 and, as stated in the Anne Arundel County Phase II WIP (Anne Arundel County, 2012), the County's funding capacity to implement urban stormwater restoration/retrofit projects was limited by the County's Capital Improvement Program (CIP) budget for environmental restoration and water quality improvement projects. To comply with forthcoming requirements of the Phase I NPDES MS4 permit, and to support restoration efforts towards reducing pollutant loads required for both the Chesapeake Bay TMDL and local TMDLs throughout Maryland, the State Legislature passed a law in 2012 (House Bill 987) mandating that Maryland's 10 largest jurisdictions (those with Phase I MS4 permits), including Anne Arundel County, develop a Watershed Protection and Restoration Program and establish a Stormwater Remediation Fee. To comply with the State legislation, Anne Arundel County passed legislation in 2013, Bill 2-13.

The County's Stormwater Remediation Fee provides a dedicated source of revenue for the implementation of local stormwater management plans through stormwater management practices and stream and wetland restoration activities and is assessed to Anne Arundel County property owners based on the amount of impervious surface on their property. The Stormwater Remediation Fee is structured to provide sufficient funding for projects to meet the pollutant load reduction required by the Chesapeake Bay TMDL, EPA approved individual TMDLs with a stormwater WLA and to meet the impervious surface management requirements as well as other stormwater obligations set forth in the County's NPDES MS 4 Permit. The fee is assessed to Anne Arundel County property owners as a separate line item on the owner's real property tax bill.

In addition to the Stormwater Remediation Fee, Anne Arundel County actively pursues grant funding from Federal, State and non-governmental organizations (NGOs) to leverage funding for its restoration projects. And, with the creation of the Stormwater Remediation Fee, the County has developed a Grant Program to provide funding to local NGOs to facilitate implementation of restoration projects that further the County's ability to meet its regulatory requirements.

7 Public Participation / Education (e)

Anne Arundel County has given numerous public presentations throughout the development of the County's Phase II WIP in order to disseminate information on the Chesapeake Bay TMDL, WIP process, and strategies for meeting the County's assigned pollutant load reductions. In addition to providing a level of understanding to the public, the County uses the presentations as an opportunity to receive input and comment on restoration efforts. Anne Arundel County has a variety of organizations interested in water quality, including Severn River Association; South River Federation; Anne Arundel County Commercial Owners; Anne Arundel Watershed Stewards Academy; Anne Arundel County Chamber of Commerce, Environmental Committee; Leadership Anne Arundel; and, Chesapeake Environmental Protection Association (Anne Arundel County, 2012).

In order to implement an effective strategy to meet water quality standards and achieve pollutant load reduction, an effort to engage a very broad audience of landowners was a necessity. The Anne Arundel Watershed Stewards Academy (AAWSA), a pre-eminent non-profit (501(c)3) environmental organization, was formed through Anne Arundel County Department of Public Works and the County Board of Education's Arlington Echo Outdoor Education Center (Anne Arundel County, 2012). AAWSA's mission is to identify, train, and support citizens to become Master Watershed Stewards who take

action with their neighbors to restore local waterways in Anne Arundel County. This program is a unique way to integrate education as a vital element in its role in preservation, conservation and advocacy. There are currently more than 100 certified Master Watershed Stewards throughout Anne Arundel County and adjacent areas.

The AAWSA has extensive resources through the Consortium of Support Professionals which is composed of over 80 governmental, non-profit and business professionals who provide technical assistance to Master Watershed Stewards. Consortium members are experts in their field of conservation, ecology, government laws, landscape architecture, low impact design, water quality monitoring, and watershed assessment and provide consulting on design and development of watershed restoration projects. The AAWSA is also supported by staff that provides day to day guidance to Master Watershed Stewards, connecting Stewards to Anne Arundel County resources, coordinating Stewards certification, post certification professional development, and networking opportunities for Stewards and Consortium of Support Professionals.

The AAWSA has an interactive website (www.aawsa.org) that provides guidance to common water quality problems including information on the following:

- Reduce Your Pollution
    - Practice Bay-Friendly Lawn Care
    - Maintain and Upgrade your Septic System
    - Pick Up Pet Waste
    - Choose Non-Toxic Household Products
    - Maintain your Car and Boat
    - Reduce your Energy Use
- Capture Stormwater
    - Install a Rain Barrel or Cistern
    - Build a Rain Garden
    - Choose to Have Conservation Landscapes
    - Plant Native Trees
    - Direct Water with Swales and Berms
    - Use Permeable Pavers and Pavement
- Clean Up!
    - Invasive Species Removal
    - Dump Site Cleanup
- Conserve and Preserve
    - Land Preservation

These programs and others like them could be more focused on the Little Patuxent watershed.

In addition to the AAWSA, the following organizations have been identified for possible partnerships and education and outreach for the Little Patuxent:

- Master Gardeners
- Audubon Society
- Students for the Environment
- Maryland civic associations and service clubs:
    - Maryland Home Builders Assoc.
    - Audubon Naturalist Society of the Central Atlantic States

- Audubon Society of Central Maryland
- Blue Water Baltimore
- Chesapeake Audubon Society
- Chesapeake Bay Program
- Chesapeake Bay Foundation
- Chesapeake Bay Trust
- Chesapeake Ecology Center
- Center for Watershed Protection
- Alliance for the Chesapeake Bay
- Alliance for Sustainable Communities
- Baywise Master Gardeners
- Sierra Club – Maryland Chapter
- Magothy River Association
- Patuxent Riverkeeper
- West/Rhode Riverkeeper
- Nature Conservancy
- Smithsonian Environmental Research Center
- Anne Arundel Community College
- University of Maryland
- University of Maryland Extension
- Volunteer Center for Anne Arundel County

WPRP also provides public outreach tools through web and social media platforms. WPRP has developed a comprehensive web-based informational program including a dedicated webpage, Facebook page, and Twitter account to provide information to the public. WPRP's website (www.aarivers.org) offers valuable information on Anne Arundel County watersheds including an interactive clickable map that displays geographically referenced environmental, utility, and land use data in addition to restoration project locations, descriptions, and drainage areas. This outreach platform is also used to notify the public of the opportunity to review and comment on this and other TMDL restoration plans.

8 Implementation Schedule and Milestones (f & g)

This section presents the target loads and the activities required to achieve those targets based on the 2017 interim and 2025 final loads and implementation targets. The following schedule and milestones follows the Chesapeake Bay TMDL milestone date framework (60% progress by 2017) and end date (2025; USEPA, 2010). This schedule has previously been approved by the CBP for the applicable Bay TMDLs and is believed to be a good option for tracking progress towards reduction goals of the Little Patuxent local TMDL.

8.1 Loading Allocations and Milestone Targets

Planning loads for 2017 and final loads for 2025 for the Little Patuxent watershed are presented in Table 15 below. As mentioned in Section 5: Expected Load Reductions (b) (see Tables 10 and 11), progress is already underway with the implementation of strategies throughout the watershed.

Table 15: Little Patuxent Planning and Target Loads (edge-of-stream loads)

Load	Sediment Load (lbs/year)
2005 Baseline Load	1,275,211
2013 Progress Load	1,200,569
2017 Interim Milestone (60% of reduction achieved)	1,118,360
2025 TMDL Allocated Load	1,013,792
Percent Reduction between 2005 Baseline and 2025 Loads	20.5%

8.2 Implementation Milestones

To meet the loading allocations and milestones outlined in the previous section, implementation of programs and BMPs must keep pace and meet planned implementation targets. Table 16 details the implementation for each tracked BMP with the associated unit of measure. The 2013 data reflects existing BMPs while the 2017, 2021, and 2025 values reflect the planned implementation for those years.

The majority of 2025 planned management strategies incorporate CIP stormwater retrofits and outfall enhancement projects. Feasibility studies of the planned strategies may reveal that some existing structures identified for retrofitting or enhancement may not be feasible candidates for future projects and may be eliminated from consideration. The County will take an adaptive management approach and will reevaluate treatment needs as feasibility studies progress. The County will continue to track the overall effectiveness of the various BMP strategies and will adapt the suite of solutions based on the results. In addition, new technologies are continuously evaluated to determine if the new technologies allow more efficient or effective pollution control.

Table 16: Little Patuxent Planning Milestones for Implementation

BMP	Unit	2013 Implemen-tation	2015 Planned	2017 Planned	2021 Planned	2025 Planned
Bioretention	acre	70.9				
Bioswale	acre	3.6				
Dry Ponds	acre	655.6				
Extended Detention Dry Ponds	acre	552.1				
Impervious Surface Reduction	acre	11.8				
Infiltration	acre	228.5				
Inlet Cleaning	no. of inlets/yr	202	202	202	900	1,602
Outfall Enhancement with SPSC	acre			306.4	306.4	
Stormwater Retrofits[1]	acre	15.2	77.9		89.9	89.9

BMP	Unit	2013 Implemen-tation	2015 Planned	2017 Planned	2021 Planned	2025 Planned
Street Sweeping (parking lots)	acre		0.7	0.7	0.7	0.7
Street Sweeping (roads)	curb-miles		26.0	26.0	43.5	61.0
SW to the MEP	acre	0.1				
Urban Filtering	acre	17.8				
Urban Tree Plantings	acre	1.5				
Urban Stream Restoration	linear feet	10,504.0				
Vegetated Open Channels	acre	21.8				
Wet Ponds or Wetlands	acre	1,067.7				

[1]Includes projects that will convert dry ponds or dry extended detention ponds into wet ponds.
[2]Includes curb-miles for arterial, collector, and local streets. Arterial streets swept bi-weekly (26 times a year) and collector and local streets swept monthly (12 times a year)

8.3 Implementation Priorities

To meet the loading allocations and milestones outlined in the previous sections, implementation will be planned based on prioritization analyses presented in the Little Patuxent Watershed Assessment (Anne Arundel, 2014 DRAFT). Little Patuxent subwatersheds were prioritized for restoration/retrofit project selection potential using four separate prioritization models. The models integrated historical environmental data, current stream assessment monitoring data, drainage area characteristics (GIS data), and watershed modeling results into indicators of watershed condition and need. The indicators are combined into the four models:

- Stream Reach Restoration
- Subwatershed Restoration
- Subwatershed Preservation
- Parcel Preservation

The models were designed to operate at three management scales, first at the individual stream reach scale, second at the subwatershed scale, and lastly at the parcel scale. Additionally the models differentiated between identification of restoration opportunities for the degraded portions of the watershed (reach and subwatershed scale), and identification of preservation opportunities (subwatershed and parcel scale) for high quality sensitive areas that could be subject to additional stressors in future scenarios. For the purpose of this Restoration Plan, prioritization results for Stream Reach Restoration and Subwatershed Restoration are presented below to address in-stream sources and urban stormwater runoff, respectively.

8.3.1 Stream Reach Restoration

The stream restoration prioritization uses a suite of indicators that are weighted and then combined into a final relative rating for each perennial reach as identified in the Physical Habitat Condition Assessment. The suite of stream restoration indicators used in the Little Patuxent watershed, along with the indicator weight is presented in Table 17.

Table 17: Stream Restoration Assessment Indicators (Anne Arundel, 2014 DRAFT)

Category	Indicator	Weight
Stream Habitat	2003 MPHI score	31.6%
Stream Morphology	Rosgen Level I classifications	5.3%
Land Cover	Percent Imperviousness	5.3%
Infrastructure	Buffer impacts	5.3%
	Erosion impacts	10.5%
	Head cut impacts	5.3%
	Dump site impacts	5.3%
	Other infrastructure impacts (pipes, ditches, crossings, and obstructions)	15.8%
Hydrology and Hydraulics	Road Crossing flooding potential	15.8%

A total of 304 reaches were processed in the stream restoration model. Ten reaches were categorized as "High" priority or worst condition, 62 were "Medium High", 117 were "Medium", and 115 were "Low" priority or best condition (Table 18 and Figure 9). The Towsers Branch subwatershed ranked as a very high priority overall, as six of the ten "High" reaches and 25% of "Medium High" reaches are located in Towsers Branch. The Piney Orchard and Crofton Golf subwatersheds had a combined total of 26 reaches (42%) rated in the "Medium High" category.

Table 18: Stream Restoration Assessment Results (Anne Arundel County, 2014 Draft)

	Number of Reaches with Priority Rating			
Subwatershed	High	Medium High	Medium	Low
LP0		3	1	5
LP1	Not Assessed			
LP2		1	3	4
LP3	2	10	7	4
LP4			3	1
LP5	Not Assessed			
LP6	No Perennial Reaches			
LP7			5	12
LP8		2	4	5
LP9			12	5
LPA		1	10	16
LPB			1	11
LPC	4	6	9	3
LPD		2	14	5
LPE	3	12	14	3
LPF			6	10

Subwatershed	Number of Reaches with Priority Rating			
	High	Medium High	Medium	Low
LPG	1	14	17	13
LPH			1	8
LPI			3	2
LPJ		6	4	7
LPK		5	3	1
Total	**10**	**62**	**117**	**115**



Figure 9: Stream Reach Priorities for Restoration (Anne Arundel County, 2014 Draft)

8.3.2 Subwatershed Restoration

Similarly to the stream restoration assessment, the subwatershed assessment used a collection of restoration indicators to assign a rating to each subwatershed. The indicators were weighted and combined into a single restoration rating for each subwatershed. Restoration indicators fell into one of six categories: stream ecology, TMDL impairments, On-site Disposal Systems (OSDS), BMPs, Hydrologic and Hydraulic (H&H) Modeling, Water Quality, and Landscape. Each category contains one to four different indicators. Table 19 provides a summary of the categories, indicators, and relative weighting assigned by the County.

Table 19: Subwatershed Priority Rating Indicators for Restoration (Anne Arundel, 2014 DRAFT)

Category	Indicator	Weight
Stream Ecology	Final habitat score	7.5%
	Bioassessment score	7.5%
303(d) List	Number of TMDL impairments	7.5%
OSDSs (Septics)	Nitrogen Loads from septics (lbs)	9.3%
BMPs	Impervious area treated by BMPs (%)	6.6%
H&H (Land and Soils only)	Peak flow from 1-year storm event (cfs/acre)	4.5%
	Peak flow from 2-year storm event (cfs/acre)	4.5%
	Runoff volume from 1-year storm event (inches/acre)	5.8%
	Runoff volume from 2-year storm event (inches/acre)	5.8%
Water Quality (Land only)	Nitrogen load from runoff (lbs/acre/yr)	6.9%
	Phosphorus load from runoff (lbs/acre/yr)	6.9%
	Total Suspended Solids from runoff (Tons/acre/yr)	0.0%
Landscape	Impervious cover (%)	9.4%
	Forest within the 100 ft stream buffer (%)	10.3%
	% of existing wetlands to potential wetlands	9.4%
	Acres of developable critical area	5.3%

The final ratings range from “Lowest Priority for Restoration” to “Highest Priority for Restoration” where “Lowest Priority” indicates that a subwatershed is a low priority for restoration and therefore in good condition whereas “Highest Priority” indicates that a subwatershed should be a priority for restoration. The Little Patuxent 2 (LP0) and Jessup (LPK) subwatersheds were rated the highest priority for restoration. Three watersheds, LP7, LP8, and LPH were rated the lowest priorities for restoration (Figure 10). It is also important to focus restoration efforts in subwatershed that ranked highest for existing TSS loads from urban runoff, which include subwatersheds LP4, LP6, LP9, LPG, and LPI (Figure 5).

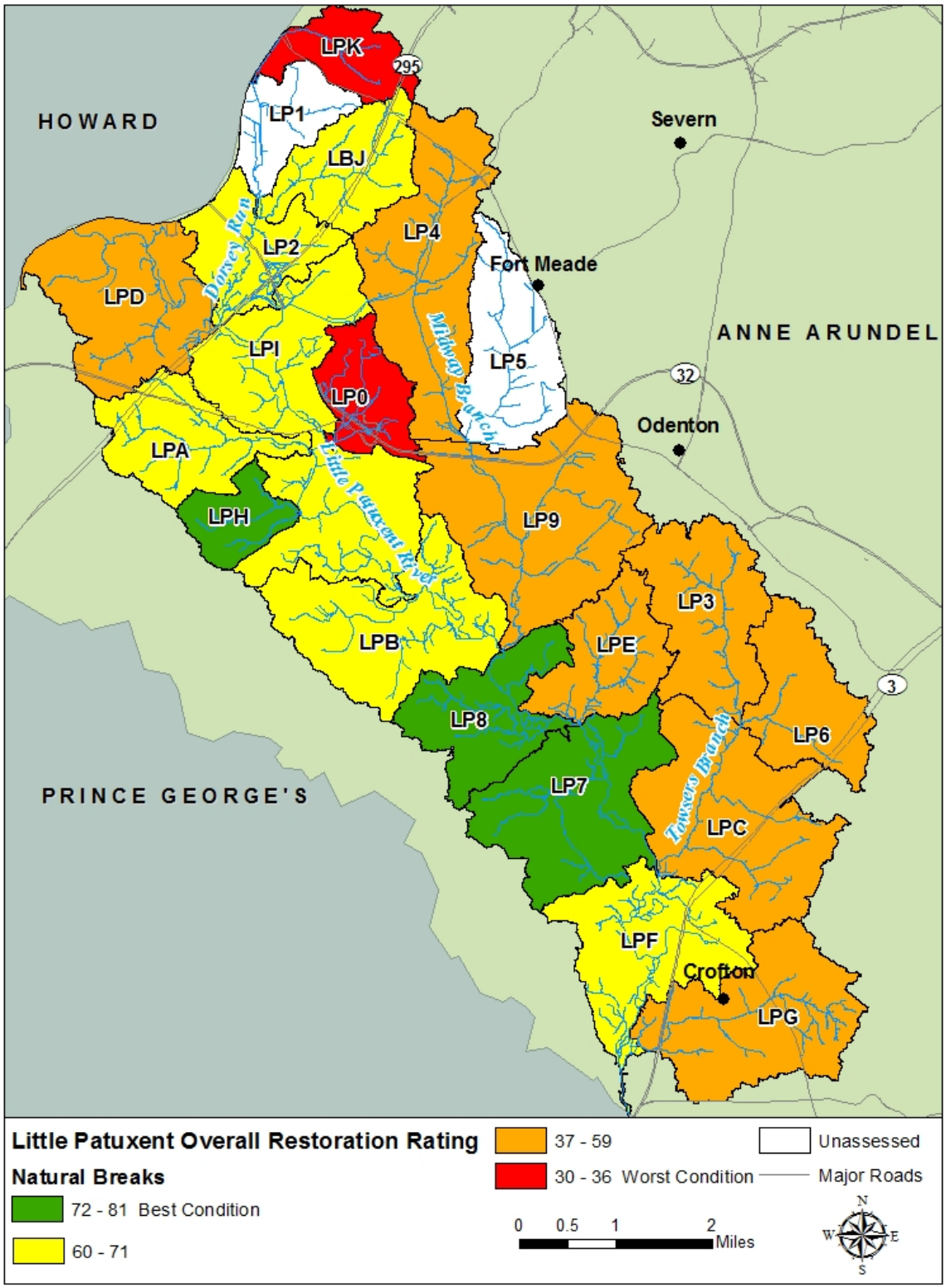


Figure 10: Subwatershed Priorities for Restoration (Anne Arundel County, 2014 Draft)

8.3.3 Prioritization of Strategy Implementation

As stated in the Anne Arundel County's Phase II WIP, the County uses three major categories to classify urban stormwater strategies: Core Strategy Tier I, Core Strategy Tier II, and Potential Load Reductions Outside the Tier I and Tier II Core Strategy (Anne Arundel County, 2012). BMP planning and implementation will be prioritized based on these three categories with highest priority given to Tier I and Tier II strategies.

Core Urban Stormwater Strategy Tier I includes the following:

- Restoration of ephemeral and perennial streams with a Department of Natural Resources (DNR) Maryland Biological Stream Survey's (MBSS) Maryland Physical Habitat Index (MPHI) score of severely degraded or degraded,
- Implementing stormwater management treatment at currently untreated major pipe outfalls; and,
- Retrofitting stormwater management ponds built prior to 2002 to optimize the pollutant reduction and ecosystem functions for the facilities

Core Urban Stormwater Strategy Tier II includes additional pollutant reduction activities that must be implemented to meet the 2025 allocations; which includes the following:

- Monthly vacuum assisted street sweeping and associated inlet cleaning for all closed section roads,
- Reforestation plan for available public open space land; and,
- SW to the MEP retrofits for County-owned properties including recreation areas

Potential Load Reductions Outside the Tier I and Tier II Core Strategies includes the following:

- Focuses on the work of private citizens and Watershed Master Stewards in implementing SW to the MEP for residential rooftops, in high density areas, and for private commercial and industrial properties.
- These areas have been selected geographically outside the area treated by the WIP core strategy.

9 Load Reduction Evaluation Criteria (h)

Adaptive management is a critical component of achieving and maintaining the Little Patuxent TMDL and this restoration plan. The milestones proposed in Section 8: Implementation Milestones (2015, 2017, and 2021) provide interim planning targets. The planning targets will be used to reevaluate against progress and will be revised, if necessary, to ensure that Anne Arundel County continues to maintain TMDL requirements. Progress evaluation will be measured through three approaches: tracking implementation of management measures, estimating load reductions through modeling, and tracking overall program success through long term monitoring.

9.1 Tracking Implementation of Management Measures

Implementation will be measured by determining whether the targets for implementation shown in Table 16 are maintained according to the milestone schedule presented. Anne Arundel County manages a comprehensive system for adding and tracking projects and accounting for new programs. New BMPs constructed through new development and redevelopment projects are entered into the County's BMP database as they come on line. WPRP is responsible for implementing and tracking Water Quality

Improvement Projects (WQIP; i.e., restoration and retrofit projects and programs). Additional internal County groups including Bureau of Highway Road Operation Division who are responsible for maintenance efforts (i.e., street sweeping and inlet cleaning) report back to WPRP. Another way the County is capturing and tracking projects is through the AAWSA. Watershed stewards can enter their own data and implementation projects through the WPRP website (www.aarivers.org). Once these data are reviewed and validated by the County, they are incorporated into the County's master list of environmental restoration projects.

The majority of 2025 planned management strategies incorporate CIP stormwater retrofits and outfall enhancement projects. Feasibility studies of the planned strategies may reveal that some existing structures identified for retrofitting or enhancement may not be feasible candidates for future projects and may be eliminated from consideration. The County will take an adaptive management approach and will reevaluate treatment needs as feasibility studies progress. The County will continue to track the overall effectiveness of the various BMP strategies and will adapt the suite of solutions based on the results. In addition, new technologies are continuously evaluated to determine if the new technologies allow more efficient or effective pollution control.

Two-Year Milestone Reporting

As a part of the federal Chesapeake Bay Accountability Framework and in support of Maryland's BayStat accountability system, the County is required to report two-year milestones representing near-term commitments and progress to MDE towards achieving load reduction goals for the Bay TMDL. These efforts will also support local TMDL planning and tracking at the County level.

Milestones are reported in two forms: Programmatic and BMP Implementation. Programmatic milestones identify the anticipated establishment or enhancement of the institutional means that support and enable implementation. Examples of Programmatic milestones include projected funding, enhancement of existing programs and resources, and the establishment of new programs and studies. The milestone period for Programmatic covers two calendar years – for example, the period for 2014 - 2015 is from January 1, 2014 through December 31, 2015. BMP Implementation milestones are a quantitative account of various types of restoration activities (e.g., structural BMPs, stream restoration, maintenance efforts), which have geo-located coordinates. The period for BMP implementation milestones differs from the Programmatic milestones period and covers two state fiscal years – for example, the period for 2014 – 2015 is from July 1, 2013 through June 30, 2015. Planned BMP Implementation milestones reported to MDE include the action (e.g., BMP type), proposed restoration over the 2-year milestone period (e.g., area treated, length restored), actual rate of implementation over 1 year, and percent progress.

The Programmatic and BMP Implementation milestone submittal and reporting process follows an iterative approach and includes three separate submittals to MDE. The first is an initial milestone submittal to MDE by January 31st of the first milestone calendar year (e.g., 2014), followed by an interim milestone progress report submittal by January 31st of the second milestone calendar year (e.g., 2015), and concluding with a final milestone progress submittal by January 31st of the start of the subsequent milestone period (e.g., 2016).

Annual NPDES Reporting

As a requirement of the NPDES permit described in Section 2.4.4, the County must submit on or before the anniversary date of the permit a progress report demonstrating the implementation of the NPDES

stormwater program based on the fiscal year. If the County's annual report does not demonstrate compliance with their permit and show progress toward meeting WLAs, the County must implement BMP and program modifications within 12 months.

The annual report includes the following – items in bold font directly relate to elements of the load reduction evaluation criteria:

a. The status of implementing the components of the stormwater management program that are established as permit conditions including:
   i. Source Identification
   ii. Stormwater Management
   iii. Erosion and Sediment Control
   iv. Illicit Discharge Detection and Elimination
   v. Litter and Floatables
   vi. Property Management and Maintenance
   vii. Public Education
   viii. Watershed Assessment
   ix. Restoration Plans
   x. TMDL Compliance
   xi. Assessment of Controls; and,
   xii. Program Funding

b. A narrative summary describing the results and analyses of data, including monitoring data that is accumulated throughout the reporting year

c. Expenditures for the reporting period and the proposed budget for the upcoming year

d. A summary describing the number and nature of enforcement actions, inspections, and public education programs

e. The identification of water quality improvements and documentation of attainment and/or progress toward attainment of benchmarks and applicable WLAs developed under EPA approved TMDLs; and,

f. The identification of any proposed changes to the County's program when WLAs are not being met

g. Attachment A – The County is required to complete a database containing the following information:
   i. Storm drain system mapping
   ii. Urban BMP locations
   iii. Impervious surfaces
   iv. Water quality improvement project locations
   v. Monitoring site locations
   vi. Chemical monitoring results
   vii. Pollutant load reductions
   viii. Biological and habitat monitoring
   ix. Illicit discharge detection and elimination activities
   x. Erosion and sediment control, and **stormwater program information**
   xi. Grading permit information
   xii. Fiscal analyses – cost of NPDES related implementation

9.2 Estimating Load Reductions

Progress assessments are scheduled by the Chesapeake Bay Program for 2017 and 2021. At this time,

multiple lines of evidence including: several models, monitoring data, and the most recent science on BMP effectiveness and water quality response will be evaluated. The milestones and progress assessments will contribute to constant reassessment of management plans, and adapting responses accordingly as technologies and efficiencies change, programs mature, credit trading is enacted, and regulations are put in place. The County will model load reductions in MAST at the interim (2014, 2016, 2018) and milestone (2015, 2017, 2019) years, which equates to about once a year at minimum.

9.3 Tracking Overall Program Success through Monitoring

Overall program success will be evaluated using trends identified through the long term monitoring program described below in Section 10: Monitoring. TMDL compliance status will be evaluated to determine if the Restoration Plan needs to be updated. If it is found during the evaluation of BMP implementation and load reductions that the milestone targets are no longer being met, a revision of the plan may be necessary.

10 Monitoring (i)

Official monitoring for Integrated Report assessments and impairment status is the responsibility of the State; however the County has many on-going monitoring programs that can support the State's efforts.

To determine the specific parameters to be monitored for tracking progress, one must understand the approach used for the initial listing. The Little Patuxent was originally listed for sediments in 1996 as a suspended sediment listing. This was refined in 2008 to a listing for total suspended solids. In 2002, the State began listing biological impairments on the Integrated Report, at the 8-digit scale, based on a percentage of stream miles degraded and whether they differ significantly from a reference condition watershed (<10% stream miles degraded). The biological listing is based on Benthic and Fish Indices of Biotic Integrity (BIBI/FIBI) results from wadeable streams from assessments conducted by the Maryland Department of Natural Resources (MDNR) Maryland Biological Stream Survey (MBSS). The Little Patuxent was listed for biological community impairment in 2006.

MDE then utilized its Biological Stressor Identification (BSID) process to identify the probable or most likely causes of poor biological conditions. For sediment specifically, the BSID identified 'altered hydrology and increased runoff from urban impervious surfaces have resulted in channel erosion and subsequent elevated suspended sediment transport through the watershed.' Overall, the results indicated inorganic pollutants (i.e. chlorides) and flow/sediment related stressors as the primary stressors.

Based on the results of the BSID, MDE replaced the biological impairment listing with a listing for total suspended solids (TSS). The 2012 final and 2014 draft integrated reports lists 'Habitat Evaluation' as the indicator, and urban runoff/storm sewers as the source. It is noted that the *Decision Methodology for Solids for the April 2002 Water Quality Inventory (updated in February of 2012)*[1], makes a specific distinction between two different, although related 'sediment' impairment types in free flowing streams:

[1] http://www.mde.state.md.us/programs/Water/TMDL/Integrated303dReports/Documents/Assessment_Methodologies/AM_Solids_2012.pdf

1. **TSS**: The first type is an impact to water clarity with impairment due to TSS using turbidity measured in Nephelometer Turbidity Units (NTUs). Although numeric criteria have not been established in Maryland for TSS, MDE uses a threshold for turbidity, a measurement of water clarity, of a maximum of 150 Nephelometer Turbidity Units (NTU's) and maximum monthly average of 50 NTU as stated in Maryland COMAR regulations (26.08.02.03-3). Turbidity also may not exceed levels detrimental to aquatic life in Use I designated waters.
2. **Sedimentation / siltation**: The second type is an impact related to erosional and depositional impacts in wadeable streams. The measures used are biocriteria and the critiera for Use I streams (the protection of aquatic life and growth and propagation of fish (other than trout) and other aquatic life).

With these two sediment impairments in mind the Little Patuxent, which is listed as impaired for TSS, would seem to be water clarity issue; however the methodology used for listing (biological and habitat measures related sediment deposition) seems to point to an in-stream sediment deposition problem. In all likelihood both types of impairment, water clarify and sedimentation, are factors and both should be incorporated into monitoring programs to track changes in the watershed condition over time.

Anne Arundel County's Watershed Protection and Restoration Program (WPRP) has several on-going monitoring programs that target measures of water clarity and sedimentation. These programs are described here.

Countywide Biological Monitoring

In 2004, a Countywide Biological Monitoring and Assessment Program for Anne Arundel County, Maryland was developed to assess the biological condition of the County's streams at multiple scales (i.e., site-specific, primary sampling unit (PSU), and countywide). Under the Countywide Biological Monitoring and Assessment program, biology (i.e., benthic macroinvertebrates) and stream habitat, as well as geomorphological and water quality parameters, are assessed at approximately 240 sites throughout the entire County over a 5-year period using a probabilistic, rotating-basin design. Round One of the County's Biological Monitoring and Assessment Program occurred between 2004 and 2008, and Round Two took place between 2009 and 2013. Round Three is scheduled to be conducted beginning in 2016.

The biological monitoring program's stated goals are applicable at three scales; Countywide, Watershed-wide, and Stream-specific, and include the following components.

- Status: describe the overall stream condition
- Trends: how has the overall stream condition changed over time
- Problem identification/prioritization: identify the impaired and most degraded streams
- Stressor-response relationships: identify anthropogenic stressors and their biological response
- Evaluation of environmental management activities: monitor the success of implemented programs and restoration/retrofit projects

The Little Patuxent watershed is made up of one PSU – Little Patuxent. Ten sampling sites were sampled in each of these PSUs in each round of sampling. Methodologies follow those used by MBSS for the biological sampling (benthic macroinvertebrates only) and habitat evaluations have included both MBSS's Physical Habitat Index (PHI) and the EPA's Rapid Bioassessment Protocol (RBP) metrics. In-situ

water quality measures are also collected at each site along with a geomorphic evaluation utilizing cross-sections, particle substrate analysis using pebble counts, and measures of channel slope.

Following these procedures, the County is collecting several parameters related to water clarity and sediment deposition at each site.

- Water Quality Measures and Observations
  - Turbidity (measured), observations of general water clarity and color
- Biological Measures
  - Benthic macroinvertebrates (BIBI)
- Habitat Measures
  - General: bar formation and substrate, presence/absence of substrate type
  - PHI: epibenthic substrate, instream habitat
  - RBP: epifaunal substrate / available cover, pool substrate characterization, sediment deposition, channel alteration
- Geomorphic Measures
  - Particle size analysis using modified Wolman pebble counts at 10 transects proportioned by channel bed features

Results summarized at the PSU scale with mean BIBI and habitat ratings (PHI and RBP) are presented in Table 20.

Table 20: Countywide Biological Monitoring Results for Little Patuxent River

PSU Name	Round	PSU Code	Year Sampled	Drainage Area (acres)	BIBI Rating	PHI Rating	RBP Rating
Little Patuxent	1	17	2007	28,196	P	D	PS
Little Patuxent	2	17	2009	28,196	P	PD	PS

BIBI Ratings: G = Good, F = Fair, P = Poor, VP = Very Poor

PHI Ratings: MD = Minimally Degraded, PD = Partially Degraded, D = Degraded, SD = Severely Degraded

RBP Ratings: C = Comparable, S = Supporting, PS = Partially Supporting, NS = Non-Supporting

Restoration Monitoring

To evaluate management activities, the County uses assessment methods similar to the Countywide program (biological monitoring, water chemistry sampling, physical habitat, geomorphic evaluation) to assess baseline and post-restoration conditions for select stream, wetland and stormwater restoration and retrofit sites. In addition, these techniques are utilized to meet several NPDES MS4 permit monitoring requirements, particularly related to Assessment of Controls and Watershed Restoration Assessment.

Watershed Assessment

In 2001, Anne Arundel County initiated a series of systematic and comprehensive watershed assessments and management plans for restoration and protection across the County. The plans are developed within a regulatory context that includes NPDES MS4 requirements, local TMDLs and Watershed Implementation Plans for the Chesapeake Bay TMDL, Maryland Stormwater Regulations and the Water Resources Element of the County's General Development Plan.

Biological monitoring is a component of the characterization and prioritization process within the management plans. The biological monitoring data is primarily utilized in the County's Watershed Management Tool (WMT), which is developed and maintained by the WPRP. Within this program, sampling sites are selected using a targeted approach with the goal of having at least one, and sometimes two sites located within each subwatershed planning unit in order to examine the relationships between land use and ecological conditions downstream. Monitoring components include benthic macroinvertebrate community sampling, *in situ* water chemistry measurements, and instream and riparian physical habitat condition assessments. Water quality grab sampling and detailed geomorphic assessments have been included for some watershed studies, but not as routine monitoring components.

The WAP program's stated goals include:

- Characterize subwatersheds;
- Prioritize subwatersheds for preservation and restoration; and
- Inform stressor-response relationships for planning and modeling.

The County continues to reevaluate its monitoring programs as the state of the science progresses, as the understanding of water quality and ecological interactions are improved, and as regulatory programs are added or modified. The WPRP is currently reviewing the Countywide monitoring program to ensure that the methods used are appropriate and meaningful, and that TMDL and NPDES requirements continue to be met.

11 References

Anne Arundel County. 2009. General Development Plan. Adopted October 19, 2009; Bill No. 64-09. Annapolis, MD.

Anne Arundel County. 2010. Stormwater Management Practices and Procedures Manual. Revised November 22, 2010; updated February 1, 2012. Annapolis, MD.

Anne Arundel County. 2012. Anne Arundel County Government Chesapeake Bay TMDL Phase II Watershed Implementation Plan – July 2, 2012. Annapolis, MD.

Anne Arundel County. 2014. Little Patuxent River Watershed Assessment Comprehensive Summary Report. Prepared by Anne Arundel County Watershed Assessment and Planning Program, Annapolis MD;

Anne Arundel County, Department of Public Works. 2015. FY15 Enhanced Street Sweeping Program. Annapolis, MD.

CWP. 2003. Impacts of impervious cover on aquatic ecosystems. Center for Watershed Protection, Ellicott City, Maryland. 142p.

CWP. 2008. Deriving Reliable Pollutant Removal Rates for Municipal Street Sweeping and Storm Drain Cleanout Programs in the Chesapeake Bay Basin. Prepared by the Center for Watershed Protection, Ellicott City, MD. Prepared for U.S. EPA as fulfillment of the U.S. EPA Chesapeake Bay Program grant CB-973222-01.

House Bill 987. 2012. State of Maryland General Assembly. Annapolis, MD

MDE. Code of Maryland Regulations (COMAR). Continuously updated. Code of Maryland Regulations, Title 26- Department of the Environment. 26.08.02.01- Water Quality.

MDE. 2011a. Total Maximum Daily Loads of Sediment in the Little Patuxent River Watershed, Howard and Anne Arundel Counties, Maryland. Maryland Department of the Environment, Baltimore, MD. Prepared for Water Protection Division, U.S. Environmental Protection Agency, Region III. Philadelphia, PA.

MDE. 2011b. Watershed Report for Biological Impairment of the Little Patuxent River in Anne Arundel and Howard Counties, Maryland – Biological Stressor Identification Analysis Results and Interpretation. Maryland Department of the Environment, Baltimore, MD. Prepared for Water Protection Division, U.S. Environmental Protection Agency, Region III. Philadelphia, PA.

MDE. 2012a. Maryland's Final 2012 Integrated Report of Surface Water Quality. Maryland Department of the Environment. Baltimore, MD. Online at: http://www.mde.state.md.us/programs/Water/TMDL/Integrated303dReports/Pages/2012_IR.aspx

MDE. 2012b. Decision Methodology for Solids for the April 2002 Water Quality Inventory (updated in February of 2012).

http://www.mde.state.md.us/programs/Water/TMDL/Integrated303dReports/Documents/Assessment_Methodologies/AM_Solids_2012.pdf

MDE. 2014a. Maryland's Draft 2014 Integrated Report of Surface Water Quality. Maryland Department of the Environment. Baltimore, MD. Online at: http://www.mde.state.md.us/programs/Water/TMDL/Integrated303dReports/Pages/2014IR.aspx

MDE. 2014b. General Guidance for Developing a Stormwater Wasteload Allocation (SW-WLA) Implementation Plan. Maryland Department of the Environment. October 2014. Baltimore, MD.

Rosgen, D.L. 1996. Applied River Morphology (Second Edition). Wildland Hydrology. Pagosa Springs, CO.

Scueler, T.R. 1987. Controlling urban runoff: a practical manual for planning and designing urban BMPs. Metropolitan Washington Council of Governments. Washington, D.C.

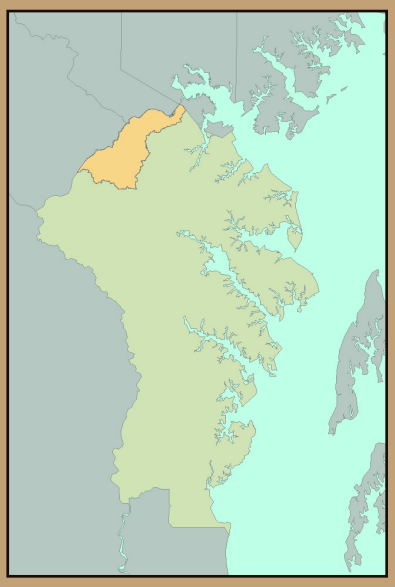
Schueler, T. 1994. The importance of imperviousness. Watershed Protection Techniques, 1(3), 100-111.

Simpson, T., and S. Weammert. 2009. Developing Best Management Practice Definitions and Effectiveness Estimates for Nitrogen, Phosphorus, and Sediment in the Chesapeake Bay Watershed. December 2009. University of Maryland Mid-Atlantic Water Program.

USEPA. 2001. PLOAD Version 3.0, An ArcView Tool to Calculate Nonpoint Sources of Pollution in Watershed and Stormwater Projects. January 2001. Developed by CH2M HILL.

USEPA. 2010. Chesapeake Bay Total Maximum Daily Load for Nitrogen, Phosphorus and Sediment, December 29, 2010. U.S. Environmental Protection Agency in collaboration with Delaware, the District of Columbia, Maryland, New York, Pennsylvania, Virginia, and West Virginia. Region 3 - Chesapeake Bay Program Field Office. Annapolis, MD.
http://www.epa.gov/reg3wapd/tmdl/ChesapeakeBay/tmdlexec.html









Patapsco River Lower North Branch Sediment TMDL Restoration Plan

Anne Arundel County, Maryland
February 2015

Anne Arundel County
WATERSHED
Protection & Restoration
PROGRAM

Patapsco River Lower North Branch Sediment TMDL Restoration Plan

February 2015

Prepared for:

Anne Arundel County
Department of Public Works
Watershed Protection and Restoration Program
2662 Riva Road, P.O. Box 6675
Annapolis, Maryland 21401

Prepared by:

KCI Technologies, Inc.
936 Ridgebrook Road
Sparks, Maryland 21152

Table of Contents

1 Introduction 4
1.1 Background and Purpose 4
1.2 TMDL Allocated and Planned Loads Summary 5
1.3 Restoration Plan Elements and Structure 6
2 Watershed Characteristics 8
2.1 Watershed Delineation 8
2.2 Patapsco River Lower North Branch 8
2.3 Land Use/Land Cover 12
2.3.1 Existing Land Use/Land Cover 12
2.3.2 Impervious Surfaces 13
2.4 Water Quality 16
2.4.1 Use Designations 16
2.4.2 303(d) Impairments 16
2.4.3 TMDLs 17
2.4.4 NPDES 17
3 Causes and Sources of Impairment (a) 19
3.1 Impairments 19
3.2 Sources 19
3.2.1 Urban Stormwater Runoff 19
3.2.2 In-stream Sources 20
3.3 Anticipated Growth 22
4 Management Measures (c) 24
4.1 Modeling Approach 24
4.2 Best Management Practices 25
4.3 Offsetting Sediment Loads from Future Growth 28
5 Expected Load Reductions (b) 28
5.1 2013 Progress – Actual Implementation 29
5.2 Planned Implementation 30
6 Technical and Financial Assistance Needs (d) 32
6.1 Funding Sources 33
7 Public Participation / Education (e) 34
8 Implementation Schedule and Milestones (f & g) 36
8.1 Loading Allocations and Milestone Targets 36
8.2 Implementation Milestones 37
8.3 Implementation Priorities 38
8.3.1 Stream Reach Restoration 38
8.3.2 Subwatershed Restoration 39
8.3.3 Prioritization of Strategy Implementation 41
9 Load Reduction Evaluation Criteria (h) 42
9.1 Tracking Implementation of Management Measures 42
9.2 Estimating Load Reductions 44
9.3 Tracking Overall Program Success through Monitoring 44

10 Monitoring (i) 44
11 References 49

List of Tables

Table 1: Patapsco River Lower North Branch Local TMDL Allocated and Planned Loads 6
Table 2: Patapsco River Lower North Branch Watershed Drainage Area and Stream Miles 8
Table 3: 2011 Land Use / Land Cover 12
Table 4: Patapsco River Lower North Branch Watershed Percent Impervious Cover 13
Table 5: Use Designations of the Patapsco River Lower North Branch River 16
Table 6: Erosion Inventory and Severity per Subwatershed (Anne Arundel County, 2011) 21
Table 7: Linear Feet of Erosion per Subwatershed (Anne Arundel County, 2011) 21
Table 8: Typical Sediment Reduction from Stormwater BMPs 27
Table 9: Sediment Loads Required for the Patapsco River Lower North Branch Local TMDL Anne Arundel County Phase I MS4 Source 29
Table 10: Current BMP Implementation through 2013 for Patapsco River Lower North Branch 29
Table 11: 2013 Progress Reductions Achieved 30
Table 12: BMP Implementation - Current 2013 and Planned 2025 Levels for the Patapsco River Lower North Branch 30
Table 13: 2025 Planned Reductions 31
Table 14: Patapsco River Lower North Branch Cost Over Milestone Periods 33
Table 15: Patapsco River Lower North Branch Planning and Target Loads (edge-of-stream loads) 37
Table 16: Patapsco River Lower North Branch Planning Milestones for Implementation 37
Table 17: Stream Priority Rating Indicators for Restoration (Anne Arundel, 2011) 38
Table 18: Subwatershed Priority Rating Indicators for Restoration (Anne Arundel, 2011) 40
Table 19: Countywide Biological Monitoring Results for Patapsco River Lower North Branch 47

List of Figures

Figure 1: Patapsco River Lower North Branch Watershed 10
Figure 2: Patapsco River Lower North Branch Subwatershed Location 11
Figure 3: Patapsco River Lower North Branch Watershed Aerial Imagery (2014) 14
Figure 4: Patapsco River Lower North Branch Watershed Land Cover (2011) 15
Figure 5: Total Suspended Solids Load from Runoff Based on Existing Conditions - Includes BMP Reductions 20
Figure 6: Modeled and Projected Land Use Loads 23
Figure 7: Total Suspended Solids Loads from Runoff Based on Future Conditions - Includes BMP Reductions 24
Figure 8: Progress and Planned Reductions in the Patapsco River Lower North Branch 32
Figure 9: Stream Reach Priorities for Restoration (Anne Arundel County, 2011) 39
Figure 10: Subwatershed Priorities for Restoration (Anne Arundel County, 2011) 41

List of Acronyms

AAWSA	Anne Arundel Watershed Stewards Academy
BMP	Best Management Practices
BSID	Biological Stressor Identification
CBP	Chesapeake Bay Program
CIP	Capital Improvement Program
EOS	Edge of Stream
H&H	Hydrologic and Hydraulic
LULC	Land use / Land cover
MAST	Maryland Assessment Scenario Tool
MDE	Maryland Department of the Environment
MS4	Municipal Separate Storm Sewer System
NPDES	National Pollutant Discharge Elimination System
OSDS	On-site Disposal Systems
SPSC	Step Pool Storm Conveyance
SW to MEP	Stormwater to the Maximum Extent Practicable
TMDL	Total Maximum Daily Load
TSS	Total Suspended Solids
USEPA	United States Environmental Protection Agency
WIP	Watershed Implementation Plan
WPRP	Watershed Protection and Restoration and Program

1 Introduction

1.1 Background and Purpose

The Anne Arundel County Department of Public Works (DPW) Watershed Protection and Restoration Program (WPRP) is developing restoration plans to address local water quality impairments for which a Total Maximum Daily Load (TMDL) has been established by the Maryland Department of the Environment (MDE) and approved by the U.S. Environmental Protection Agency (EPA). A TMDL establishes a maximum load of a specific single pollutant or stressor that a waterbody can assimilate and still meet water quality standards for its designated use class.

Under the Federal Clean Water Act (CWA), the State of Maryland is required to assess and report on the quality of waters throughout the state. Where Maryland's water quality standards are not fully met, Section 303(d) requires the state to list these water bodies as impaired waters. States are then required to develop a TMDL for pollutants of concern for the listed impaired waters. The Patapsco River Lower North Branch (Patapsco LNB) watershed has several impaired waters listings in Maryland's Integrated Report of Surface Water Quality [(303(d) list) and 305(b) Report] including nutrients, sediment, heavy metals, *Escherichia coli*, and polychlorinated biphenyls (PCBs). There are currently two final approved TMDLs within the Patapsco LNB; a bacteria TMDL approved in 2009, and a sediment TMDL approved in 2011. These TMDLs apply to several jurisdictions including Baltimore City and Baltimore, Carroll, Howard, and Anne Arundel Counties. This plan will specifically address the Patapsco LNB sediment TMDL under the responsibility of Anne Arundel County. The bacteria TMDL is being addressed by Anne Arundel County in a separate plan.

Responsibility for Patapsco LNB sediment reduction is divided among the contributing jurisdictions, listed above. The TMDL loading targets, or allocations, are also divided among the pollution source categories, which in this case includes non-point sources (termed load allocation or LA) and point sources (termed waste load allocation or WLA). The WLA consists of loads attributable to regulated process water or wastewater treatment, and to regulated stormwater. For the purposes of the TMDL and consistent with implementation of the National Pollutant Discharge Elimination System (NPDES) Municipal Separate Storm Sewer System Discharge Permit (MS4), stormwater runoff from MS4 areas is considered a point source contribution.

Anne Arundel County's current MS4 permit (11-DP-3316, MD0068306) issued in its final form by the MDE in February of 2014 requires development of restoration plans for each stormwater WLA approved by EPA prior to the effective date of the permit (permit section IV.E.2.b). This plan satisfies this permit requirement and provides the loading target, recommended management measures, load reduction estimates, schedule, milestones, cost estimates and funding sources, and the tracking and monitoring approaches to meet the stormwater WLA (SW-WLA).

It is noted that TMDL restoration plans are an important first step. The MS4 permit calls for an iterative and adaptive plan for implementation. If new methods of stormwater treatment are identified, or better approaches to source control are found, the plans can be extended and updated to take the changes into account. Similarly, if some elements of the plans are not as successful as expected, adaptations and improvements will be incorporated in future updates.

This plan demonstrates that Anne Arundel County has met its sediment SW-WLA for the Patapsco LNB as of 2013. Therefore, the strategies proposed serve to maintain the current levels of treatment, while also accounting for expected additional loads due to growth in the urban stormwater sector.

1.2 TMDL Allocated and Planned Loads Summary

The following Restoration Plan only addresses loads allocated to Anne Arundel County NPDES regulated stormwater point source sediment. Additional SW-WLAs for the Patapsco LNB watershed TMDL assigned to Baltimore, Carroll, and Howard counties, Baltimore City, Maryland State Highway Administration, and other NPDES regulated stormwater are not the responsibility of Anne Arundel County and will not be addressed in this plan. A large section of Baltimore-Washington International Thurgood Marshall Airport (BWI) is located in the western portion of the watershed. Pollutant loads from BWI are the responsibility of Maryland Aviation Association and are not addressed in this plan.

The Patapsco LNB Watershed TMDL requires a 22.2% reduction of sediment loads from 2005 baseline levels to achieve the target SW-WLA for Anne Arundel County NPDES regulated stormwater. A planning horizon of 2025 was initially used as the date to achieve these load reductions with a proposed 2017 interim milestone. However; results of the 2013 progress load calculation indicates that load reductions from management strategies in place as of 2013 are meeting the SW-WLA for the Patapsco LNB for the local sediment TMDL.

This section of the plan, including Table 1, provides a concise summary of the loads and reductions at important timeline intervals including the 2005 baseline, 2013 progress, 2017 milestone and 2025 final planning intervals. These terms and dates are used throughout the plan and explained in more detail in the following sections. They are presented here to assist the reader in understanding the definitions of each, how they were derived, and to provide an overall summary demonstrating the percent reduction required and percent reduction achieved through full implementation of this plan. Sediment loads and wasteload allocations are presented as tons/year in the local TMDL but will be discussed as lbs/year in this restoration plan.

- **2005 Baseline Loads**: Baseline levels (i.e., land use loads with baseline BMPs) from 2005 conditions in the Patapsco LNB watershed using the Maryland Assessment Scenario Tool (MAST) Chesapeake Bay Program Phase 5.3.2 (CBP P5.3.2) model. Baseline loads were used to calculate the stormwater allocated sediment loads, or SW-WLA.
- **2013 Progress Loads and Reductions**: Progress loads and load reductions achieved from stormwater best management practice (BMP) implementation through 2013.
- **2017 Interim Milestone Goal Loads and Planned Loads and Reductions**: 2017 Interim Milestone loads were calculated by subtracting 60% of the absolute reduction goal from 2005 baseline loads. Planned 2017 loads and reductions will result from implementation of strategies through 2017.
- **2025 Allocated Load**: Allocated loads are calculated from the 2005 baseline levels, calibrated to CBP P5.3.2 as noted above, using the following calculation: 2005 Baseline – (2005 Baseline x 0.222); or, 2005 Baseline x (1 – 0.222)
- **2025 Planned Loads and Planned Reductions**: Loads and reductions that will result from implementation of this plan.

Table 1: Patapsco River Lower North Branch Local TMDL Allocated and Planned Loads

	Sediment (tons/year)	Sediment (lbs/year)
2005 Baseline Loads	1,016	2,032,381
2013 Progress Loads	607	1,214,022
2013 Progress Reductions	409	818,359
2017 Interim Milestone Loads	881	1,761,668
2017 Planned Loads*	535	1,070,886
2017 Planned Reductions	481	961,495
2025 TMDL Allocated Loads	791	1,581,193
2025 Planned Loads*	546	1,091,074
2025 Planned Reductions	471	941,307
Required Percent Reduction	22.2%	22.2%
Planned Percent Reduction Achieved	46.3%	46.3%

*2017 and 2025 planned loads include additional projected land use loading from new development through 2025. It is assumed that all new development will be treated with SW to the MEP implementation to achieve 90% sediment removal.

1.3 Restoration Plan Elements and Structure

This plan is developed within the context of on-going watershed management planning, restoration, and resource protection being conducted by Anne Arundel County. The County initiated comprehensive watershed assessment and management plans in 2000 and has currently completed plans for seven of the 12 major watersheds, including the Patapsco LNB which was completed in 2011. The 2011 plan used the term 'Patapsco Non-Tidal' for the watershed, however it references the same geography included in Anne Arundel County's portion of the Patapsco LNB. The County also prepared a Phase II Watershed Implementation Plan (WIP) in 2012 in response to requirements set forth in the Chesapeake Bay TMDL for nitrogen, phosphorus and sediment. Information synthesized and incorporated into this plan for the Patapsco LNB watershed draws upon these sources with updates and additions where necessary to meet the specific goals of the SW-WLA. The TMDL analyses and reports developed by MDE are also referenced. These primary sources include:

- Patapsco Non-Tidal Watershed Assessment Comprehensive Summary Report (Anne Arundel County, 2011)
- Chesapeake Bay TMDL, Phase II Watershed Implementation Plan, Final (Anne Arundel County, 2012)
- Total Maximum Daily Load of Sediment in the Patapsco River Lower North Branch Watershed, Baltimore City and Baltimore, Howard, Carroll, and Anne Arundel Counties, Maryland (MDE, 2011)

MDE has prepared several guidance documents to assist municipalities with preparation of TMDL restoration plans. This plan is developed following the guidance detailed in the following documents with modifications as necessary:

- General Guidance for Developing a Stormwater Wasteload Allocation (SW-WLA) Implementation Plan (MDE, May 2014)
- Guidance for Using the Maryland Assessment Scenario Tool to Develop Stormwater Wasteload Allocation Implementation Plans for Local Nitrogen, Phosphorus, and Sediment TMDLs (MDE, June 2014)
- Guidance for Developing Stormwater Wasteload Allocation Implementation Plans for Nutrient and Sediment Total Maximum Daily Loads (MDE, November 2014)
- Accounting for Stormwater Wasteload Allocations and Impervious Acres Treated (MDE, August 2014)

The Patapsco LNB plan has been prepared in accordance with the EPA's nine essential elements for watershed planning. These elements, commonly called the 'a through i criteria' are important for the creation of thorough, robust, and meaningful watershed plans and incorporation of these elements is of particular importance when seeking implementation funding. The EPA has clearly stated that to ensure that Section 319 (the EPA Nonpoint Source Management Program) funded projects make progress towards restoring waters impaired by nonpoint source pollution, watershed-based plans that are developed or implemented with Section 319 funds to address 303(d)-listed waters must include at least the nine elements.

The Patapsco LNB Restoration Plan is organized based on these elements. A modification to the order has been incorporated such that element c., a description of the management measures, is included before element b., the expected load reductions. We feel this modified approach is easier to follow. The letters (a. through i.) are included in the headers of the plan's major sections to indicate to the reader the elements included in that section. The planning elements are:

a. An identification of the causes and sources that will need to be controlled to achieve the load reductions estimated in the plan and to achieve any other watershed goals identified in the plan, as discussed in item (b) immediately below. (Section 3)

b. An estimate of the load reductions expected for the management measures described under paragraph (c) below, recognizing the natural variability and the difficulty in precisely predicting the performance of management measures over time. (Section 5)

c. A description of the management measures that will need to be implemented to achieve the load reductions estimated under paragraph (b) above as well as to achieve other watershed goals identified in the plan, and an identification of the critical areas in which those measures will be needed to implement this plan. (Section 4)

d. An estimate of the amount of technical and financial assistance needed, associated costs, and/or the sources and authorities that will be relied upon, to implement this plan. (Section 6)

e. An information/education component that will be used to enhance public understanding of the project and encourage their early and continued participation in selecting, designing, and implementing the recommended management measures. (Section 7)

f. A schedule for implementing the management measures identified in this plan that is reasonably expeditious. (Section 8)

g. A description of interim, measurable milestones for determining whether management measures or other control actions are being implemented. (Section 8)

h. A set of criteria that can be used to determine whether loading reductions are being achieved over time and substantial progress is being made towards attaining water quality standards and, if not, the criteria for determining whether the plan needs to be revised. (Section 9)

i. A monitoring component to evaluate the effectiveness of the implementation efforts over time, measured against the criteria established under item (h) immediately above. (Section 10)

The outcomes of the planning effort are to provide guidance for the strategic implementation of watershed protection and restoration efforts that will advance progress toward meeting Anne Arundel County's local TMDLs pollutant loading allocations, and ultimately meeting water quality standards. Successful implementation of the plan will lead to improvements in local watershed conditions and aquatic health.

2 Watershed Characteristics

2.1 Watershed Delineation

The Patapsco LNB is one of 12 major watersheds in Anne Arundel County, Maryland, and is situated in the northwestern portion of the County (Figure 1). The watershed shares political boundaries with Howard County along Deep Run and Baltimore County along the mainstem of the Patapsco River. The most downstream extent of the watershed borders Baltimore City. The Patapsco LNB watershed is a part of the Chesapeake Bay watershed with the Patapsco River mainstem discharging to the tidal portions of the Patapsco River in Baltimore City before entering the Chesapeake Bay.

2.2 Patapsco River Lower North Branch

The Patapsco LNB watershed is approximately 15,270 acres (23.9 square miles) in area and contains approximately 96 miles of streams. The watershed includes several named streams including Stoney Run, Piney Run, Deep Run, Holly Creek, and the mainstem of the Patapsco River. These named streams are distributed among 12 subwatersheds, as shown below in Table 2 and on Figure 2. These subwatersheds were used as planning units for the watershed assessment and management plan completed in 2011. Although the average subwatershed size is 1,272 acres, the subwatersheds range in size from 431 in PN6 to 2,646 in PNB. The channel length in each subwatershed also varies similarly.

Communities within the Patapsco LNB include Linthicum Heights, Hanover, and Severn. A large section of Baltimore-Washington International Thurgood Marshall Airport (BWI) is located in the western portion of the watershed (Figure 2).

Table 2: Patapsco River Lower North Branch Watershed Drainage Area and Stream Miles

Subwatershed Code	Subwatershed Name	Drainage Area (Acres)	Drainage Area (Square Miles)	Stream Miles
PN1	Patapsco Mainstem	1,030	1.6	6.5
PN2	Holly Creek	856	1.3	4.5
PN3	Patapsco Mainstem	526	0.8	4.3
PN4	Unnamed Tributary	1,175	1.8	6.3
PN5	Patapsco Mainstem	575	0.9	5.4
PN6	Stoney Run 1	429	0.7	4
PN7	Stoney Run 2	2,078	3.2	10.6

Subwatershed Code	Subwatershed Name	Drainage Area (Acres)	Drainage Area (Square Miles)	Stream Miles
PN8	Stoney Run 3	1,421	2.2	6
PN9	Stoney Run 4	2,252	3.5	12.2
PNA	Deep Run	709	1.1	7.4
PNB	Piney Run	2,646	4.1	17.5
PNC	Deep Run	1,571	2.5	11.4
Patapsco River Lower North Branch Total		**15,268**	**23.9**	**96.1**

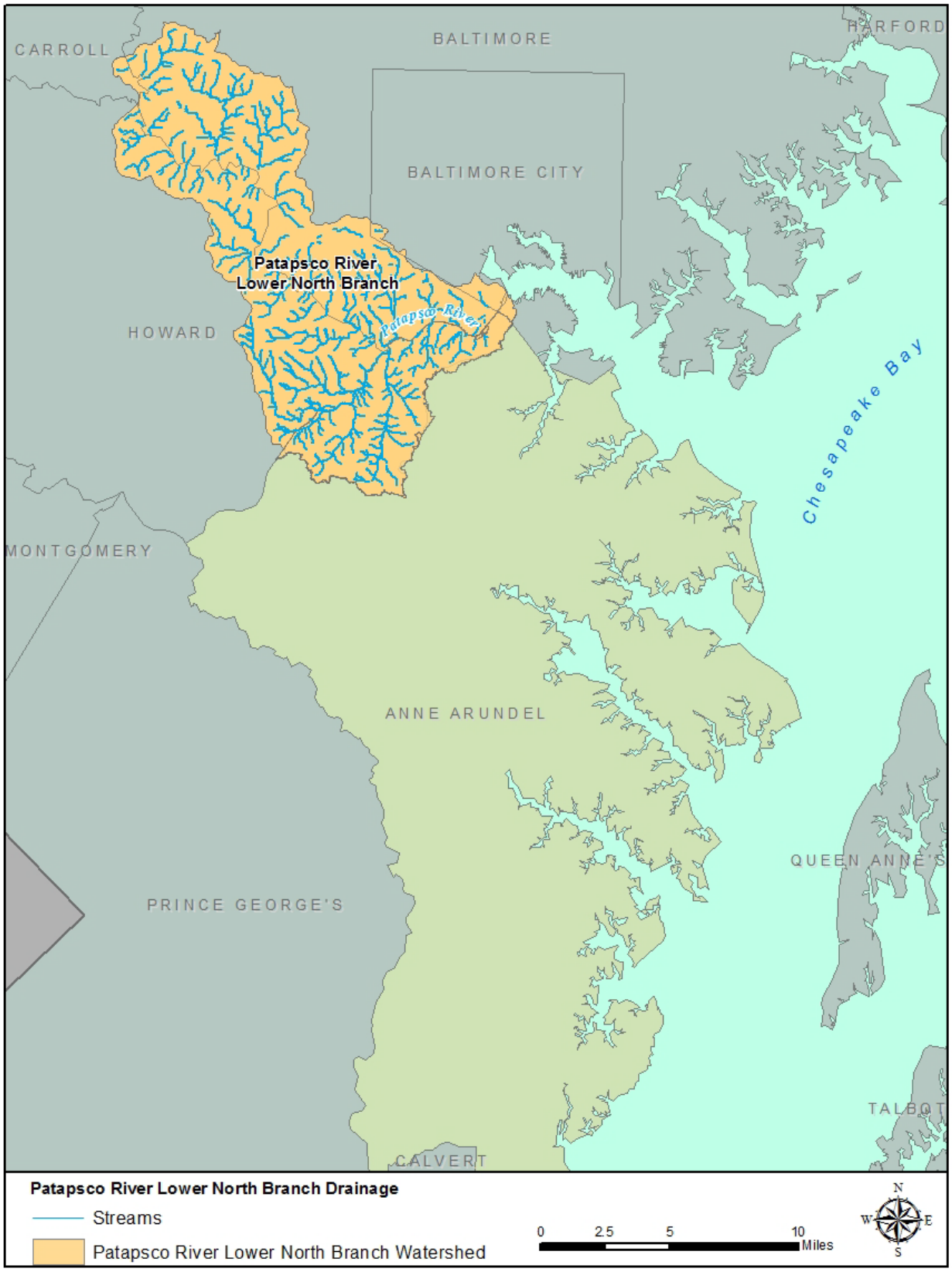
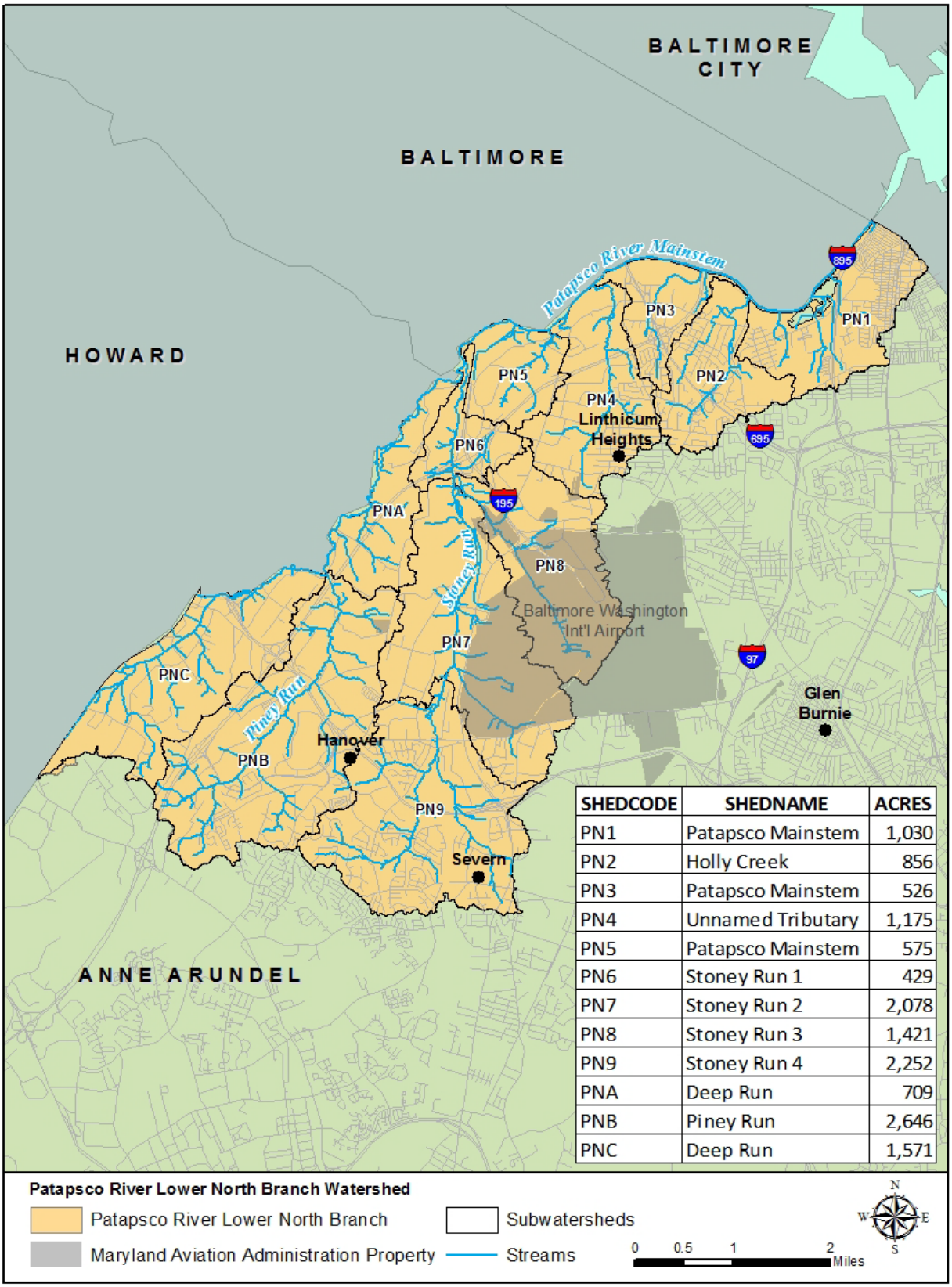


Figure 1: Patapsco River Lower North Branch Watershed



SHEDCODE	SHEDNAME	ACRES
PN1	Patapsco Mainstem	1,030
PN2	Holly Creek	856
PN3	Patapsco Mainstem	526
PN4	Unnamed Tributary	1,175
PN5	Patapsco Mainstem	575
PN6	Stoney Run 1	429
PN7	Stoney Run 2	2,078
PN8	Stoney Run 3	1,421
PN9	Stoney Run 4	2,252
PNA	Deep Run	709
PNB	Piney Run	2,646
PNC	Deep Run	1,571

Figure 2: Patapsco River Lower North Branch Subwatershed Location

2.3 Land Use/Land Cover

The type and density of various land uses can have a dramatic effect on water quality and stream habitat. Forested areas slow stormwater flow and allow water to gradually seep into soils and drain into streams. Vegetation and soils bind nutrients and pollutants found within stormwater—improving water quality as it infiltrates the ground. Developed areas, with a high percentage of impervious surfaces (buildings, paved roads, parking lots, etc.), do not reduce either the volume or flow of stormwater—increasing the amount of pollutants entering streams. Increased stormflow affects stream habitat negatively by increasing bank erosion and decreasing instream and riparian habitat. Agricultural land, if managed incorrectly, can also impair streams with increases nutrients and bacteria.

See Figure 3 for aerial imagery of the Patapsco LNB watershed. Land use / land cover (LULC) data from the Anne Arundel County Office of Information Technology (2011) is presented in Figure 4. Data presented in the figures below were used to characterize the watershed and show potential pollution sources. These LULC data were not used in the calculations of loads and load reduction, which were based instead on the land-river segment scale from the Chesapeake Bay Program Partnership Watershed Model.

2.3.1 Existing Land Use/Land Cover

According to 2011 LULC data (Table 3), the largest category in the Patapsco LNB is forested land, or woods (33.1%) followed by open space (11.5%). Developed land in the watershed largely consists of industrial (9.5%), residential (1/8-acre 9.0%, 1/4-acre 7.9%), commercial (6.9%), and transportation (6.8%). Residential areas as a total make up 26.5% of the watershed.

Table 3: 2011 Land Use / Land Cover

Land Use / Land Cover	Acres	Percent of Watershed
Airport	627	4.1%
Commercial	1,052	6.9%
Forested Wetland	33	0.2%
Industrial	1,450	9.5%
Open Space	1,759	11.5%
Open Wetland	76	0.5%
Pasture/Hay	2	0.0%
Residential 1/2-acre	335	2.2%
Residential 1/4-acre	1,213	7.9%
Residential 1/8-acre	1,367	9.0%
Residential 1-acre	424	2.8%
Residential 2-acre	637	4.2%
Row Crops	33	0.2%
Transportation	1,033	6.8%
Utility	43	0.3%
Water	133	0.9%
Woods	5,050	33.1%
Total	**15,268**	**100.0%**

2.3.2 Impervious Surfaces

Impervious surfaces concentrate stormwater runoff, accelerating flow rates and directing stormwater to the receiving stream. This accelerated, concentrated runoff can cause stream erosion and habitat degradation. Runoff from impervious surfaces picks up and washes off pollutants and is usually more polluted than runoff generated from pervious areas. In general, undeveloped watersheds with small amounts of impervious cover are more likely to have better water quality in local streams than urbanized watersheds with greater amounts of impervious cover. Impervious cover is a primary factor when determining pollutant characteristics and loadings in stormwater runoff.

The degree of imperviousness in a watershed also affects aquatic life. There is a strong relationship between watershed impervious cover and the decline of a suite of stream indicators. As imperviousness increases the potential stream quality decreases with most research suggesting that stream quality begins to decline at or around 10 percent imperviousness (Schueler, 1994; CWP, 2003). However, there is considerable variability in the response of stream indicators to impervious cover observed from 5 to 20 percent imperviousness due to historical effects, watershed management, riparian width and vegetative protection, co-occurrence of stressors, and natural biological variation. Because of this variability, one cannot conclude that streams draining low impervious cover will automatically have good habitat conditions and a high quality aquatic life.

Impervious surfaces make up 27.3% of the overall Patapsco LNP drainage (Table 4; impervious surfaces data obtained from Anne Arundel County Office of Information Technology - 2011). Impervious surface is highest in areas surrounding the Arundel Mills Mall in Hanover and Baltimore-Washington International Airport.

Table 4: Patapsco River Lower North Branch Watershed Percent Impervious Cover

Subwatershed Code	Subwatershed Name	% Impervious Cover
PN1	Patapsco Mainstem	34.6%
PN2	Holly Creek	27.0%
PN3	Patapsco Mainstem	37.7%
PN4	Unnamed Tributary	31.6%
PN5	Patapsco Mainstem	14.1%
PN6	Stoney Run 1	21.4%
PN7	Stoney Run 2	25.0%
PN8	Stoney Run 3	46.9%
PN9	Stoney Run 4	25.5%
PNA	Deep Run	6.7%
PNB	Piney Run	28.2%
PNC	Deep Run	18.1%
Patapsco River Lower North Branch Total		**27.3%**

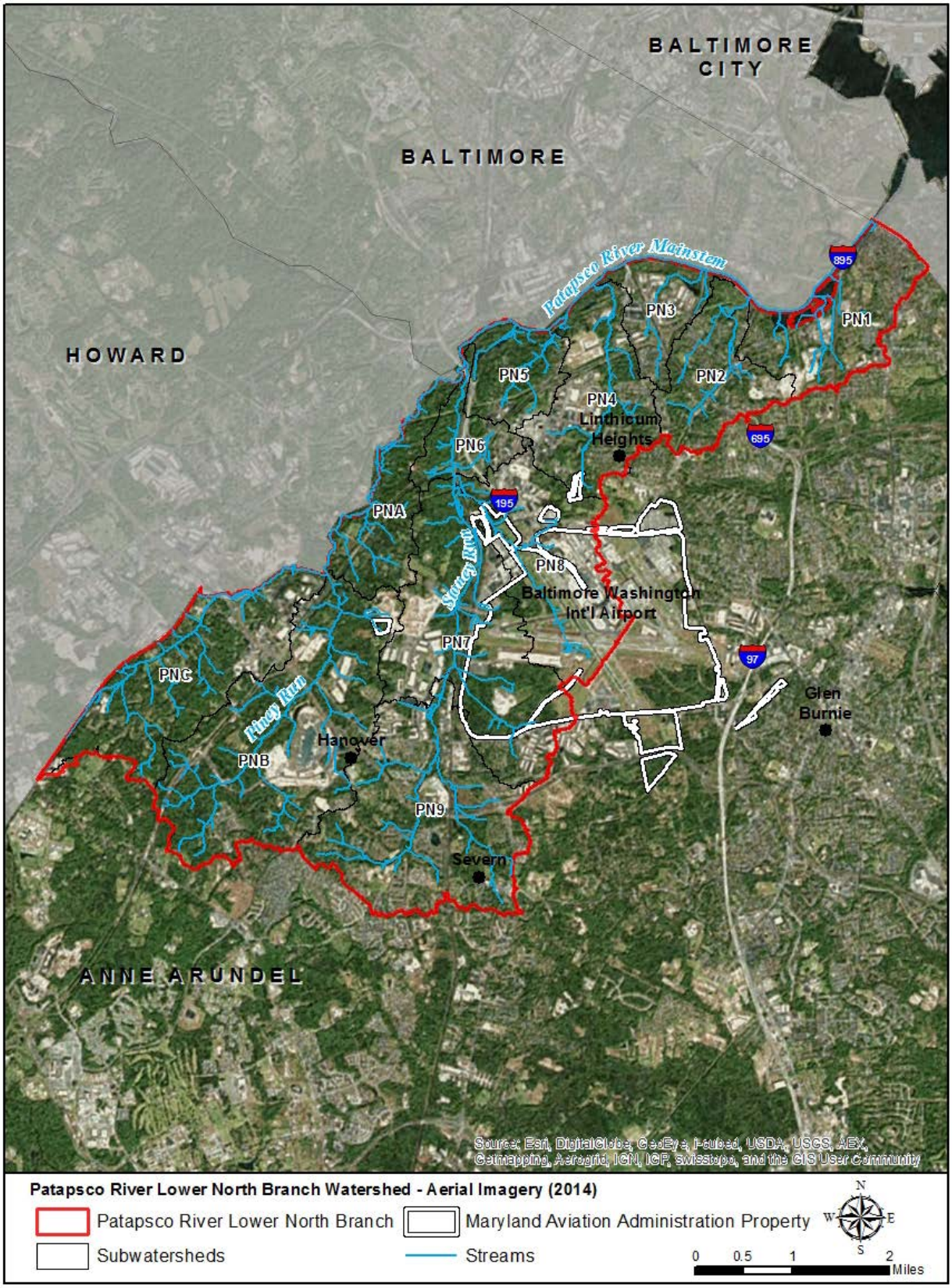


Figure 3: Patapsco River Lower North Branch Watershed Aerial Imagery (2014)

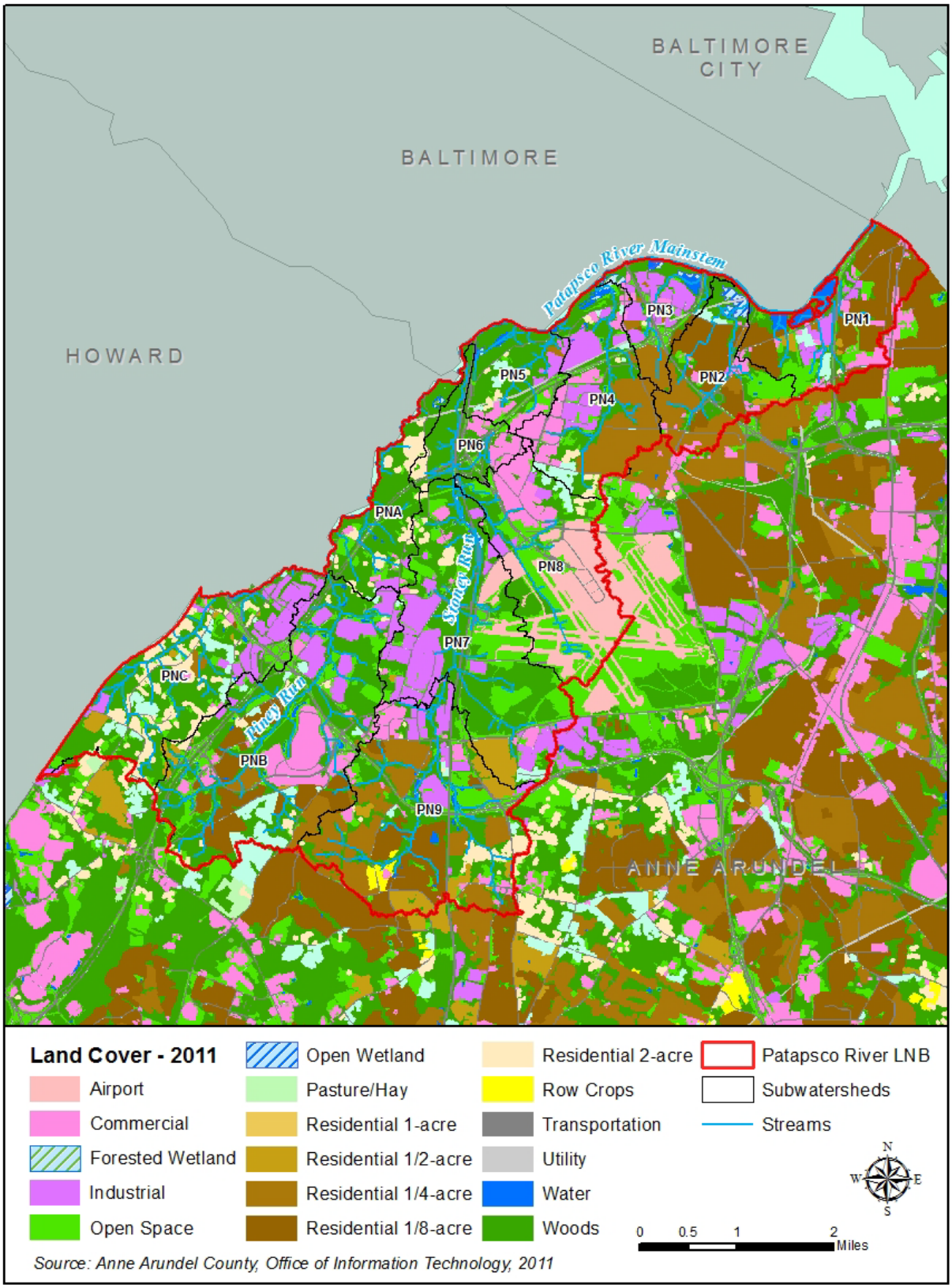


Figure 4: Patapsco River Lower North Branch Watershed Land Cover (2011)

2.4 Water Quality

2.4.1 Use Designations

According to water quality standards established by MDE in the Code of Maryland Regulations (COMAR) 26.08.02.03-.03 - Water Quality, Patapsco LNB is classified as Use I waters which are designated to support water contact recreation, and protection of non-tidal warmwater aquatic life. Designations include recreation; industrial and agricultural water supply; and fish, aquatic life, and wildlife (Table 5).

Table 5: Use Designations of the Patapsco River Lower North Branch River

Designated Uses	Patapsco LNB
Growth and propagation of fish (not trout), other aquatic life and wildlife	X
Water contact sports	X
Leisure activities involving direct contact with surface water	X
Fishing	X
Agricultural water supply	X
Industrial water supply	X
Propagation and harvesting of shellfish	-
Seasonal migratory fish spawning and nursery use	-
Seasonal shallow-water submerged aquatic vegetation use	-
Open-water fish and shellfish use	-
Seasonal deep-water fish and shellfish use	-
Seasonal deep-channel refuge use	-
Growth and propagation of trout	-
Capable of supporting adult trout for a put and take fishery	-
Public water supply	-

Source: http://www.mde.state.md.us/programs/Water/TMDL/Water%20Quality%20Standards/Pages/programs/waterprograms/ tmdl/wqstandards/wqs_designated_uses.aspx

2.4.2 303(d) Impairments

According to Maryland's final 2012 and draft 2014 303(d) list of impaired waters (MDE, 2012a; MDE, 2014a), several segments within the Patapsco LNB watershed are listed for water quality impairments.

The Patapsco LNB watershed contains two Category 4a stream segments which include those waters that are not meeting their use designation but for which a TMDL has been developed to address the impairments. Category 4a waters include the entire watershed listed for sediment; and multiple segments in the lower portion and upper portion of the watershed listed for fecal bacteria (*Escherichia coli*).

Category 5 waters for the Patapsco LNB watershed, which include those waters that are not meeting their use designation and require a TMDL, include the entire watershed for chlorides and sulfates. In addition to category 4a and 5 listings, the Patapsco LNB watershed is also listed as a Category 4c, which includes those waters that are listed as impaired but are not impaired by a conventional pollutant. The Category 4c listing for the Patapsco LNB is for stream channelization due to urban development in all 1st through 4th order streams. This listing is significant due to the Category 5 listing for sediment.

2.4.3 TMDLs

Total Maximum Daily Loads (TMDLs) are established for waterbodies on Maryland's 303(d) integrated list of impaired waterbodies to set pollutant limits to achieve attainment of the designated use. For each combination of waterbody and pollutant, the State must estimate the maximum allowable pollutant load, or TMDL, that the waterbody can receive and still meet water quality standards. TMDLs are required by Clean Water Act.

Category 4a of the 303(d) list describes impaired waters with a TMDL or other reduction measure in place. Category 5 lists impaired waters in need of a TMDL. Listings for chlorides and sulfates in the Patapsco LNB are currently in need of a TMDL. In addition a Water Quality Analysis was completed in 2004 for heavy metals and in 2009 for eutrophication within the Patapsco LNB. EPA concurrence determining that a TMDL was not required was received in 2005 for heavy metals and in 2009 for eutrophication.

The Patapsco LNB currently has two final TMDLs completed - one for sediment (approved 2011) and another for *Escherichia coli* (approved 2009). This Restoration Plan focuses on implementing strategies to address the sediment TMDL which requires a 22.2% reduction of Anne Arundel County NPDES regulated stormwater point source sediment.

In addition to local TMDLs in the Patapsco LNB, the County must also meet WLAs allocated from the *Chesapeake Bay Total Maximum Daily Loads for Nitrogen, Phosphorus, and Sediment* (USEPA, 2010). The Bay TMDL is a result of requirements under the CWA to meet water quality standards and executive order 13508 signed by President Barack Obama in 2009 that put a renewed emphasis and focus on the Chesapeake Bay. The local sediment TMDL for the Patapsco LNB is more geographically specific than the Bay-wide allocated loads assigned in the Bay TMDL. However, all load reductions achieved from implementation efforts described in this plan will help support the County's Bay TMDL goals.

2.4.4 NPDES

Section 402(p) of the Clean Water Act required the EPA to add Municipal Separate Storm Sewer System (MS4) discharges to the NPDES permit program. In 2002, EPA directed permit writers to include WLA requirements in NPDES permits, including those for MS4 discharges. Anne Arundel County holds a Phase I – Large Jurisdiction (greater than 250,000 population) MS4 permit (11-DP-3316, MD0068306) issued by the MDE. The County's first generation permit was issued in 1993. The current fourth generation permit was issued in February of 2014.

TMDL Permit Requirements

The objective of this plan is to meet the County's MS4 NPDES permit requirement to develop restoration plans for local TMDLs per permit condition IV.E.2.b. Plans must be developed within the first year of permit issuance. Anne Arundel County's final permit was issued on February 12, 2014 therefore the restoration plans must be complete by February 11, 2015.

The permit states the County must submit "…a restoration plan for each stormwater Waste Load Allocation (WLA) approved by EPA prior to the effective date of the permit." For each WLA, the County is required to:

PART IV. Standard Permit Conditions
E. Restoration Plans and Total Maximum Daily Loads
2. Restoration Plans
b. Within one year of permit issuance, Anne Arundel County shall submit to MDE for approval a restoration plan for each stormwater WLA approved by EPA prior to the effective date of the permit. The County shall submit restoration plans for subsequent TMDL WLAs within one year of EPA approval. Upon approval by MDE, these restoration plans will be enforceable under this permit. As part of the restoration plans, Anne Arundel County shall:

i. Include the final date for meeting applicable WLAs and a detailed schedule for implementing all structural and nonstructural water quality improvement projects, enhanced stormwater management programs, and alternative stormwater control initiatives necessary for meeting applicable WLAs;
ii. Provide detailed cost estimates for individual projects, programs, controls, and plan implementation;
iii. Evaluate and track the implementation of restoration plans through monitoring or modeling to document the progress toward meeting established benchmarks, deadlines, and stormwater WLAs; and
iv. Develop an ongoing, iterative process that continuously implements structural and nonstructural restoration projects, program enhancements, new and additional programs, and alternative BMPs where EPA approved TMDL stormwater WLAs are not being met according to the benchmarks and deadlines established as part of the County's watershed assessments.

Further, the permit requires continual outreach to the public regarding the development of its watershed assessments and restoration plans and requires public participation in the TMDL process (permit section IV.E.3.a-d).

The permit requires an annual progress report presenting the assessment of the NPDES stormwater program based on the fiscal year. A TMDL assessment report to include complete descriptions of the analytical methodology used to evaluate the effectiveness of the County's restoration plans and how these plans are working to achieve compliance with EPA approved TMDLs is a component of the annual report. The assessment will include: estimated net change in pollutant load reductions from water quality improvement projects; a comparison of the net change to targets, deadlines, and applicable WLAs; cost data for completed projects; cost estimates for planned projects; and a description of a plan for implementing additional actions if targets, deadlines, and WLAs are not being met (permit section IV.E.4.a-e).

Impervious Surface Permit Requirements

The County's permit requires implementation of restoration efforts for 20% of the County's impervious surface area that has not already been restored to the maximum extent practicable (MEP) (permit section (IV.E.2.a). Though projects and strategies outlined in this plan will certainly add treatment of impervious surfaces, accounting for impervious treatment is not included in this report.

3 Causes and Sources of Impairment (a)

3.1 Impairments

Elevated levels of sediment currently impair the Patapsco LNB watershed as evident through the 303(d) listings and local TMDL requirement. Sediment, both from upland and in-stream sources, can impact in-stream habitat by covering and filling gravelly and rocky substrate, which is a preferred substrate habitat for some aquatic organisms (fish and benthic community) and necessary for some fish species for spawning. Finer clays, silts and sands associated with sediment as a pollutant are more mobile and transient and provide less liveable space for more sensitive benthic macroinvertebrate species by filling the interstitial spaces between larger substrate particles in the channel bottom. Increases in sediment loads in channels that cannot adequately transport the load can lead to deposition and aggrading streams. These factors often negatively impact channel flow, causing additional erosion and increases in flooding, particularly if road crossing capacity is limited by sediment accumulation. Suspended sediment in the water column may limit light penetration and prohibit healthy propagation of algae and submerged aquatic vegetation. Suspended sediments can cause gill abrasion in fish and can limit clarity which impacts aquatic species that rely on sight for feeding.

3.2 Sources

The majority of sediment loads in the Patapsco LNB originate from urban stormwater runoff from development and in-stream sources related to channel erosion.

3.2.1 Urban Stormwater Runoff

The contribution of urban stormwater to sediment loading was analyzed in the Patapsco Non-Tidal Watershed Assessment (Anne Arundel County, 2011). Figure 5 presents the annual total suspended solids runoff load as the relative quantity of sediment contributed from each subwatershed (i.e., lowest to highest). The water quality model used for the assessment was based on EPA's Simple Method (Schueler, 1987) and PLOAD models (EPA, 2001) using event mean concentrations (EMCs) for each LULC type. The results presented here are only the sediment associated with runoff, and do not reflect in-stream sources. The most significant contributing LULC categories related to urban stormwater in terms of loading rates include airport, transportation, and commercial and industrial areas. Residential development, while a lower loading rate, makes up a large portion of the watershed (26.1%) and is therefore also a significant contributor.

Subwatersheds contributing the lowest amount of existing sediment loads include PN5, PN6, and PNA followed by PN2 and PN7. Subwatersheds contributing the highest amount of existing sediment loads include PN1, PN8, and PN9 and to a lesser extent, subwatersheds PN3, PN4, PNB, and PNC. Management measures targeted in subwatersheds with high existing sediment loads will be the priority of this restoration plan to ensure required reductions are achieved and maintained.

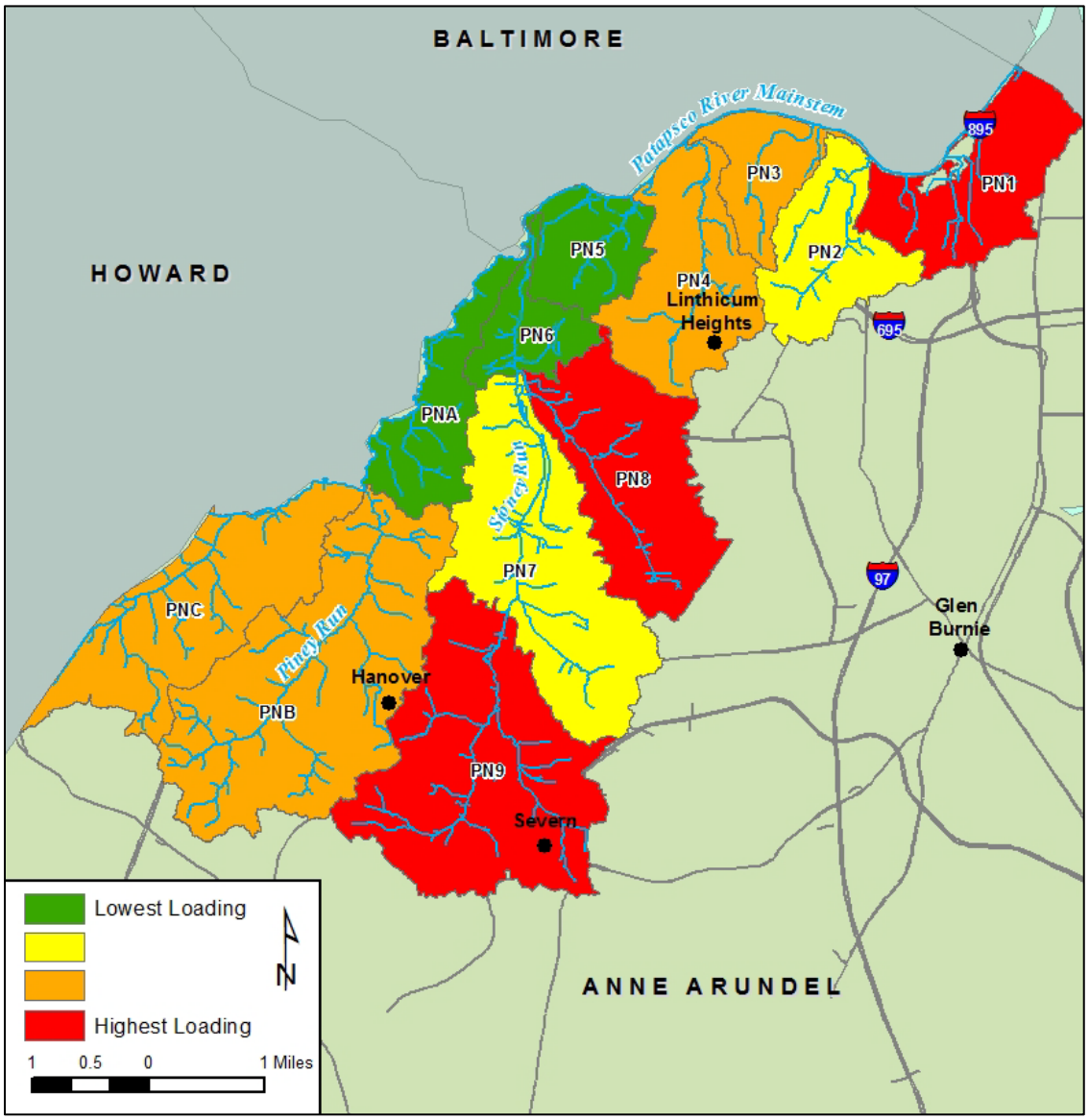


Figure 5: Total Suspended Solids Load from Runoff Based on Existing Conditions - Includes BMP Reductions

3.2.2 In-stream Sources

Although channel bed and bank erosion occurs naturally as streams work to maintain a state of dynamic equilibrium, excessive erosion can occur due to increased stream velocities associated with development activities that increase imperviousness within the watershed. Channel erosion can deliver excessive pollutants, such as sediment and phosphorus, downstream, where water quality can be impacted and important habitat for fish spawning and benthic invertebrates can be smothered. Excessive erosion can also threaten the stability of other nearby built infrastructure. The Biological Stressor Identification Analysis (BSID; MDE, 2012c) for the Patapsco LNB has determined that biological communities in this watershed are likely degraded due to flow/sediment related stressors. These stressors often result from altered hydrology and increased runoff from impervious area, specifically from channel erosion and subsequent elevated suspended sediment transport through the watershed. Thus, suspended sediment was identified as a probable cause and confirmed the 2008 Category 5 listing for total suspended sediment as an impairing substance in this watershed.

Approximately 96 miles of streams were assessed, and characterized for the Patapsco Non-Tidal Watershed Assessment (Anne Arundel County, 2011). Collected data included stream classifications, physical habitat condition assessment, inventory of infrastructure and environmental features, habitat scores, channel geomorphology, road crossing flood potential, bioassessments, and aquatic resource indicators. Within each perennial reach, channel erosion was assessed and scored based on severity. A score of 5 was considered Moderate impact, a score of 7 was considered Severe, and a score of 10 was considered an Extreme condition. A total of 225 erosion locations impacting approximately 22,000 linear feet of stream reaches were cataloged in the Patapsco LNB with the majority of points scored as moderate or severe erosion (Table 6 and Table 7). Over half of the erosion sites were located in Piney Run (PNB), Deep Run (PNC), and portions of the Patapsco Mainstem (PN5).

Table 6: Erosion Inventory and Severity per Subwatershed (Anne Arundel County, 2011)

Subwatershed and stream miles		Number of Erosion Impacts			Total
		5	7	10	
PN1	6.6	3	2		5
PN2	4.6		5		5
PN3	4.3		2		2
PN4	6.2	2	6		8
PN5	5.4	18	17	2	37
PN6	4.0	6	7		13
PN7	10.6	10			10
PN8	6.0	17	4		21
PN9	12.3	21	6		27
PNA	7.4	6	4		10
PNB	17.4	18	27	1	46
PNC	11.4	26	15		41
Total number per rating		**127**	**95**	**3**	
Total number per type		**225**			

Gray =<5 sites | Green = 5-10 sites | Yellow = 11-20 sites | Orange = 21-50 sites

Table 7: Linear Feet of Erosion per Subwatershed (Anne Arundel County, 2011)

Subwatershed	Erosion Impacts and Linear Feet			Total Linear Feet
	5	7	10	
PN1	650	470	0	1,120
PN2	0	225	0	225
PN3	0	130	0	130
PN4	120	290	0	410

Subwatershed	Erosion Impacts and Linear Feet			Total Linear Feet
	5	7	10	
PN5	1,555	1,440	125	3,120
PN6	465	180	0	645
PN7	705	0	0	705
PN8	2,370	180	0	2,550
PN9	1,200	695	0	1,895
PNA	1,580	255	0	1,835
PNB	1,495	4,060	40	5,595
PNC	2,240	1,570	0	3,810
Total	**12,380**	**9,495**	**165**	**22,040**

An assessment of channel geomorphology utilizing Rosgen Level I geomorphic classifications was also administered for each single-threaded, perennial reach throughout the watershed as part of the Patapsco Non-Tidal Watershed Assessment (Anne Arundel County, 2011). An assessment of channel geomorphology is useful to better understand the stability of a stream and its associated behaviors including channel entrenchment. The Rosgen classification system has four levels. The Level I classification is a geomorphic characterization that groups streams as Types A through G based on aspects of channel geometry, including water surface slope, entrenchment, width/depth ratio, and sinuosity. Over one-third of the perennial reaches assessed were classified as entrenched and incised F and G stream types (23.3% and 12.4%, respectively). "F" stream types can develop very high bank erosion rates, significant bar deposition and accelerated channel aggradation and/or degradation while providing for very high sediment supply and storage capacities (Rosgen, 1996). Similarly, "G" stream types also have very high bank erosion rates and a high sediment supply and generate high bedload and suspended sediment transport rates (Rosgen, 1996).

3.3 Anticipated Growth

The Anne Arundel County General Development Plan was finalized April 2009 and was adopted in October 2009 (Bill No. 64-09; Anne Arundel County, 2009). The next update of the plan is due by 2019. Anne Arundel County is considered one of the fastest growing counties in the region with 14.6% population growth (427,239 to 489,656 persons) over 1990-2000 compared to 6.9% growth in the Baltimore region and 10.8% growth throughout the State of Maryland (Anne Arundel County, 2009). The population in Anne Arundel County is projected to increase to 564,925 persons by 2025, which is an increase of 15.4% from 2000 data and to 579,137 persons by 2035, an increase of 18.3% from 2000 data.

The primary developed areas located in Patapsco LNB watershed are Hanover, Severn, and Linthicum Heights which include Baltimore-Washington International Airport and various commercial developments, specifically Arundel Mills Mall. The majority of the Patapsco LNB is a part of the County's Priority Funding Areas which are areas where the County directs new growth. Anne Arundel County continues to utilize strategies such as promoting low impact development and implementing stormwater BMPs for water quality treatment. However, increased urban stormwater related loads will inevitably occur as growth continues.

To account for growth and increases in urban stormwater loads over time, an analysis was completed using a combination of MAST modeled loading estimates, and estimates based on recent growth

patterns. Figure 6 shows initial conditions loads without BMPs as modeled in MAST (grey bars) at the Patapsco LNB 8-digit subwatershed scale as well as projected loads with (blue bars) and without (orange bars) the application of stormwater BMPs to the maximum extent practicable (SW to the MEP). Projected loads were calculated by applying the average percent change observed between MAST loading results from 2010 through 2015 (2.1%) to loads of the previous year. In this manner a 2.1% annual increase in loads would be expected from 2015 to 2025 if development were to occur at the same rate and be implemented without BMPs. Because in actuality new development will follow Maryland's stormwater regulations, the resultant loading increases were reduced by 90% based on the MAST removal rates for sediment treated by stormwater treatment to the maximum extent practicable (SW to the MEP). The results are shown as the blue bars in Figure 6. Additional projected loads without the application of SW to the MEP sediment removal rates are shown as the orange bars in Figure 6.

Projected loading in 2025 with the application of SW to the MEP, will be incorporated in TMDL modeling efforts to account for growth in the watershed.

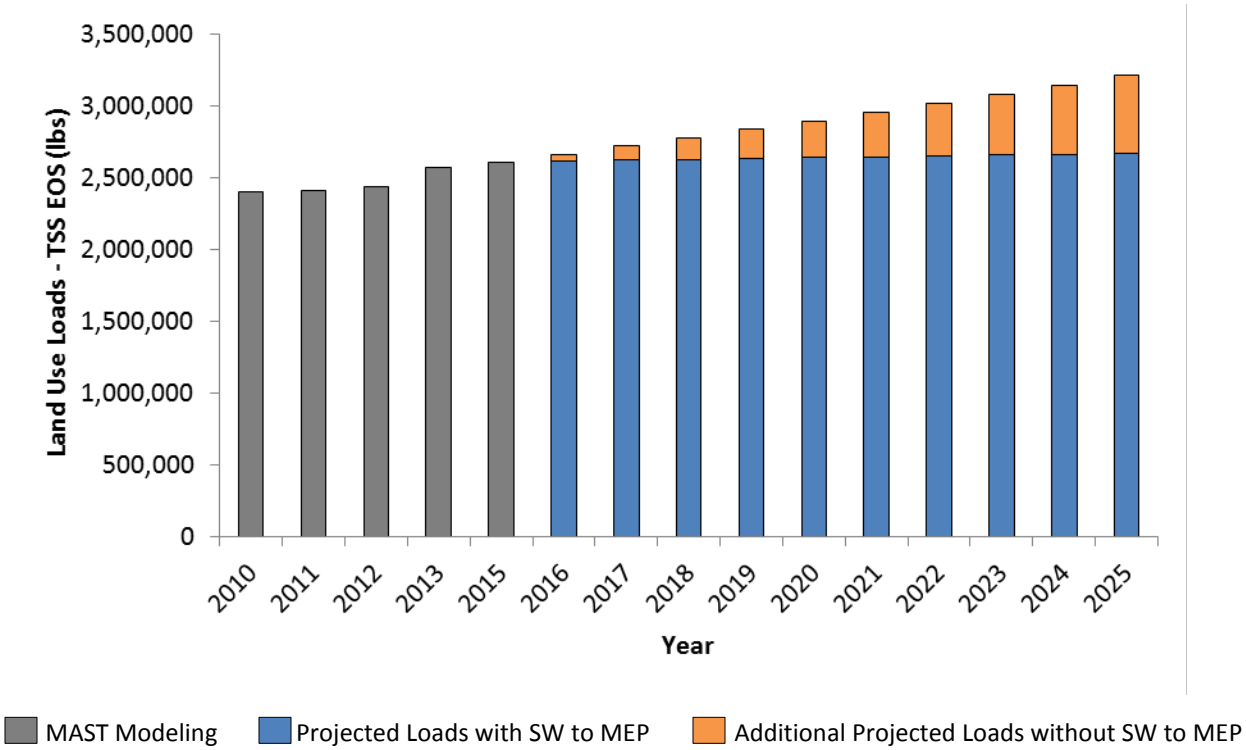


Figure 6: Modeled and Projected Land Use Loads

Figure 7 depicts sediment runoff loading by subwatershed based on a future conditions modeling scenario with the implementation of projects funded in the County's Capital Improvement Program (CIP) as recommended in the Patapsco Non-Tidal Watershed Assessment (Anne Arundel County, 2011) and discussed further in Section 4: Management Measures. In general, future sediment loading is projected to be highest in the headwater systems of Deep Run (PNC), Piney Run (PNB), and Stoney Run (PN7, PN8, PN9) which drain Hanover, Severn, and Baltimore-Washington International Airport.

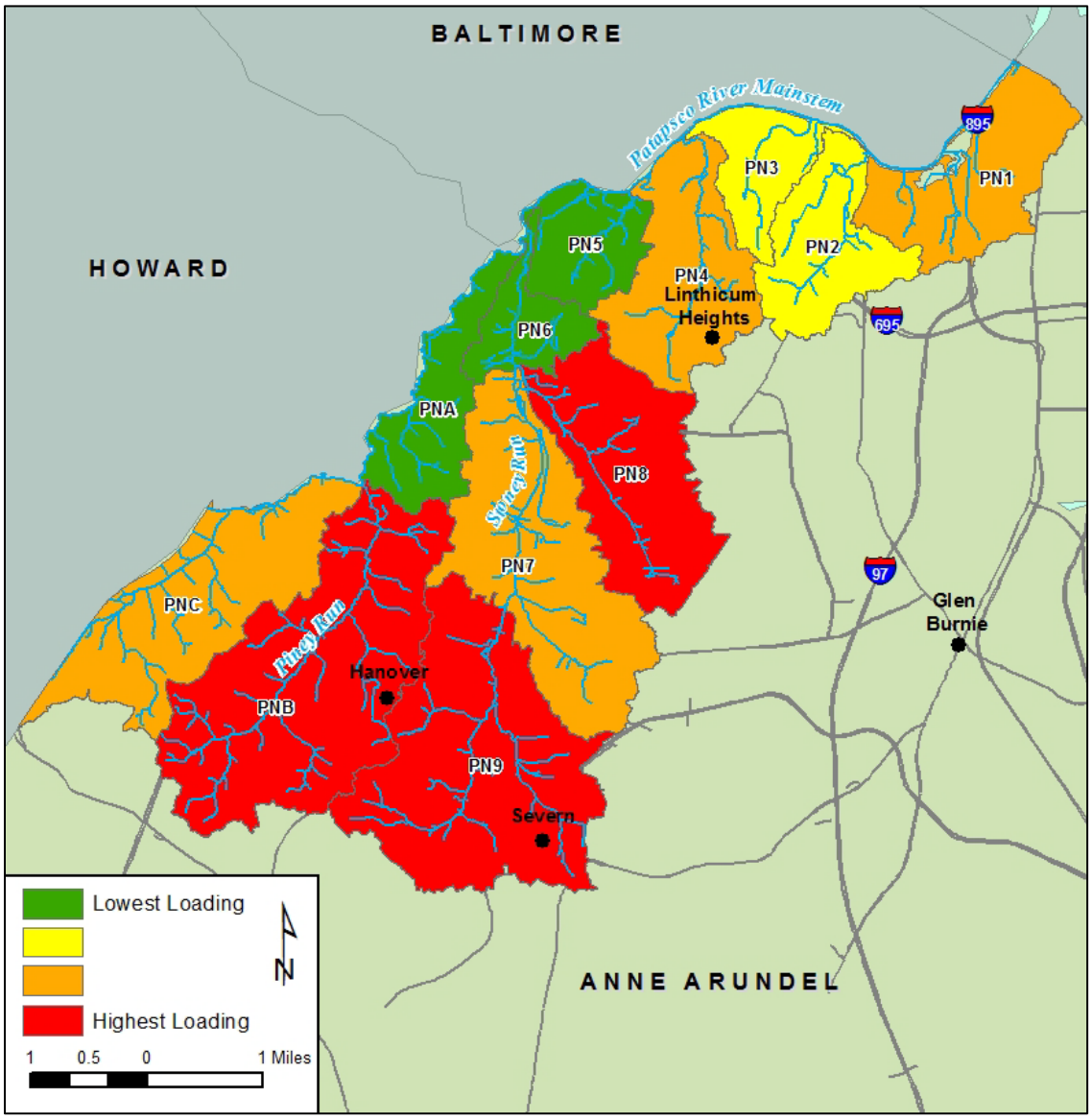


Figure 7: Total Suspended Solids Loads from Runoff Based on Future Conditions - Includes BMP Reductions

4 Management Measures (c)

Best management practices (BMPs) are either already implemented or are planned for implementation to achieve and maintain the Patapsco LNB local TMDL load reductions. This section serves to describe the types of BMPs and management measures being implemented in the watershed. Load reductions that result from these measures are discussed in the following section, Section 5: Expected Load Reductions.

4.1 Modeling Approach

Each BMP provides a reduction for nitrogen, phosphorus, and sediment, along with other pollutants. The pollutant load for the Patapsco LNB watershed was determined using MAST, which calculates pollutant loads and reductions calibrated to the Chesapeake Bay Program Partnership Watershed

Model. MAST, created by Devereux Environmental Consulting for MDE, is a web-based pollutant load estimating tool that streamlines environmental planning. Users specify a geographic area (e.g. County, watershed) and then select BMPs to apply on that area. MAST builds the scenario and provides estimates of pollutant load reductions and allows users to understand which BMPs provide the greatest load reduction benefit and the extent to which these BMPs can be implemented. Based on the scenario outputs, users can refine their BMP choices in their planning. MAST facilitates an iterative process to determine if TMDL allocations are met. Scenarios may be compared to each other, to TMDL allocations, or to the amount of pollutants reduced by current BMP implementation.

MAST estimates of load reductions for point and nonpoint sources include: agriculture, urban, forest, and septic loading. Load reductions are not tied to any single BMP, but rather to a suite of BMPs working in concert to treat the loads. Both MAST and the Watershed Model calculate reductions from all BMPs as a group, much like a treatment train. Reductions are processed in order, with land use change BMPs first, load reduction BMPs next, and BMPs with individual effectiveness values at the end. The overall the load reduction can vary depending on which BMPs are implemented.

Pollutant load reductions achieved by maintenance efforts (e.g., street sweeping and inlet cleaning) are calculated outside of MAST. As discussed in the following section 4.2: Best Management Practices, street sweeping and inlet cleaning will be practiced in the Patapsco LNB watershed. Sediment reduction credit for street sweeping and inlet cleaning is calculated following methods described in MDE (2014b). Vacuum-assisted street sweeping at a rate of 2 times per month reduces the load on the swept area by 25%. Inlet cleaning receives credit based on the mass of material collected, at the rate of 420 lb TSS per ton of wet material.

Both the Watershed Model and MAST provide loads at two different scales: Edge-of-Stream (EOS) and Delivered (DEL). Delivered loads show reductions based on in-stream processes, such as nutrient uptake by algae or other aquatic life. This TMDL plan focuses on reducing load on the land, so EOS estimates are more appropriate and were used for all the modeling analysis.

This section presents the level of BMP implementation. Section 9 presents information on how progress toward load reductions will be evaluated and management plans adapted on an on-going basis.

4.2 Best Management Practices

Many stormwater BMPs address both water quantity and quality, however, some BMPs are more effective at reducing sediment than others. The stormwater practices listed below keep the focus on “green technology” to reduce the impacts of stormwater runoff from impervious surfaces. These BMPs were selected specifically for three reasons: 1) effectiveness for water quality improvement, 2) willingness among the public to adopt, and 3) implementable in multiple facility types without limitations by zoning or other controls.

These practices are consistent with those currently being implemented by Anne Arundel County DPW as water quality improvement projects. The County has the technical expertise, operational capacity, and system resources in place to site, design, construct and maintain these practices.

The recommended practices are also consistent with those proposed in the County’s Phase II WIP for the Chesapeake Bay TMDL and in the County’s comprehensive watershed planning efforts. Exceptions to this are dry ponds which include dry detention ponds and dry extended detention ponds. These

practices are no longer considered for future implementation; however, there are many existing facilities that are still actively treating runoff throughout the County so they are described here as well. The practices include:

- **Bioretention** — An excavated pit backfilled with engineered media, topsoil, mulch, and vegetation. These are planting areas installed in shallow basins in which the storm water runoff is temporarily ponded and then treated by filtering through the bed components, and through biological and biochemical reactions within the soil matrix and around the root zones of the plants. Rain gardens may be engineered to perform as a bioretention.
- **Bioswales** —An open channel conveyance that functions similarly to bioretention. Unlike other open channel designs, there is additional treatment through filter media and infiltration into the soil.
- **Dry Detention Ponds** – Depressions or basins created by excavation or berm construction that temporarily store runoff and release it slowly via surface flow MAST modeling includes hydrodynamic structures in this category. These devices are designed to improve quality of stormwater using features such as swirl concentrators, grit chambers, oil barriers, baffles, micropools, and absorbent pads to remove sediments, nutrients, metals, organic chemicals, or oil and grease from urban runoff.
- **Dry Extended Detention Ponds** - Depressions created by excavation or berm construction that temporarily store runoff and release it slowly via surface flow or groundwater infiltration following storms. They are similar in construction and function to dry detention basins, except that the duration of detention of stormwater is designed to be longer, allowing additional wet sedimentation to improve treatment effectiveness.
- **Impervious Surface Reduction** - Reducing impervious surfaces to promote infiltration and percolation of runoff storm water. Disconnection of rooftop and non-rooftop runoff, rainwater harvesting (e.g., rain barrels), and sheetflow to conservation areas are examples of impervious surface reduction.
- **Infiltration** — A depression or trench to form a shallow basin where sediment is trapped and stormwater infiltrates into the soil. No underdrains are associated with infiltration basins and trenches, because by definition these systems provide complete infiltration. Design specifications require infiltration basins and trenches to be built in good soil; they are not constructed on poor soils, such as C and D soil types. Yearly inspections to determine if the basin or trench is still infiltrating runoff are planned. Dry wells, infiltration basins, infiltration trenches, and landscaped infiltration are all examples of this practice type.
- **Outfall Enhancement with Step Pool Storm Conveyance (SPSC)** – The SPSC is designed to stabilize outfalls and provide water quality treatment through pool, subsurface flow, and vegetative uptake. The retrofits promote infiltration and reduce stormwater velocities. This strategy is modeled in MAST as bioswales.
- **Permeable Pavement -** Pavement or pavers that reduce runoff volume and treat water quality through both infiltration and filtration mechanisms. Water filters through open voids in the pavement surface to a washed gravel subsurface storage reservoir, where it is then slowly infiltrated into the underlying soils or exits via an underdrain.
- **Stream Restoration -** Stream restoration in urban areas is used to restore the urban stream ecosystem by restoring the natural hydrology and landscape of a stream, help improve habitat and water quality conditions in degraded streams.
- **Stormwater Retrofits –** Anne Arundel County plans to construct a variety of retrofits throughout the County. Stormwater retrofits may include converting dry ponds, dry extended detention

ponds, or wet extended detention ponds into wet pond structures, wetlands, infiltration basins, or decommissioning the pond entirely to install SPSC (step pool storm conveyance).

- **Urban Filtering** - Practices that capture and temporarily store runoff and pass it through a filter bed of either sand or an organic media. There are various sand filter designs, such as above ground, below ground, perimeter, etc. An organic media filter uses another medium besides sand to enhance pollutant removal for many compounds due to the increased cation exchange capacity achieved by increasing the organic matter. These systems require yearly inspection and maintenance to receive pollutant reduction credit.
- **Urban Tree Plantings** - Urban tree planting is planting trees on urban pervious areas at a rate that would produce a forest-like condition over time. The intent of the planting is to eventually convert the urban area to forest. If the trees are planted as part of the urban landscape, with no intention to covert the area to forest, then this would not count as urban tree planting
- **Wet ponds or wetlands** — A water impoundment structure that intercepts stormwater runoff then releases it at a specified flow rate. These structures retain a permanent pool and usually have retention times sufficient to allow settlement of some portion of the intercepted sediments and attached pollutants. Until 2002 in Maryland, these practices were generally designed to meet water quantity, not water quality objectives. There is little or no vegetation within the pooled area nor are outfalls directed through vegetated areas prior to open water release. Nitrogen reduction is minimal, but phosphorus and sediment are reduced.

The measured effectiveness for each of these practices may be found in Table 8.

Table 8: Typical Sediment Reduction from Stormwater BMPs

BMP	Sediment Reduction
Bioretention	55 – 80%
Bioswales	80%
Dry Detention Ponds	10%
Dry Extended Detention Ponds	60%
Impervious Surface Reduction*	-
Infiltration	95%
Outfall Enhancement with SPSC**	80%
Permeable Pavement	85%
Stream Restoration	15.13 lbs/linear ft
Urban Filtering	80%
Urban Tree Plantings*	-
Wet Ponds or Wetlands	60%

Sources: Simpson and Weammert, 2009; and Maryland Assessment Scenario Tool (MAST) documentation
* Calculated as a land use change to a lower loading land use
**Outfall enhancement with SPSC modeled as bioswales in MAST

Along with the structural BMPs listed above, treatment will also be provided through non-structural measures. These are treatments that rely on programs that continue throughout the year and are repeated annually.

- **Inlet Cleaning -** Storm drain cleanout practice ranks among the oldest practices used by communities for a variety of purposes to provide a clean and healthy environment, and more

recently to comply with their NPDES stormwater permits. Sediment reduction credit is based on the mass of material collected, at the rate of 420 lb TSS per ton of wet material (MDE, 2014b).

- **Street sweeping** — Starting Fiscal Year 2015, Anne Arundel County has enhanced their street sweeping program which includes additional sweeping curb-miles within the Patapsco LNB (Anne Arundel County DPW, 2015). This enhanced program targets impaired watersheds and curbed streets that contribute trash/litter, sediment, and other pollutants. For full credit by MDE, street sweeping should occur twice a month or 26 times a year on urban streets. This frequent sweeping of the same street will reduce nitrogen and phosphorus as well as sediment. Under the enhanced street sweeping program, Anne Arundel County is sweeping arterial streets within the Patapsco LNB watershed on a bi-weekly basis (26 times a year) and collector and local streets on a monthly basis (12 times a year). Vacuum-assisted street sweeping at a rate of 2 times per month reduces the load on the swept area by 25%. In order to quantify sediment load reductions from monthly sweeping efforts, the removal rate of 22% for vacuum-assisted monthly sweeping was applied to total sediment collected from collector and local streets (CWP, 2008).

4.3 Offsetting Sediment Loads from Future Growth

Growth and development is expected to occur throughout Anne Arundel County, and depending on when and where this growth occurs, pollutant loading from urban stormwater sources may also increase. It is anticipated that new development will make use of ESD stormwater treatment according to MDE's Stormwater Regulations.

Maryland's 2007 Stormwater Management Act went into effect in October of 2007, with resulting changes to COMAR and the 2000 Maryland Stormwater Design Manual in May of 2009. The most significant changes relative to watershed planning are in regard to implementation of ESD. The 2007 Act defines ESD as "using small-scale stormwater management practices, nonstructural techniques, and better site planning to mimic natural hydrologic runoff characteristics and minimize the impact of land development on water resources." As such Anne Arundel County has updated Articles 16 and 17 of the County Code to incorporate the requirements for ESD. Anne Arundel County finalized the *Anne Arundel County Stormwater Management Practices and Procedures Manual* to incorporate criteria specific to the County that are not addressed within the Maryland Design Manual (Anne Arundel County, 2010).

Figure 6 in Section 3.3: Anticipated Growth shows projected land use loads with and without the application of stormwater treatment. TMDL modeling efforts include the application of SW to the MEP to represent ESD treatment for new development in the watershed. SW to the MEP will control 90% of sediment loads for that new development; therefore the plan is to address the residual 10% of the load that is uncontrolled.

5 Expected Load Reductions (b)

WLAs in the sediment TMDL were developed using the Chesapeake Bay Program Phase 5 (CBP P5) watershed model. Currently, MAST is using a computational framework that is compatible with an updated version of the model: CBP P5.3.2. Because the TMDL was developed under an older version of the model, the TMDL WLA needed to be translated into a MAST-compatible target load. In order to do this, the 2005 baseline sediment load was re-calculated in MAST with the 8-digit county split geography (Patapsco LNB 02130906, Anne Arundel County). The required reduction percent assigned to the Anne

Arundel County Phase I MS4 source (22.2%) in the local TMDL regulation was then applied to the new baseline load to calculate required sediment reduction. The required sediment reduction was then subtracted from the new baseline load to calculate the MAST-compatible target TMDL WLA. Sediment loads required for the Patapsco LNB Anne Arundel County Phase I MS4 source are shown in Table 9.

Table 9: Sediment Loads Required for the Patapsco River Lower North Branch Local TMDL Anne Arundel County Phase I MS4 Source

2005 Baseline Load (lbs/yr)	Required Reduction %	Required Reductions (lbs/yr)	TMDL Load Allocation (lbs/yr)
2,032,381	22.2%	451,189	1,581,193

5.1 2013 Progress – Actual Implementation

Anne Arundel County maintains an extensive geodatabase of urban stormwater BMP facilities and water quality improvement projects (WQIP). Approximately 2,850 acres of County Phase I MS4 land has been treated through 2013 in addition to 650 linear feet of stream restoration and other non-structural BMPs (source: WPRP urban BMP and WQIP database, 2014). Current BMP implementation through 2013 in the Patapsco LNB is shown in Table 10.

Table 10: Current BMP Implementation through 2013 for Patapsco River Lower North Branch

BMP	Unit	2013 Current Implementation
Bioretention	acre	40.1
Bioswale	acre	27.6
Dry Ponds	acre	317.1
Extended Detention Dry Ponds	acre	763.3
Impervious Surface Reduction	acre	8.9
Infiltration	acre	483.8
Inlet Cleaning	no. of inlets	213
Outfall Enhancement with SPSC	acre	46.9
Permeable Pavement	acre	2.0
Stormwater Retrofits[1]	acre	76.7
Street Sweeping[2]	curb-miles	29.6
SW to the MEP	acre	18.8
Urban Filtering	acre	219.0
Urban Tree Plantings	acre	1.4
Urban Stream Restoration	linear feet	650.0
Wet Ponds or Wetlands	acre	926.5

Source: WPRP urban BMP and WQIP database

[1]Includes projects that will convert dry ponds into wet ponds. Stormwater retrofits are modeled by decreasing acreage for dry ponds and increasing acreage for wet ponds.

[2]Streets swept monthly in 2013

2013 Progress results are shown in Table 11. **The implementation of 2013 Progress BMPs listed in Table 10 have achieved sediment loads that meet the requirement of the local TMDL.**

Table 11: 2013 Progress Reductions Achieved

Baseline Load and TMDL WLA	TSS-EOS lbs/yr
2005 Baseline Scenario Load	2,032,381
Required Percent Reduction	22.2%
Required Reduction	451,189
Local TMDL WLA	1,581,193
2013 Progress Results	**TSS-EOS lbs/yr**
2013 Progress Scenario Load	1,214,022
2013 Progress Reduction Achieved	818,359
2013 Percent Reduction Achieved	40.3%

5.2 Planned Implementation

Table 12 compares implementation of existing BMPs with planned levels of implementation. This increase in implementation will continue to achieve the loads required in the local TMDL and ensure that future growth (through 2025) is treated. These loads meet the TMDL required reductions for the Patapsco LNB (Table 13).

Figure 8 shows baseline and progress loads (green bars) and planned loads (yellow bars) compared to milestone goal loads (red bars and red line) and background land use loads (grey bars). As discussed in Section 3.3: Anticipated Growth, initial conditions loads (2011 – 2015) without BMPs were modeled in MAST at the Patapsco LNB 8-digit subwatershed scale. To account for growth and increases in loads over time, loads were projected (2017 – 2025) with the application of SW to the MEP. This comparison shows that all background loads will be treated to the required TMDL allocated load with current and future BMP implementation.

Table 12: BMP Implementation - Current 2013 and Planned 2025 Levels for the Patapsco River Lower North Branch

BMP	Units	2013 Current Implementation	2025 Planned Implementation
Bioretention	acre	40.1	-
Bioswale	acre	27.6	
Dry Ponds	acre	317.1	-
Extended Detention Dry Ponds	acre	763.3	-
Impervious Surface Reduction	acre	8.9	-
Infiltration	acre	483.8	-
Inlet Cleaning	no. of inlets	213	213
Outfall Enhancement with SPSC	acre	46.9	618.1
Permeable Pavement	acre	2.0	-

BMP	Units	2013 Current Implementation	2025 Planned Implementation
Stormwater Retrofits[1]	acre	76.7	124.7
Street Sweeping[2]	curb-miles	29.6	40.2
SW to the MEP	acre	18.8	-
Urban Filtering	acre	219.0	-
Urban Tree Plantings	acre	1.4	-
Urban Stream Restoration	linear feet	650.0	-
Wet Ponds or Wetlands	acre	926.5	-

[1]Includes projects that will convert dry ponds into wet ponds. Stormwater retrofits are modeled by decreasing acreage for dry ponds, dry extended detention ponds or wet extended detention ponds and increasing acreage for wet ponds.

[2]Streets swept monthly in 2013. 2025 Planned includes curb-miles for arterial, collector, and local streets. Arterial streets swept bi-weekly (26 times a year) and collector and local streets swept monthly (12 times a year)

Table 13: 2025 Planned Reductions

Baseline Load and TMDL WLA	TSS-EOS lbs/yr
2005 Baseline Scenario Load	2,032,381
Required Percent Reduction	22.2%
Required Reduction	451,189
Local TMDL WLA	1,581,193
2025 Planned Results	**TSS-EOS lbs/yr**
2025 Planned Load[1]	1,091,074
2025 Planned Reduction Achieved	941,307
2025 Percent Reduction Achieved	46.3%

[1]2025 Planned load includes additional projected land use loading from new development through 2025. It is assumed that all new development will be treated with SW to the MEP implementation to achieve 90% sediment removal.

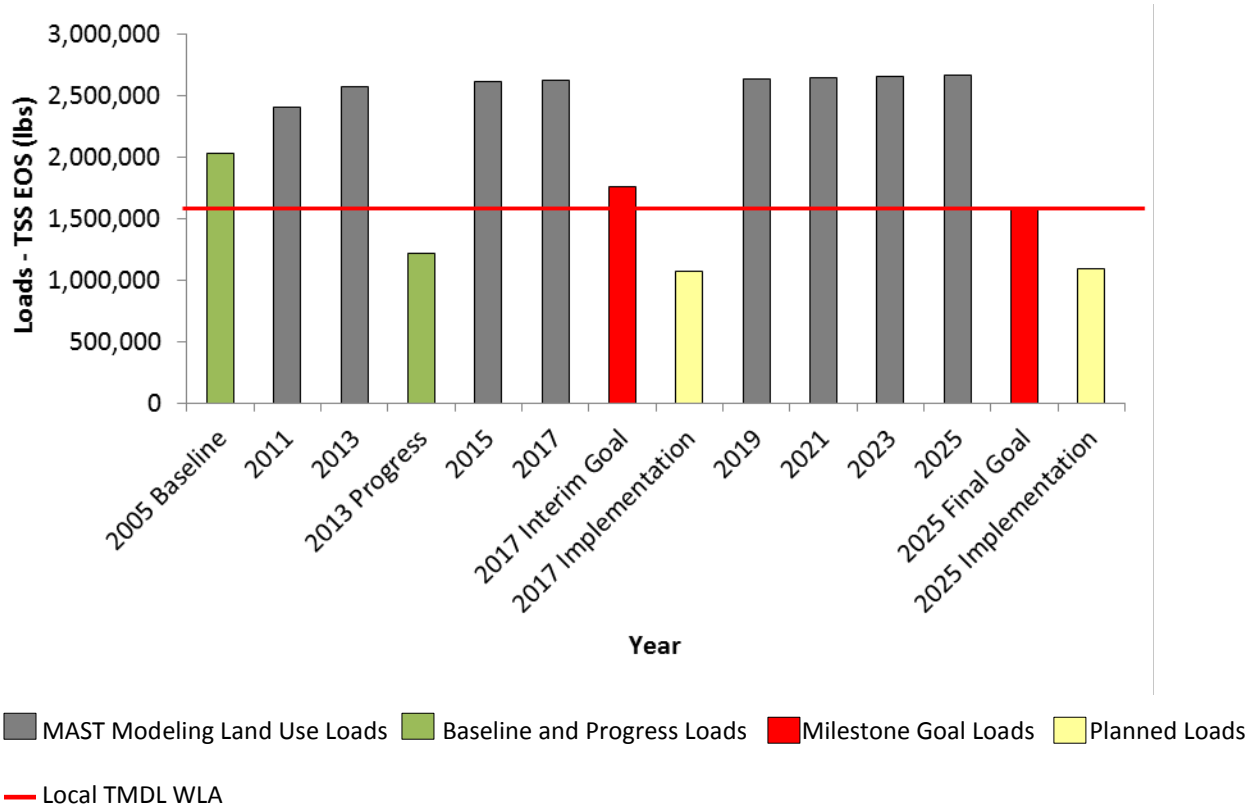


Figure 8: Progress and Planned Reductions in the Patapsco River Lower North Branch

6 Technical and Financial Assistance Needs (d)

Technical Needs

Technical assistance to meet the reductions and goals of a TMDL takes on many forms including MDE assistance to local governments, state and local partner assistance to both MDE and municipalities, and technical consultants contracted to provide support across a wide variety of service areas related to BMP planning and implementation.

MDE has and will provide technical assistance to local governments through training, outreach and tools, including recommendations on ordinance improvements, technical review and assistance for implementation of BMPs at the local level, and identification of potential financial resources for implementation (MDE, 2014b).

Anne Arundel County DPW contracts with consultants through several contract vehicles including open-end task based assignments, to provide a variety of technical services. These services, provided by planners, engineers, environmental scientists and GIS specialists, include watershed assessment and management, stream monitoring, stormwater planning and design, stream restoration design, outfall enhancement with SPSC, and environmental permitting, among others. The County itself has complementary staff in DPW and other County departments to manage contracts, provide review and approval of planning and design work, conduct assessments, and develop and administer planning and progress tracking tools.

Anne Arundel County has many partners that provide outreach to homeowners and communities in the form of technical assistance, education, and funding for implementation of best management practices within local communities. The Watershed Stewards Academy, further discussed in Section 7: Public Participation/Education, routinely engages and informs the public on reducing pollution sources and employing stormwater/rainscaping retrofits to reduce their impacts.

Technical assistance for Public Participation and Education and for Monitoring will also be necessary to fully implement and track progress towards meeting the goals of the local TMDL. These elements are discussed in sections 7 and 10 of this plan.

Financial Needs

The total projected cost to implement the County's CIP projects described in this plan for the Patapsco LNB watershed is $18,192,444 including $14,579,883 towards outfall enhancement with SPSC, $2,010,545 towards stormwater pond retrofits, $426,000 for inlet cleaning, and $1,176,016 for street sweeping. Structural BMP project costs are estimated based on the average cost per pound of nitrogen removed based on a group of completed projects consisting of various BMP types. Since these practices reduce nitrogen and phosphorus as well as sediment, costs derived from this method translate for sediment removal. This approach was used to calculate structural BMP costs in the County's Phase II WIP. Non-structural BMP costs for inlet cleaning and street sweeping were derived from historic County data and include equipment, operations, and maintenance costs.

Table 14 includes a summary of funding need per CIP project BMP type and project phase. Project cost is split throughout the implementation timeframe with design and land ROW estimated costs to occur the first year of the project, construction costs to occur in the second year, and overhead costs split between the first and second year.

Table 14: Patapsco River Lower North Branch Cost Over Milestone Periods

BMP	2014-2015	2016-2017	2018-2019	2020-2021	2022-2025	Total Cost
Outfall Enhancement with SPSC	**$7,884,156**			**$6,695,727**		**$14,579,883**
Design	$800,910			$680,184		$1,481,093
Land ROW	$160,182			$136,037		$296,219
Construction	$6,407,278			$5,441,469		$11,848,747
Overhead	$515,786			$438,038		$953,824
SWM Pond Retrofit	**$1,280,352**	**$730,193**				**$2,010,545**
Design	$204,241					$204,241
Land ROW	$40,848					$40,848
Construction	$931,985	$701,940				$1,633,925
Overhead	$103,278	$28,253				$131,531
Inlet Cleaning	**$85,200**	**$85,200**	**$85,200**	**$85,200**	**$85,200**	**$426,000**
Street Sweeping	**$235,203**	**$235,203**	**$235,203**	**$235,203**	**$235,203**	**$1,176,016**

6.1 Funding Sources

Prior to the passage of Maryland House Bill 987 and, as stated in the Anne Arundel County Phase II WIP (Anne Arundel County, 2012), the County's funding capacity to implement urban stormwater restoration/retrofit projects was limited by the County's Capital Improvement Program (CIP) budget for

environmental restoration and water quality improvement projects. To comply with forthcoming requirements of the Phase I NPDES MS4 permit, and to support restoration efforts towards reducing pollutant loads required for both the Chesapeake Bay TMDL and local TMDLs throughout Maryland, the State Legislature passed a law in 2012 (House Bill 987) mandating that Maryland's 10 largest jurisdictions (those with Phase I MS4 permits), including Anne Arundel County, develop a Watershed Protection and Restoration Program and establish a Stormwater Remediation Fee. To comply with the State legislation, Anne Arundel County passed legislation in 2013, Bill 2-13.

The County's Stormwater Remediation Fee provides a dedicated source of revenue for the implementation of local stormwater management plans through stormwater management practices and stream and wetland restoration activities and is assessed to Anne Arundel County property owners based on the amount of impervious surface on their property. The Stormwater Remediation Fee is structured to provide sufficient funding for projects to meet the pollutant load reduction required by the Chesapeake Bay TMDL, EPA approved individual TMDLs with a stormwater WLA and to meet the impervious surface management requirements as well as other stormwater obligations set forth in the County's NPDES MS 4 Permit. The fee is assessed to Anne Arundel County property owners as a separate line item on the owner's real property tax bill.

In addition to the Stormwater Remediation Fee, Anne Arundel County actively pursues grant funding from Federal, State and non-governmental organizations (NGOs) to leverage funding for its restoration projects. And, with the creation of the Stormwater Remediation Fee, the County has developed a Grant Program to provide funding to local NGOs to facilitate implementation of restoration projects that further the County's ability to meet its regulatory requirements.

7 Public Participation / Education (e)

Anne Arundel County has given numerous public presentations throughout the development of the County's Phase II WIP in order to disseminate information on the Chesapeake Bay TMDL, WIP process, and strategies for meeting the County's assigned pollutant load reductions. In addition to providing a level of understanding to the public, the County uses the presentations as an opportunity to receive input and comment on restoration efforts. Anne Arundel County has a variety of organizations interested in water quality, including Severn River Association; South River Federation; Anne Arundel County Commercial Owners; Anne Arundel Watershed Stewards Academy; Anne Arundel County Chamber of Commerce, Environmental Committee; Leadership Anne Arundel; and, Chesapeake Environmental Protection Association (Anne Arundel County, 2012).

In order to implement an effective strategy to meet water quality standards and achieve pollutant load reduction, an effort to engage a very broad audience of landowners was a necessity. The Anne Arundel Watershed Stewards Academy (AAWSA), a pre-eminent non-profit (501(c)3) environmental organization, was formed through Anne Arundel County Department of Public Works and the County Board of Education's Arlington Echo Outdoor Education Center (Anne Arundel County, 2012). AAWSA's mission is to identify, train, and support citizens to become Master Watershed Stewards who take action with their neighbors to restore local waterways in Anne Arundel County. This program is a unique way to integrate education as a vital element in its role in preservation, conservation and advocacy. There are currently more than 100 certified Master Watershed Stewards throughout Anne Arundel County and adjacent areas.

The AAWSA has extensive resources through the Consortium of Support Professionals which is composed of over 80 governmental, non-profit and business professionals who provide technical assistance to Master Watershed Stewards. Consortium members are experts in their field of conservation, ecology, government laws, landscape architecture, low impact design, water quality monitoring, and watershed assessment and provide consulting on design and development of watershed restoration projects. The AAWSA is also supported by staff that provides day to day guidance to Master Watershed Stewards, connecting Stewards to Anne Arundel County resources, coordinating Stewards certification, post certification professional development, and networking opportunities for Stewards and Consortium of Support Professionals.

The AAWSA has an interactive website (www.aawsa.org) that provides guidance to common water quality problems including information on the following:

- Reduce Your Pollution
    - Practice Bay-Friendly Lawn Care
    - Maintain and Upgrade your Septic System
    - Pick Up Pet Waste
    - Choose Non-Toxic Household Products
    - Maintain your Car and Boat
    - Reduce your Energy Use
- Capture Stormwater
    - Install a Rain Barrel or Cistern
    - Build a Rain Garden
    - Choose to Have Conservation Landscapes
    - Plant Native Trees
    - Direct Water with Swales and Berms
    - Use Permeable Pavers and Pavement
- Clean Up!
    - Invasive Species Removal
    - Dump Site Cleanup
- Conserve and Preserve
    - Land Preservation

These programs and others like them could be more focused on the Patapsco LNB watershed.

In addition to the AAWSA, the following organizations have been identified for possible partnerships and education and outreach for the Patapsco LNB:

- Master Gardeners
- Audubon Society
- Students for the Environment
- Maryland civic associations and service clubs:
    - Maryland Home Builders Assoc.
    - Linthicum-Shipley Improvement Association
    - Audubon Naturalist Society of the Central Atlantic States
    - Audubon Society of Central Maryland
    - Blue Water Baltimore
    - Chesapeake Audubon Society
    - Chesapeake Bay Program

- Chesapeake Bay Foundation
- Chesapeake Bay Trust
- Chesapeake Ecology Center
- Center for Watershed Protection
- Alliance for the Chesapeake Bay
- Alliance for Sustainable Communities
- Baywise Master Gardeners
- Sierra Club – Maryland Chapter
- Magothy River Association
- Patuxent Riverkeeper
- West/Rhode Riverkeeper
- Nature Conservancy
- Smithsonian Environmental Research Center
- Anne Arundel Community College
- University of Maryland
- University of Maryland Extension
- Volunteer Center for Anne Arundel County

WPRP also provides public outreach tools through web and social media platforms. WPRP has developed a comprehensive web-based informational program including a dedicated webpage, Facebook page, and Twitter account to provide information to the public. WPRP's website (www.aarivers.org) offers valuable information on Anne Arundel County watersheds including an interactive clickable map that displays geographically referenced environmental, utility, and land use data in addition to restoration project locations, descriptions, and drainage areas. This outreach platform is also used to notify the public of the opportunity to review and comment on this and other TMDL restoration plans.

8 Implementation Schedule and Milestones (f & g)

This section presents the target loads and the activities required to achieve those targets based on the 2017 interim and 2025 final loads and implementation targets. The following schedule and milestones follows the Chesapeake Bay TMDL milestone date framework (60% progress by 2017) and end date (2025; USEPA, 2010). This schedule has previously been approved by the CBP for the applicable Bay TMDLs and is believed to be a good option for tracking progress towards reduction goals of the Patapsco LNB local TMDL.

8.1 Loading Allocations and Milestone Targets

Planning loads for 2017 and final loads for 2025 for the Patapsco LNB watershed are presented in Table 15 below. As mentioned in Section 5: Expected Load Reductions (b) (see Tables 10 and 11), progress is already underway with the implementation of strategies throughout the watershed. As a result of current implementation efforts, the 2013 Progress sediment load is less than the 2017 Interim Milestone and 2025 TMDL Allocated load.

Table 15: Patapsco River Lower North Branch Planning and Target Loads (edge-of-stream loads)

Load	Sediment Load (lbs/year)
2005 Baseline Load	2,032,381
2013 Progress Load	1,214,022
2017 Interim Milestone (60% of reduction achieved)	1,761,668
2025 TMDL Allocated Load	1,581,193
Percent Reduction between 2005 Baseline and 2025 Loads	22.2%

8.2 Implementation Milestones

To meet the loading allocations and milestones outlined in the previous section, implementation of programs and BMPs must keep pace and meet planned implementation targets. Table 16 details the implementation for each tracked BMP with the associated unit of measure. The 2013 data reflects existing BMPs while the 2017, 2021, and 2025 values reflect the planned implementation within these time periods.

Table 16: Patapsco River Lower North Branch Planning Milestones for Implementation

BMP	Unit	2013 Implemen-tation	2015 Planned	2017 Planned	2021 Planned	2025 Planned
Bioretention	acre	40.1				
Bioswale	acre	27.6				
Dry Ponds	acre	317.1				
Extended Detention Dry Ponds	acre	763.3				
Impervious Surface Reduction	acre	8.9				
Infiltration	acre	483.8				
Inlet Cleaning	no. of inlets/yr	213	213	213	213	213
Outfall Enhancement with SPSC	acre	46.9	312.1		305.9	
Permeable Pavement	acre	2.0				
Stormwater Retrofits[1]	acre	76.7	124.7			
Street Sweeping [2]	curb-miles	29.6	40.2	40.2	40.2	40.2
SW to the MEP	acre	18.8				
Urban Filtering	acre	219.0				
Urban Tree Plantings	acre	1.4				
Urban Stream Restoration	linear feet	650.0				

BMP	Unit	2013 Implemen-tation	2015 Planned	2017 Planned	2021 Planned	2025 Planned
Wet Ponds or Wetlands	acre	926.5				

[1]Stormwater retrofits are modeled by decreasing acreage for dry ponds, dry extended detention ponds or wet extended detention ponds and increasing acreage for wet ponds.
[2]Streets swept monthly in 2013. 2025 Planned includes curb-miles for arterial, collector, and local streets. Arterial streets swept bi-weekly (26 times a year) and collector and local streets swept monthly (12 times a year)

8.3 Implementation Priorities

To meet the loading allocations and milestones outlined in the previous sections, implementation will be planned based on prioritization analyses presented in the Patapsco Non-Tidal Watershed Assessment (Anne Arundel, 2011). Patapsco LNB subwatersheds were prioritized for restoration/retrofit project selection potential using four separate prioritization models. The models integrated historical environmental data, current stream assessment monitoring data, drainage area characteristics (GIS data), and watershed modeling results into indicators of watershed condition and need. The indicators are combined into the four models:

- Stream Reach Restoration
- Subwatershed Restoration
- Subwatershed Preservation
- Parcel Preservation

The models were designed to operate at three management scales, first at the individual stream reach scale, second at the subwatershed scale, and lastly at the parcel scale. Additionally the models differentiated between identification of restoration opportunities for the degraded portions of the watershed (reach and subwatershed scale), and identification of preservation opportunities (subwatershed and parcel scale) for high quality sensitive areas that could be subject to additional stressors in future scenarios. For the purpose of this Restoration Plan, prioritization results for Stream Reach Restoration and Subwatershed Restoration are presented below to address in-stream sources and urban stormwater runoff, respectively.

8.3.1 Stream Reach Restoration

The stream restoration prioritization uses a suite of indicators that are weighted and then combined into a final relative rating for each perennial reach as identified in the Physical Habitat Condition Assessment. The suite of stream restoration indicators used in the Patapsco Non-Tidal watershed, along with the indicator weight is presented in Table 17.

Table 17: Stream Priority Rating Indicators for Restoration (Anne Arundel, 2011)

Category	Indicator	Weight
Stream Habitat	MPHI score	31.6%
Stream Morphology	Rosgen Level I Classification	5.3%
Land Cover	Percent Imperviousness	5.3%
Infrastructure	Riparian buffer impacts	5.3%
	Channel erosion impacts	10.5%

Category	Indicator	Weight
	Head cut impacts	5.3%
	Dumpsite impacts	5.3%
	Other infrastructure impacts (pipes, ditches, stream crossings, obstructions)	15.8%
Hydrology and Hydraulics	Road Crossing Flooding Potential	15.8%

A total of 142 reaches were processed in the stream restoration model. Nine reaches were categorized as "High" priority or worst condition, 31 were "Medium High", 48 were "Medium", and 54 were "Low" priority or best condition (Figure 9). The Deep Run (PNC) subwatershed ranked as a very high priority overall, as seven of the nine "High" reaches are located in Deep Run. The Stoney Run subwatersheds had a combined total of 13 reaches rated in the "Medium High" category.

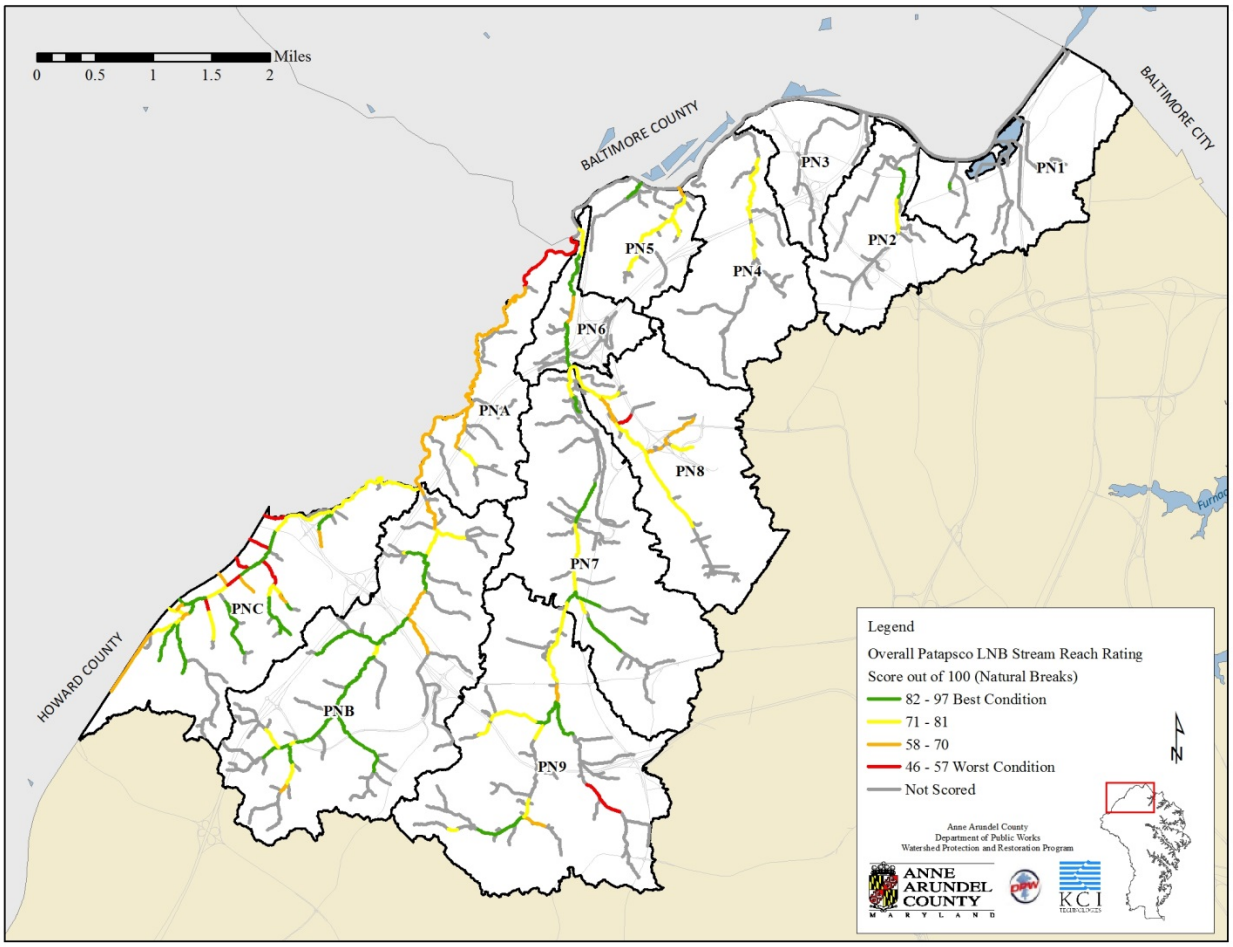


Figure 9: Stream Reach Priorities for Restoration (Anne Arundel County, 2011)

8.3.2 Subwatershed Restoration

Similarly to the stream restoration assessment, the subwatershed assessment used a collection of restoration indicators to assign a rating to each subwatershed. The indicators were weighted and

combined into a single restoration rating for each subwatershed. Restoration indicators fell into one of six categories: stream ecology, TMDL impairments, On-site Disposal Systems (OSDS), BMPs, Hydrologic and Hydraulic (H&H) Modeling, Water Quality, and Landscape. Each category contains one to four different indicators. Table 18 provides a summary of the categories, indicators, and relative weighting assigned by the County.

Table 18: Subwatershed Priority Rating Indicators for Restoration (Anne Arundel, 2011)

Category	Indicator	Weight
Stream Ecology	Final habitat score	8.1%
	Bioassessment score	8.1%
303(d) List	Number of TMDL impairments	8.1%
OSDSs	Nitrogen Loads from septics (lbs)	2.0%
BMPs	Impervious area treated by BMPs (%)	6.4%
H&H (Land and Soils only)	Peak flow from 1-year storm event (cfs/acre)	4.4%
	Peak flow from 2-year storm event (cfs/acre)	4.4%
	Runoff volume from 1-year storm event (inches/acre)	5.6%
	Runoff volume from 2-year storm event (inches/acre)	5.6%
Water Quality (Land only)	Nitrogen load from runoff (lbs/acre/yr)	6.7%
	Phosphorus load from runoff (lbs/acre/yr)	6.7%
	Total Suspended Solids from runoff (Tons/acre/yr)	0.0%
Landscape	Impervious cover (%)	9.3%
	Forest within the 100 ft stream buffer (%)	10.1%
	% of existing wetlands to potential wetlands	9.3%
	Acres of developable critical area	5.2%

The final ratings range from “Lowest Priority for Restoration” to “Highest Priority for Restoration” where “Lowest Priority” indicates that a subwatershed is a low priority for restoration and therefore in good condition whereas “Highest Priority” indicates that a subwatershed should be a priority for restoration. The Patapsco Mainstem Watershed (PN1) was rated the highest priority for restoration. It is also important to focus restoration efforts in subwatersheds that ranked highest for existing TSS loads from urban runoff, which include subwatersheds PN8 and PN9 in addition to PN1 (Figure 5). Four watersheds, PN5, PNA, PN7, and PNC were rated the lowest priorities for restoration (Figure 10).

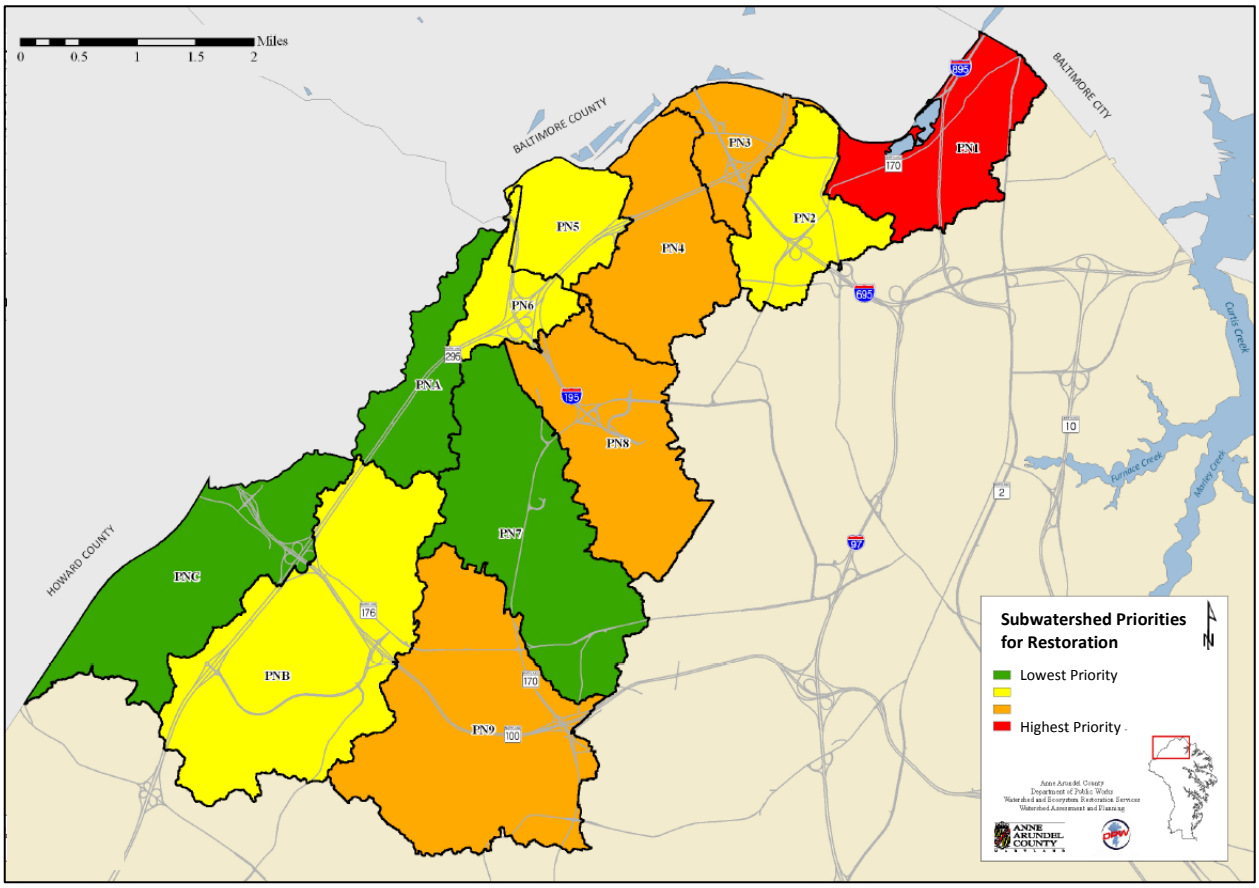


Figure 10: Subwatershed Priorities for Restoration (Anne Arundel County, 2011)

8.3.3 Prioritization of Strategy Implementation

As stated in the Anne Arundel County's Phase II WIP, the County uses three major categories to classify urban stormwater strategies: Core Strategy Tier I, Core Strategy Tier II, and Potential Load Reductions Outside the Tier I and Tier II Core Strategy (Anne Arundel County, 2012). BMP planning and implementation will be prioritized based on these three categories with highest priority given to Tier I and Tier II strategies.

Core Urban Stormwater Strategy Tier I includes the following:

- Restoration of ephemeral and perennial streams with a Department of Natural Resources (DNR) Maryland Biological Stream Survey's (MBSS) Maryland Physical Habitat Index (MPHI) score of severely degraded or degraded,
- Implementing stormwater management treatment at currently untreated major pipe outfalls; and,
- Retrofitting stormwater management ponds built prior to 2002 to optimize the pollutant reduction and ecosystem functions for the facilities

Core Urban Stormwater Strategy Tier II includes additional pollutant reduction activities that must be implemented to meet the 2025 allocations; which includes the following:

- Monthly vacuum assisted street sweeping and associated inlet cleaning for all closed section roads,
- Reforestation plan for available public open space land; and,
- (SW to the MEP retrofits for County-owned properties including recreation areas

Potential Load Reductions Outside the Tier I and Tier II Core Strategies include the following:

- Focuses on the work of private citizens and Watershed Master Stewards in implementing SW to the MEP for residential rooftops, in high density areas, and for private commercial and industrial properties.
- These areas have been selected geographically outside the area treated by the WIP core strategy.

9 Load Reduction Evaluation Criteria (h)

Adaptive management is a critical component of achieving and maintaining the Patapsco LNB TMDL and this restoration plan. The milestones proposed in Section 8: Implementation Milestones (2015, 2017, and 2021) provide interim planning targets. As shown in Section 5.1, as a result of current implementation efforts, the 2013 Progress sediment load is less than the 2017 Interim Milestone and 2025 TMDL Allocated load. Therefore, the planning targets will be used to reevaluate against progress and will be revised, if necessary, to ensure that Anne Arundel County continues to maintain TMDL requirements. Progress evaluation will be measured through three approaches: tracking implementation of management measures, estimating load reductions through modeling, and tracking overall program success through long term monitoring.

9.1 Tracking Implementation of Management Measures

Implementation will be measured by determining whether the targets for implementation shown in Table 16 are maintained according to the milestone schedule presented. Anne Arundel County manages a comprehensive system for adding and tracking projects and accounting for new programs. New BMPs constructed through new development and redevelopment projects are entered into the County's BMP database as they come on line. WPRP is responsible for implementing and tracking Water Quality Improvement Projects (WQIP; i.e., restoration and retrofit projects and programs). Additional internal County groups including Bureau of Highway Road Operation Division who are responsible for maintenance efforts (i.e., street sweeping and inlet cleaning) report back to WPRP. Another way the County is capturing and tracking projects is through the AAWSA. Watershed stewards can enter their own data and implementation projects through the WPRP website (www.aarivers.org). Once these data are reviewed and validated by the County, they are incorporated into the County's master list of environmental restoration projects.

Two-Year Milestone Reporting

As a part of the federal Chesapeake Bay Accountability Framework and in support of Maryland's BayStat accountability system, the County is required to report two-year milestones representing near-term commitments and progress to MDE towards achieving load reduction goals for the Bay TMDL. These efforts will also support local TMDL planning and tracking at the County level.

Milestones are reported in two forms: Programmatic and BMP Implementation. Programmatic milestones identify the anticipated establishment or enhancement of the institutional means that

support and enable implementation. Examples of Programmatic milestones include projected funding, enhancement of existing programs and resources, and the establishment of new programs and studies. The milestone period for Programmatic covers two calendar years – for example, the period for 2014 - 2015 is from January 1, 2014 through December 31, 2015. BMP Implementation milestones are a quantitative account of various types of restoration activities (e.g., structural BMPs, stream restoration, maintenance efforts), which have geo-located coordinates. The period for BMP implementation milestones differs from the Programmatic milestones period and covers two state fiscal years – for example, the period for 2014 – 2015 is from July 1, 2013 through June 30, 2015. Planned BMP Implementation milestones reported to MDE include the action (e.g., BMP type), proposed restoration over the 2-year milestone period (e.g., area treated, length restored), actual rate of implementation over 1 year, and percent progress.

The Programmatic and BMP Implementation milestone submittal and reporting process follows an iterative approach and includes three separate submittals to MDE. The first is an initial milestone submittal to MDE by January 31st of the first milestone calendar year (e.g., 2014), followed by an interim milestone progress report submittal by January 31st of the second milestone calendar year (e.g., 2015), and concluding with a final milestone progress submittal by January 31st of the start of the subsequent milestone period (e.g., 2016).

Annual NPDES Reporting

As a requirement of the NPDES permit described in Section 2.4.4, the County must submit on or before the anniversary date of the permit a progress report demonstrating the implementation of the NPDES stormwater program based on the fiscal year. If the County's annual report does not demonstrate compliance with their permit and show progress toward meeting WLAs, the County must implement BMP and program modifications within 12 months.

The annual report includes the following – items in bold font directly relate to elements of the load reduction evaluation criteria:

a. The status of implementing the components of the stormwater management program that are established as permit conditions including:
    i. Source Identification
    ii. Stormwater Management
    iii. Erosion and Sediment Control
    iv. Illicit Discharge Detection and Elimination
    v. Litter and Floatables
    vi. Property Management and Maintenance
    vii. Public Education
    viii. Watershed Assessment
    ix. Restoration Plans
    x. TMDL Compliance
    xi. Assessment of Controls; and,
    xii. Program Funding
b. A narrative summary describing the results and analyses of data, including monitoring data that is accumulated throughout the reporting year
c. Expenditures for the reporting period and the proposed budget for the upcoming year

d. A summary describing the number and nature of enforcement actions, inspections, and public education programs
e. The identification of water quality improvements and documentation of attainment and/or progress toward attainment of benchmarks and applicable WLAs developed under EPA approved TMDLs; and,
f. The identification of any proposed changes to the County's program when WLAs are not being met
g. Attachment A – The County is required to complete a database containing the following information:
    i. Storm drain system mapping
    ii. Urban BMP locations
    iii. Impervious surfaces
    iv. Water quality improvement project locations
    v. Monitoring site locations
    vi. Chemical monitoring results
    vii. Pollutant load reductions
    viii. Biological and habitat monitoring
    ix. Illicit discharge detection and elimination activities
    x. Erosion and sediment control, and **stormwater program information**
    xi. Grading permit information
    xii. Fiscal analyses – cost of NPDES related implementation

9.2 Estimating Load Reductions

Progress assessments are scheduled by the Chesapeake Bay Program for 2017 and 2021. At this time, multiple lines of evidence including: several models, monitoring data, and the most recent science on BMP effectiveness and water quality response will be evaluated. The milestones and progress assessments will contribute to constant reassessment of management plans, and adapting responses accordingly as technologies and efficiencies change, programs mature, credit trading is enacted, and regulations are put in place. The County will model load reductions in MAST at the interim (2014, 2016, 2018) and milestone (2015, 2017, 2019) years, which equates to about once a year at minimum.

9.3 Tracking Overall Program Success through Monitoring

Overall program success will be evaluated using trends identified through the long term monitoring program described below in Section 10: Monitoring. TMDL compliance status will be evaluated to determine if the Restoration Plan needs to be updated. If it is found during the evaluation of BMP implementation and load reductions that the milestone targets are no longer being met, a revision of the plan may be necessary.

10 Monitoring (i)

Official monitoring for Integrated Report assessments and impairment status is the responsibility of the State; however the County has many on-going monitoring programs that can support the State's efforts.

To determine the specific parameters to be monitored for tracking progress, one must understand the approach used for the initial listing. The Patapsco LNB was originally listed for sediments in 1996 as a suspended sediment listing. This was refined in 2008 to a listing for total suspended solids. In 2002, the

State began listing biological impairments on the Integrated Report, at the 8-digit scale, based on a percentage of stream miles degraded and whether they differ significantly from a reference condition watershed (<10% stream miles degraded). The biological listing is based on Benthic and Fish Indices of Biotic Integrity (BIBI/FIBI) results from wadeable streams from assessments conducted by the Maryland Department of Natural Resources (MDNR) Maryland Biological Stream Survey (MBSS). The Patapsco LNB was listed for biological community impairment in 2002.

MDE then utilized its Biological Stressor Identification (BSID) process to identify the probable or most likely causes of poor biological conditions. For sediment specifically, the BSID identified 'sediment condition' parameters related to *channel alteration* and *bar formation* with statistically significant associations to biological condition. Likewise, the 'in-stream' habitat measure of *channelization* also had a statistically significant relationship to the biological condition. Overall, the results indicated inorganic pollutants (i.e. chlorides, conductivity, sulfate), and flow/sediment related stressors, and channelization as the primary stressors.

Based on the results of the BSID, MDE replaced the biological impairment listing with a listing for total suspended solids (TSS). The 2012 final and 2014 draft integrated reports lists 'Habitat Evaluation' as the indicator, and urban runoff/storm sewers as the source. It is noted that the *Decision Methodology for Solids for the April 2002 Water Quality Inventory (updated in February of 2012)*[1], makes a specific distinction between two different, although related 'sediment' impairment types in free flowing streams:

1. **TSS**: The first type is an impact to water clarity with impairment due to TSS using turbidity measured in Nephelometer Turbidity Units (NTUs). Although numeric criteria have not been established in Maryland for TSS, MDE uses a threshold for turbidity, a measurement of water clarity, of a maximum of 150 Nephelometer Turbidity Units (NTU's) and maximum monthly average of 50 NTU as stated in Maryland COMAR regulations (26.08.02.03-3). Turbidity also may not exceed levels detrimental to aquatic life in Use I designated waters.
2. **Sedimentation / siltation**: The second type is an impact related to erosional and depositional impacts in wadeable streams. The measures used are biocriteria and the critiera for Use I streams (the protection of aquatic life and growth and propagation of fish (other than trout) and other aquatic life).

With these two sediment impairments in mind the Patapsco LNB, which is listed as impaired for TSS, would seem to be water clarity issue; however the methodology used for listing (biological and habitat measures related sediment deposition) seems to point to an in-stream sediment deposition problem. In all likelihood both types of impairment, water clarify and sedimentation, are factors and both should be incorporated into monitoring programs to track changes in the watershed condition over time.

Anne Arundel County's Watershed Protection and Restoration Program (WPRP) has several on-going monitoring programs that target measures of water clarity and sedimentation. These programs are described here.

[1] http://www.mde.state.md.us/programs/Water/TMDL/Integrated303dReports/Documents/Assessment_Methodologies/AM_Solids_2012.pdf

Countywide Biological Monitoring

In 2004, a Countywide Biological Monitoring and Assessment Program for Anne Arundel County, Maryland was developed to assess the biological condition of the County's streams at multiple scales (i.e., site-specific, primary sampling unit (PSU), and countywide). Under the Countywide Biological Monitoring and Assessment program, biology (i.e., benthic macroinvertebrates) and stream habitat, as well as geomorphological and water quality parameters, are assessed at approximately 240 sites throughout the entire County over a 5-year period using a probabilistic, rotating-basin design. Round One of the County's Biological Monitoring and Assessment Program occurred between 2004 and 2008, and Round Two took place between 2009 and 2013. Round Three is scheduled to be conducted beginning in 2016.

The biological monitoring program's stated goals are applicable at three scales; Countywide, Watershed-wide, and Stream-specific, and include the following components.

- Status: describe the overall stream condition
- Trends: how has the overall stream condition changed over time
- Problem identification/prioritization: identify the impaired and most degraded streams
- Stressor-response relationships: identify anthropogenic stressors and their biological response
- Evaluation of environmental management activities: monitor the success of implemented programs and restoration/retrofit projects

The Patapsco LNB watershed is made up of three PSUs, Piney Run, Stony Run and Lower Patapsco. Ten sampling sites were sampled in each of these PSUs in each round of sampling. Methodologies follow those used by MBSS for the biological sampling (benthic macroinvertebrates only) and habitat evaluations have included both MBSS's Physical Habitat Index (PHI) and the EPA's Rapid Bioassessment Protocol (RBP) metrics. In-situ water quality measures are also collected at each site along with a geomorphic evaluation utilizing cross-sections, particle substrate analysis using pebble counts, and measures of channel slope.

Following these procedures, the County is collecting several parameters related to water clarity and sediment deposition at each site.

- Water Quality Measures and Observations
    - Turbidity (measured), observations of general water clarity and color
- Biological Measures
    - Benthic macroinvertebrates (BIBI)
- Habitat Measures
    - General: bar formation and substrate, presence/absence of substrate type
    - PHI: epibenthic substrate, instream habitat
    - RBP: epifaunal substrate / available cover, pool substrate characterization, sediment deposition, channel alteration
- Geomorphic Measures
    - Particle size analysis using modified Wolman pebble counts at 10 transects proportioned by channel bed features

Results summarized at the PSU scale with mean BIBI and habitat ratings (PHI and RBP) are presented in Table 19.

Table 19: Countywide Biological Monitoring Results for Patapsco River Lower North Branch

PSU Name	Round	PSU Code	Year Sampled	Drainage Area (acres)	BIBI Rating	PHI Rating	RBP Rating
Piney Run	1	1	2007	4,868	P	D	PS
Stony Run	1	2	2007	6,203	P	D	PS
Lower Patapsco	1	3	2004	4,040	P	PD	PS
Piney Run	2	1	2012	4,868	P	D	PS
Stony Run	2	2	2010	6,203	P	PD	S
Lower Patapsco	2	3	2012	4,040	P	PD	NS

BIBI Ratings: G = Good, F = Fair, P = Poor, VP = Very Poor
PHI Ratings: MD = Minimally Degraded, PD = Partially Degraded, D = Degraded, SD = Severely Degraded
RBP Ratings: C = Comparable, S = Supporting, PS = Partially Supporting, NS = Non-Supporting

Restoration Monitoring

To evaluate management activities, the County uses assessment methods similar to the Countywide program (biological monitoring, water chemistry sampling, physical habitat, geomorphic evaluation) to assess baseline and post-restoration conditions for select stream, wetland and stormwater restoration and retrofit sites. In addition, these techniques are utilized to meet several NPDES MS4 permit monitoring requirements, particularly related to Assessment of Controls and Watershed Restoration Assessment.

Watershed Assessment

In 2001, Anne Arundel County initiated a series of systematic and comprehensive watershed assessments and management plans for restoration and protection across the County. The plans are developed within a regulatory context that includes NPDES MS4 requirements, local TMDLs and Watershed Implementation Plans for the Chesapeake Bay TMDL, Maryland Stormwater Regulations and the Water Resources Element of the County's General Development Plan.

Biological monitoring is a component of the characterization and prioritization process within the management plans. The biological monitoring data is primarily utilized in the County's Watershed Management Tool (WMT), which is developed and maintained by the WPRP. Within this program, sampling sites are selected using a targeted approach with the goal of having at least one, and sometimes two sites located within each subwatershed planning unit in order to examine the relationships between land use and ecological conditions downstream. Monitoring components include benthic macroinvertebrate community sampling, *in situ* water chemistry measurements, and instream and riparian physical habitat condition assessments. Water quality grab sampling and detailed geomorphic assessments have been included for some watershed studies, but not as routine monitoring components.

The WAP program's stated goals include:

- Characterize subwatersheds;
- Prioritize subwatersheds for preservation and restoration; and
- Inform stressor-response relationships for planning and modeling.

The County continues to reevaluate its monitoring programs as the state of the science progresses, as the understanding of water quality and ecological interactions are improved, and as regulatory programs are added or modified. The WPRP is currently reviewing the Countywide monitoring program to ensure that the methods used are appropriate and meaningful, and that TMDL and NPDES requirements continue to be met.

11 References

Anne Arundel County. 2009. General Development Plan. Adopted October 19, 2009; Bill No. 64-09. Annapolis, MD.

Anne Arundel County. 2010. Stormwater Management Practices and Procedures Manual. Revised November 22, 2010; updated February 1, 2012. Annapolis, MD.

Anne Arundel County. 2011. Patapsco Non-Tidal Watershed Assessment Comprehensive Summary Report. Prepared by Anne Arundel County Watershed Assessment and Planning Program, Annapolis MD; KCI Technologies, Inc., Sparks MD; CH2MHill, Chantilly VA.

Anne Arundel County. 2012. Anne Arundel County Government Chesapeake Bay TMDL Phase II Watershed Implementation Plan – July 2, 2012. Annapolis, MD.

Anne Arundel County, Department of Public Works. 2015. FY15 Enhanced Street Sweeping Program. Annapolis, MD.

CWP. 2003. Impacts of impervious cover on aquatic ecosystems. Center for Watershed Protection, Ellicott City, Maryland. 142p.

CWP. 2008. Deriving Reliable Pollutant Removal Rates for Municipal Street Sweeping and Storm Drain Cleanout Programs in the Chesapeake Bay Basin. Prepared by the Center for Watershed Protection, Ellicott City, MD. Prepared for U.S. EPA as fulfillment of the U.S. EPA Chesapeake Bay Program grant CB-973222-01.

House Bill 987. 2012. State of Maryland General Assembly. Annapolis, MD

MDE. Code of Maryland Regulations (COMAR). Continuously updated. Code of Maryland Regulations, Title 26- Department of the Environment. 26.08.02.01- Water Quality.

MDE. 2009. Total Maximum Daily Loads of Fecal Bacteria for the Patapsco River Lower North Branch Basin in Anne Arundel, Baltimore, Carroll, and Howard Counties, and Baltimore City, Maryland. Maryland Department of the Environment. Prepared for Water Protection Division, U.S. Environmental Protection Agency, Region III. Baltimore, MD.

MDE. 2011. Total Maximum Daily Loads of Sediment for the Patapsco River Lower North Branch Watershed, Baltimore City and Baltimore, Howard, Carroll, and Anne Arundel Counties, Maryland. Maryland Department of the Environment. Prepared for Water Protection Division, U.S. Environmental Protection Agency, Region III. Baltimore, MD.

MDE. 2012a. Maryland's Final 2012 Integrated Report of Surface Water Quality. Maryland Department of the Environment. Baltimore, MD. Online at: http://www.mde.state.md.us/programs/Water/TMDL/Integrated303dReports/Pages/2012_IR.aspx

MDE. 2012b. Decision Methodology for Solids for the April 2002 Water Quality Inventory (updated in February of 2012).

http://www.mde.state.md.us/programs/Water/TMDL/Integrated303dReports/Documents/Assessment_Methodologies/AM_Solids_2012.pdf

MDE. 2012c. Watershed Report for Biological Impairment of the Patapsco Lower North Branch Watershed in Anne Arundel, Baltimore, Carroll, and Howard Counties and Baltimore City, Maryland – Biological Stressor Identification Analysis Results and Interpretation. Maryland Department of the Environment, Baltimore, MD. Prepared for Water Protection Division, U.S. Environmental Protection Agency, Region III. Philadelphia, PA.

MDE. 2014a. Maryland's Draft 2014 Integrated Report of Surface Water Quality. Maryland Department of the Environment. Baltimore, MD. Online at: http://www.mde.state.md.us/programs/Water/TMDL/Integrated303dReports/Pages/2014IR.aspx

MDE. 2014b. General Guidance for Developing a Stormwater Wasteload Allocation (SW-WLA) Implementation Plan. Maryland Department of the Environment. October 2014. Baltimore, MD.

Rosgen, D.L. 1996. Applied River Morphology (Second Edition). Wildland Hydrology. Pagosa Springs, CO.

Scueler, T.R. 1987. Controlling urban runoff: a practical manual for planning and designing urban BMPs. Metropolitan Washington Council of Governments. Washington, D.C.

Schueler, T. 1994. The importance of imperviousness. Watershed Protection Techniques, 1(3), 100-111.

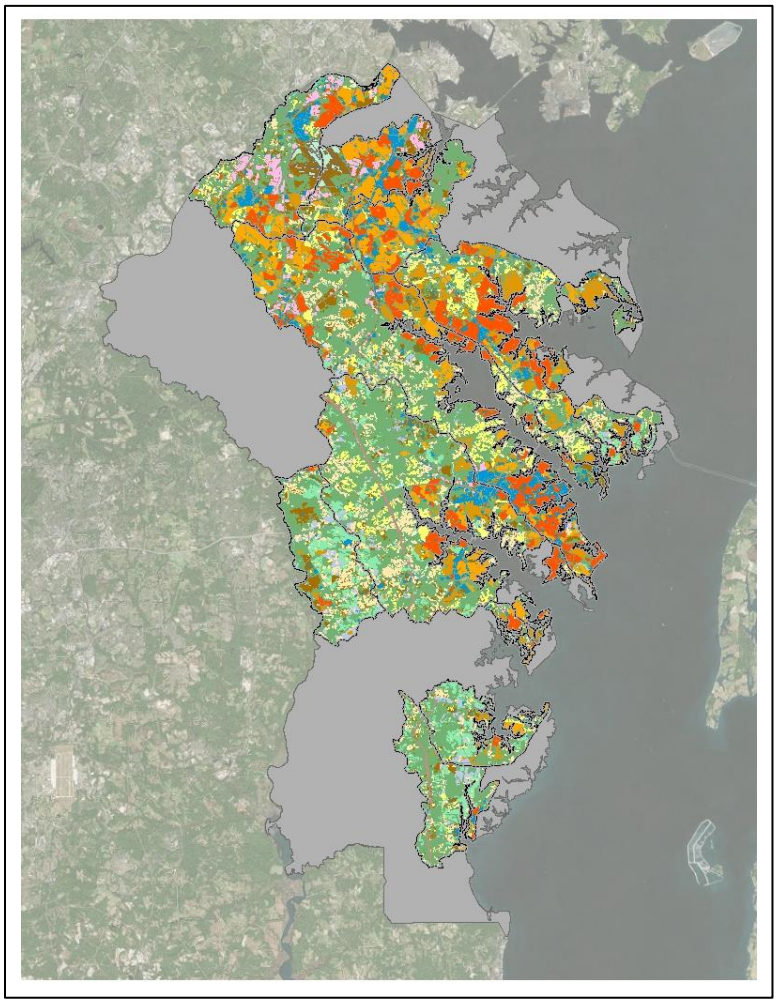
Simpson, T., and S. Weammert. 2009. Developing Best Management Practice Definitions and Effectiveness Estimates for Nitrogen, Phosphorus, and Sediment in the Chesapeake Bay Watershed. December 2009. University of Maryland Mid-Atlantic Water Program.

USEPA. 2001. PLOAD Version 3.0, An ArcView Tool to Calculate Nonpoint Sources of Pollution in Watershed and Stormwater Projects. January 2001. Developed by CH2M HILL.

USEPA. 2010. Chesapeake Bay Total Maximum Daily Load for Nitrogen, Phosphorus and Sediment, December 29, 2010. U.S. Environmental Protection Agency in collaboration with Delaware, the District of Columbia, Maryland, New York, Pennsylvania, Virginia, and West Virginia. Region 3 - Chesapeake Bay Program Field Office. Annapolis, MD.
http://www.epa.gov/reg3wapd/tmdl/ChesapeakeBay/tmdlexec.html

Total Maximum Daily Load Restoration Plan for Bacteria

Draft Report



Prepared for:

Anne Arundel County
Department of Public Works
Watershed Protection and Restoration Services Division
2664 Riva Road
Annapolis, Maryland 21401

February 2015

URS ESA JOINT VENTURE

ACRONYMS AND ABBREVIATIONS v

EXECUTIVE SUMMARY 1

SECTION ONE: INTRODUCTION 1-1

1.1 Anne Arundel County Bacteria TMDLs 1-2
1.2 Definition and Requirements of a TMDL Restoration Plan 1-5
1.3 Four Categories of Bacteria Sources 1-6

SECTION TWO: EXISTING CONDITIONS 2-1

2.1 Magothy River Watershed – Magothy River Mainstem, Forked Creek, and Tar Cove 2-4
2.2 Patapsco River Lower North Branch 2-6
2.3 Patapsco River – Furnace Creek and Marley Creek 2-8
2.4 Patuxent River Upper 2-10
2.5 Rhode River – Bear Neck Creek and Cadle Creek 2-12
2.6 Severn River Watershed – Severn River Mainstem, Mill Creek, and Whitehall / Meredith Creeks 2-14
2.7 South River Watershed – South River Mainstem, Duvall Creek, Ramsey Lake, and Selby Bay 2-16
2.8 West Chesapeake Bay – Tracy and Rockhold Creeks 2-18
2.9 West River Watershed – West River Mainstem and Parish Creek 2-20
2.10 Development of Existing Conditions WTM 2-22
2.11 Impact of TMDL Restoration Plan to Tier II Waters 2-22

SECTION THREE: RESTORATION PLAN GOALS 3-1

3.1 TMDL Reduction Goals for Bacteria 3-1
3.2 Timeline for Meeting Bacteria TMDL 3-2

SECTION FOUR: RESTORATION STRATEGIES 4-1

4.1 Proposed Strategies 4-2
4.1.1 Tier A Strategies 4-2
4.1.2 Tier B Strategies 4-6
4.2 Implementation Costs of Proposed Restoration Strategies 4-12
4.3 Pollutant Load Reductions 4-13
4.3.1 Estimation of Load Reductions from Prior Management Measures 4-13
4.3.2 Estimation of Load Reductions for Proposed Strategies 4-15
4.4 Proposed Strategies with Largest Impact and Recommended Prioritization of Strategies 4-29

SECTION FIVE: PUBLIC AND STAKEHOLDER PARTICIPATION 5-1

5.1 Current Outreach Programs 5-1
5.2 Potential Challenges and Solutions to Improve the County's Current Outreach Programs 5-2
5.3 Potential Outreach Programs 5-4

SECTION SIX: FUNDING SOURCES AND TECHNICAL ASSISTANCE 6-1

6.1 Funding Sources 6-1

6.2 Technical Assistance 6-4

SECTION SEVEN: IMPLEMENTATION SCHEDULE AND MILESTONES 7-1

SECTION EIGHT: METHODS FOR EVALUATING PROGRESS 8-1

SECTION NINE: REFERENCES 9-1

List of Tables

Table 1-1: U.S. Environmental Protection Agency-Approved Bacteria TMDLs in Anne Arundel County 1-2

Table 2-1: Existing Land Use in Anne Arundel County's Bacteria TMDL Watersheds 2-1

Table 2-2: Anne Arundel County BMPs and Pollutant Removal Efficiencies 2-2

Table 2-3: Bacteria Source Distribution in the Magothy River Watershed 2-4

Table 2-4: Number of Existing BMPs in the Magothy River Watershed 2-4

Table 2-5: Bacteria Source Distribution in the Patapsco River Lower North Branch Watershed 2-6

Table 2-6: Number of Existing BMPs in the Patapsco River Lower North Branch Watershed 2-6

Table 2-7: Bacteria Source Distribution in the Furnace Creek and Marley Creek Watersheds 2-8

Table 2-8: Number of Existing BMPs in the Furnace Creek and Marley Creek Watersheds 2-8

Table 2-9: Bacteria Source Distribution in the Patuxent River Upper Watershed 2-10

Table 2-10: Number of Existing BMPs in the Patuxent River Upper Watershed 2-11

Table 2-11: Bacteria Source Distribution in the Rhode River Watershed 2-12

Table 2-12: Number of Existing BMPs in the Rhode River Watershed 2-13

Table 2-13: Bacteria Source Distribution in the Severn River Mainstem, Mill Creek, and Whitehall/Meredith Creek Watersheds 2-14

Table 2-14: Number of Existing BMPs in the Severn River Mainstem, Mill Creek, and Whitehall/Meredith Creek Watersheds 2-15

Table 2-15: Bacteria Source Distribution in the South River Mainstem, Ramsey Lake, Selby Bay, and Duvall Creek Watersheds 2-16

Table 2-16: Number of Existing BMPs in the South River Mainstem, Ramsey Lake, Selby Bay, and Duvall Creek Watersheds 2-17

Table 2-17: Bacteria Source Distribution in the Tracy and Rockhold Creeks Watershed 2-18

Table 2-18: Number of Existing BMPs in the Tracy and Rockhold Creeks Watershed 2-18

Table 2-19: Bacteria Source Distribution in the West River Mainstem and Parish Creek Watersheds 2-20

Table 2-20: Number of Existing BMPs in the West River Mainstem and Parish Creek Watersheds 2-20

Table 3-1: TMDL Reduction Goals for Bacteria from MDE's TMDL Reports 3-2
Table 4-1: List of Sanitary Sewer Overflows Occurring in Bacteria TMDL Watersheds from 2001 to 2014 4-3
Table 4-2: List of Active Sewage Pump Station Upgrade Projects in 12 of the 19 TMDL Watersheds 4-4
Table 4-3: Number of Septic Systems Selected for Retirement as Identified by the County Department of Public Works 4-6
Table 4-4: Number of Currently Unmanaged Impervious Acres[1] in Need of Treatment to Reach 20% Restoration Goal in NPDES Permit 4-8
Table 4-5: Number of Pre-2002 Dry Ponds Proposed for Retrofit in Each TMDL Watershed 4-9
Table 4-6: Estimates of Load Reductions from Prior Management Measures and Corresponding Adjustments to TMDL Required Percent Reductions 4-14
Table 4-7A: Estimated Load Reductions for Proposed Strategies in the Magothy Mainstem, Forked Creek, and Tar Cove Watersheds 4-17
Table 4-7B: Estimated Load Reductions for Proposed Strategies in the Patapsco River Lower North Branch Watershed 4-19
Table 4-7C: Estimated Load Reductions for Proposed Strategies in the Furnace Creek and Marley Creek Watersheds 4-20
Table 4-7D: Estimated Load Reductions for Proposed Strategies in the Patuxent River Upper Watershed. Note that a Livestock Fencing Strategy is included since this Watershed Contains Some Agricultural Land. 4-21
Table 4-7E: Estimated Load Reductions for Proposed Strategies in the Bear Neck and Cadle Creek Watersheds 4-22
Table 4-7F: Estimated Load Reductions for Proposed Strategies in the Severn River Mainstem, Mill Creek, and Whitehall-Meredith Creek Watersheds 4-23
Table 4-7G: Estimated Load Reductions for Proposed Strategies in the South River Mainstem, Duvall Creek, Ramsey Lake, and Selby Bay Watersheds 4-25
Table 4-7H: Estimated Load Reductions for Proposed Strategies in the Tracy and Rockhold Creek Watershed 4-27
Table 4-7I: Estimated Load Reductions for Proposed Strategies in the West River Mainstem and Parish Creek Watersheds. Note that a Livestock Fencing Strategy is included in the West River Mainstem Watershed Since this Watershed Contains Some Agricultural Land. 4-28
Table 4-8: Priority of Proposed Strategies 4-31
Table 5-1: Available County Outreach Programs/Materials that Promote Awareness Related to Bacteria Impairments 5-2
Table 5-2: Challenges and Solutions to Public and Stakeholder Participation in the Watershed Restoration Process 5-3
Table 6-1: Potential Funding Sources for Bacteria TMDL Implementation 6-1
Table 7-1: Bacteria TMDL Implementation Schedule by Milestone Year 7-1

Table 8-1: Potential Methods to Evaluate Progress 8-1
Table A-1: Land Use Classification and EMCs A-2
Table A-2: WTM Pollutant Concentration in Wastewater A-3
Table A-3: Bacteria Pollutant Removal Efficiency of OSDSs A-4
Table A-4: Pollutant Concentrations for Illicit Business Connections A-5
Table A-5: Livestock Census Data for Anne Arundel County (USDA, 2012) and Associated Bacteria Loads (MDE) A-6
Table A-6: Permitted Discharges of Non-stormwater Point Sources in the Study Watersheds A-7
Table A-7: Effectiveness of Media for Pet Waste Education Program A-8
Table A-8: Anne Arundel County BMPs and Pollutant Removal Efficiencies A-9
Table A-9: Baseline Bacteria Loads Contributing to Surface Water for Study Watersheds A-11
Table A-10: Septic Systems Identified by the County to Be Connected to a Public Sewer System A-13
Table A-11: Septic Systems Identified by the County to Be Connected to a Public Sewer System A-15
Table A-12: List of SPS Upgrades in the TMDL Watersheds A-16
Table A-13: Proposed Urban Stormwater Retrofits in the TMDL Watersheds A-18
Table A-14: Bacteria Load Reductions from Proposed Tier A and Tier B Strategies that Were Quantified Using WTM A-19

List of Figures

Figure 1-1: Location of Bacteria TMDL Watersheds 1-4
Figure 2-1: Land Use Map of Magothy River Watershed 2-5
Figure 2-2: Land Use Map of the Patapsco River Lower North Branch Watershed 2-7
Figure 2-3: Land Use Map of the Furnace Creek and Marley Creek Watersheds 2-9
Figure 2-4: Land Use Map of the Patuxent River Upper Watershed 2-11
Figure 2-5: Land Use Map of the Bear Neck Creek and Cadle Creek Watersheds 2-13
Figure 2-6: Land Use Map of the Severn River Mainstem, Mill Creek, and Whitehall-Meredith Creeks Watersheds 2-15
Figure 2-7: Land Use Map of the South River Mainstem, Duvall Creek, Ramsey Lake, and Selby Bay Watersheds 2-17
Figure 2-8: Land Use Map of the Tracy and Rockhold Creeks Watershed 2-19
Figure 2-9: Land Use Map of the West River Mainstem and Parish Creek Watersheds 2-21

List of Appendices

Appendix A Watershed Treatment Model Methodology

BMP	best management practice
BRF	Bay Restoration Fund
CIP	Capital Improvement Plan
CMOM	Capacity, Management, Operations, and Maintenance
COMAR	Code of Maryland Regulations
CWA	Clean Water Act
CWP	Center for Watershed Protection
DNR	Department of Natural Resources
DPW	Department of Public Works
EMCs	event mean concentrations
EPA	Environmental Protection Agency
EQIP	Environmental Quality Incentives Program
ESD	environmental site design
GIS	Geographic Information System
IDDE	Illicit Discharge Detection and Elimination
LA	Load Allocation
LNB	Lower North Branch
MACS	Maryland Agricultural Water Quality Cost-Share
MDE	Maryland Department of the Environment
ml	milliliters
MPN	Most Probable Number
MS4	Municipal Separate Storm Sewer System
NPDES	National Pollutant Discharge Elimination System
NPS	Nonpoint source
NRU	Nitrogen Removal Unit
OSDS	Onsite sewage disposal system (septic system)
PSA	Public Service Announcement
SPS	Sewage Pump Station
SPSC	Step Pool Storm Conveyance
SSO	sanitary sewer overflow
SW	stormwater
SWM	stormwater management

TMDLs	Total Maximum Daily Loads
TN	total nitrogen
TP	total phosphorus
TSS	total suspended solids
USDA	U.S. Department of Agriculture
WIP	Watershed Implementation Plan
WLA	wasteload allocation
WRF	Water Reclamation Facility
WTM	Watershed Treatment Model

EXECUTIVE SUMMARY

The Anne Arundel County Department of Public Works (DPW) Watershed Protection and Restoration Program is developing restoration plans to address local water quality impairments for watersheds with an approved Total Maximum Daily Load (TMDL) issued by the Maryland Department of the Environment (MDE) and approved by the U.S. Environmental Protection Agency (EPA). As defined by EPA, a TMDL sets a maximum load of a specific pollutant or stressor that a water body can assimilate and still meet water quality standards for its designated use.

There are currently 19 approved bacteria TMDLs associated with Anne Arundel County waterways. Fecal coliform is the impairing pollutant for 15 of the TMDLs, while E. coli and Enterococci are identified as the impairing pollutant for two TMDLs each. These bacteria are indicator organisms that suggest a potential for pathogenic bacteria to be present in the waterways. Anne Arundel County, via the requirements of its National Pollutant Discharge Elimination System (NPDES) Municipal Separate Storm Sewer System (MS4) permit (11-DP-3316, MD0068306), has developed this plan to address the Stormwater Waste Load Allocation (SW-WLA) associated with each of the 19 approved bacteria TMDLs.

This report presents a Bacteria TMDL Restoration Plan that identifies potential strategies for reducing bacteria to achieve the TMDL goals in each of the watersheds. MDE developed most of the TMDLs in the early 2000s. Based on the analyses conducted as part of the TMDL development, pet waste was identified as a primary source of bacteria in the watersheds, followed by wildlife, livestock, and human sources.

This restoration plan estimates bacteria load reductions for identified strategies based on modeling and literature review. The strategies were broken down into Tier A strategies (i.e., strategies that treat human sources) and Tier B strategies (i.e., strategies that treat non-human sources). Of the Tier B strategies, pet waste education was found to achieve the greatest load reductions for the least cost.

This Bacteria TMDL Restoration Plan recommends implementing a multi-media-based pet waste education program including increasing educational signage on public lands, adding pet waste stations on public lands, providing grant-funding for pet waste stations in targeted residential communities, and improving management of pet waste at existing dog parks. It is important to prioritize the target areas for the pet waste program because certain watersheds need more intensive outreach than others to reach the required TMDL load reductions.

Other non-structural Tier B strategies such as riparian buffer improvements and possibly localized waterfowl and wildlife management in specific areas (e.g., ponds, public parks, golf courses, campuses) were highly cost-effective, although the load reductions of these strategies may be difficult to measure. Stormwater retrofit projects such as conversion of dry ponds to shallow wetland/marsh filtering systems and step pool storm conveyance (SPSC) retrofits at impaired stream channels and outfalls (as recommended by the County's Chesapeake Bay

TMDL Phase II Watershed Implementation Plan [Phase II WIP]), are also considered Tier B strategies. As the County identifies and confirms dry pond drainage area and retrofit opportunities, this strategy will continue to be implemented.

The County's NPDES MS4 Permit (11-DP-3316, MD0068306) also requires that the County undertake efforts to restore 20 percent of the currently unmanaged impervious cover, within the County's MS4 area, before the end of the 5-year permit term. The County's Phase II WIP suggests this will be accomplished by implementing restoration practices such as SPSCs or other retrofit BMPs with high pollutant removal efficiency. Modeling this implementation strategy resulted in limited load reductions because managing only 20 percent of impervious area is not sufficient to mitigate bacteria loads from such highly urbanized watersheds. Lastly, livestock fencing was identified as a useful cost-effective tool for agricultural pastures that support livestock populations; however, there are only two TMDL watersheds where this strategy would be applicable.

Tier A strategies are a priority, as human bacteria sources pose a greater risk to public health than non-human sources. Implementation of Tier A strategies to treat human sources of bacteria are generally less cost-effective. These strategies primarily involve large projects in the County's Capital Improvement Program (e.g., wastewater capital improvement projects or septic system retirement). Estimated costs for these types of projects can be in the millions and result in relatively small bacteria load reductions.

Overall, it is clear that a suite of strategies should be implemented in combination to achieve bacteria TMDL SW-WLA goals in each watershed. For many of the bacteria TMDL SW-WLAs, all of the strategies are needed, and where load reduction gaps still exist, it is recommended to prioritize pet waste education in high pet-waste areas. There were no meaningful differences in the strategies needed from one watershed to the next, with the slight exception that livestock fencing is applicable in the two watersheds with agricultural areas.

SECTION ONE: INTRODUCTION

All natural water bodies contain bacteria of some kind, but in excessive amounts, bacteria can have ecological impacts and cause potentially serious health problems in humans. Most bacteria are beneficial to the ecosystem because they break down organic matter, help to recycle nutrients and carbon, and serve as part of the food chain. Certain types of bacteria, however, are pathogenic and may cause waterborne illnesses in humans.

Per Maryland State regulations, the Anne Arundel County (County) Health Department monitors more than 80 County beaches for Enterococci bacteria, a type of fecal bacteria that comes from the intestines of warm-blooded mammals, including humans. Enterococci are an indicator organism, meaning it indicates the potential presence of pathogens that cannot be directly measured because they are difficult to isolate and identify in a laboratory (EPA, 2001). While monitoring results establish a general characterization of the water, the data provide no information about the sources of bacteria in the watershed. The sources of bacteria can be difficult to discern, as many factors are involved, (e.g., amount of recent rainfall; presence of waterfowl and wildlife; and location of sewage spills, septic systems, and pet wastes).

The Maryland Department of the Environment (MDE) currently monitors, and has done so for years, various shellfish harvesting waters (Use II waters) in the County for fecal coliform, which is the indicator organism specified in the Code of Maryland Regulations (COMAR) for Use II waters. In the early 2000s, these monitoring data were used to develop the fecal coliform bacteria Total Maximum Daily Loads (TMDLs). Fifteen of the 19 total TMDLs in this TMDL Restoration Plan are for fecal coliform and occur in shellfish harvesting areas. Since the monitoring data at the time of TMDL development indicated that fecal coliform counts periodically exceeded water quality criteria, the 15 fecal coliform TMDL waterways are listed by MDE as restricted for shellfish harvesting. For Use II waters, the median fecal coliform concentration cannot exceed 14 Most Probable Number (MPN) per 100 milliliters (ml), and more than 10 percent of samples taken cannot exceed 43 MPN per 100 ml. For more details, see COMAR 26.08.02.03-3.

In addition to Use II waters, four of the 19 TMDL waterways are in designated Use I waters for public recreational use and are impaired for either E. coli or Enterococci. For Use I waters, the water quality criteria are: for freshwater, the steady state geometric mean cannot exceed 33 counts/100 ml for *Enterococci* and 126 counts/100 ml for *E. coli*; in marine water, the steady state geometric mean cannot exceed 35 counts/100 ml *Enterococci*. Again, for more details, see COMAR 26.08.02.03-3.

To address the concerns about bacteria pollution in the County's waterways, and to meet the requirements of the federal Clean Water Act (CWA), the MDE developed 19 bacteria TMDLs for areas in Anne Arundel County.

A TMDL is a calculation of the maximum amount of a pollutant that a water body can receive and still meet State water quality standards and designated uses. TMDLs are typically developed

using pollutant load models calibrated with monitoring data. The TMDL is made up of two major components. The first component is the wasteload allocation (WLA), which includes point sources such as municipal wastewater treatment plants (called Water Reclamation Facilities, or WRFs,) and National Pollutant Discharge Elimination System (NPDES) Municipal Separate Storm Sewer System (MS4)-regulated urban stormwater (referred to as the SW-WLA). The second component is the Load Allocation (LA), which includes nonpoint sources such as pet waste, wildlife, non-regulated stormwater, and septic systems. Some TMDLs also include a Margin of Safety, which accounts for uncertainty in the TMDL analyses, and a Future Allocation, which accounts for future increases in pollutant loads due to population growth and/or land use changes. However, these are not applicable to the County's bacteria TMDLs because they are built into the TMDL analyses. In summary, a TMDL can be expressed as follows:

$$TMDL = \text{total allowable load to waterway} = \text{point sources} + \text{nonpoint sources}$$
$$= WLA + LA$$

1.1 ANNE ARUNDEL COUNTY BACTERIA TMDLS

The U.S. Environmental Protection Agency (EPA)-approved bacteria TMDLs are listed in Table 1-1 and shown in Figure 1-1 below. The table lists TMDL watersheds and subwatersheds, along with each waterway's State-designated use. Throughout this plan, the TMDLs are presented in alphabetical order of watershed.

Table 1-1: U.S. Environmental Protection Agency-Approved Bacteria TMDLs in Anne Arundel County

TMDL Watershed	TMDL Subwatershed	Impairment	Designated Use[1]	Jurisdiction
Magothy River	Mainstem	Fecal Coliform	Use II	Anne Arundel County
	Forked Creek	Fecal Coliform	Use II	Anne Arundel County
	Tar Cove	Fecal Coliform	Use II	Anne Arundel County
Patapsco River	Furnace Creek	Enterococci	Use I	Anne Arundel County
	Marley Creek	Enterococci	Use I	Anne Arundel County
Patapsco River Lower North Branch	Patapsco River Lower North Branch	E. Coli[2]	Use I	Anne Arundel, Baltimore, Carroll, and Howard Counties, and Baltimore City
Patuxent River Upper	Patuxent River Upper	E. Coli	Use I	Anne Arundel and Prince George's Counties

TMDL Watershed	TMDL Subwatershed	Impairment	Designated Use[1]	Jurisdiction
Rhode River	Bear Neck Creek	Fecal Coliform	Use II	Anne Arundel County
	Cadle Creek	Fecal Coliform	Use II	Anne Arundel County
Severn River	Mainstem	Fecal Coliform	Use II	Anne Arundel County
	Mill Creek	Fecal Coliform	Use II	Anne Arundel County
	Whitehall and Meredith Creeks	Fecal Coliform	Use II	Anne Arundel County
South River	Mainstem	Fecal Coliform	Use II	Anne Arundel County
	Duvall Creek	Fecal Coliform	Use II	Anne Arundel County
	Ramsey Lake	Fecal Coliform	Use II	Anne Arundel County
	Selby Bay	Fecal Coliform	Use II	Anne Arundel County
West Chesapeake Bay Mainstem	Tracy and Rockhold Creeks	Fecal Coliform	Use II	Anne Arundel County
West River	Mainstem	Fecal Coliform	Use II	Anne Arundel County
	Parish Creek	Fecal Coliform	Use II	Anne Arundel County

1-Use I water = Water Contact Recreation, and Protection of Nontidal Warmwater Aquatic Life; Use II water = Support of Estuarine and Marine Aquatic Life and Shellfish Harvesting
2-Multiple bacteria indicators were used in the TMDL analyses; however, the TMDL is written for E. coli.



Figure 1-1: Location of Bacteria TMDL Watersheds

MDE requires the County to develop an SW-WLA Restoration Plan and it is enforceable, under the County's NPDES MS4 permit. All but two of the subject TMDLs (i.e., Patapsco River Lower North Branch and Patuxent River Upper) are located entirely within the County.

1.2 DEFINITION AND REQUIREMENTS OF A TMDL RESTORATION PLAN

A TMDL Restoration Plan is a planning-level document that identifies water quality-based strategies that a local jurisdiction may implement to control existing point and nonpoint pollutant sources in a degraded watershed. MDE allows flexibility in how local jurisdictions develop their TMDL Restoration Plans, provided that the approach is reasonable and that the Plan identifies management actions and practices that, when implemented, will restore the State water quality standards and designated uses of the impaired waterway (MDE, 2014).

The County's NPDES MS4 permit (Part IV.E.2.B) requires the development of a TMDL Restoration Plan for each SW-WLA approved by EPA. Once approved by MDE, the Restoration Plan is enforceable under the NPDES MS4 permit.

Pertinent to the development of a TMDL Restoration Plan is acknowledgement that other pollution source sectors such as agriculture or septic systems may contribute to the need for the TMDL. Although the NPDES MS4 permit requires only the SW-WLA to be addressed in the Restoration Plan, if greater load reductions can be achieved for less cost from another sector (i.e., upgrading of septic systems), the County has the option to pursue these strategies to meet the SW-WLA. Per MDE guidance, "if achieving [TMDL] targets is deemed to be technically infeasible via traditional stormwater controls, the jurisdictions are encouraged to offer alternative options to MDE for consideration" (MDE, 2014c). One of the objectives of this TMDL Restoration Plan is to provide the County with a wide array of strategies that can be implemented in all source sectors to maximize the potential for load reductions and achieve TMDL water quality goals.

At the federal level, EPA identifies nine required elements for an approvable watershed Restoration Plan (EPA, 2013b). These elements are commonly called the "a through i criteria." While these elements are specific to CWA Section 319 nonpoint source grants, they are strongly recommended by EPA and others for watershed restoration plans because they provide the basic framework needed for effective watershed planning and implementation (MDE, 2006; EPA, 2013a; EPA, 2013b). This Bacteria TMDL Restoration Plan is prepared in accordance with the EPA's nine elements for watershed planning. The nine elements are listed below along with the corresponding section in this document. For further explanation of the elements, see EPA (2013b).

a. Identification of causes and sources of bacteria (Section 2)

c. Description of management measures needed (Section 4.1)

b. An estimate of the load reductions expected from management measures (Section 4.3)

e. Information and education activities to enhance public understanding of the Restoration Plan and encourage the public's participation (Section 5)

d. Financial and technical assistance needed to implement the above management measures (Section 6)

f. Schedule for implementing the above management measures (Section 7)

f. Description of interim measurable milestones to determine whether the above management measures are being implemented (Section 7)

g. Set of indicators to evaluate progress toward water quality standards (Section 8)

h. Monitoring program to evaluate effectiveness of implementation efforts (Section 8)

1.3 FOUR CATEGORIES OF BACTERIA SOURCES

MDE's TMDL analyses identify four categories of bacteria sources in each of the 19 TMDL watersheds. The four categories are: pet waste, wildlife, humans, and livestock. During the development of the TMDLs, MDE quantified the contribution for each of these categories to the observed impairment in the waterway. Among all 19 TMDL watersheds, the average percent contribution for each category was determined to be:

- pet waste – 46.0 percent
- wildlife – 34.5 percent
- human – 6.9 percent
- livestock – 12.6 percent

Throughout this Restoration Plan, this is referred to as the "bacteria source distribution." The following sections briefly describe and characterize the four primary categories of bacteria.

Pet waste: Pets (mainly domestic dogs) contribute bacteria to a waterway through their waste products that seep into waterways during storms. It is estimated that about 40 percent of households own a dog, and of these, 60 percent pick up their pet's waste (Swann, 1999). Dog waste may contain up to 23 million bacteria per gram, much more than wildlife waste (e.g., deer) and about twice as much as human waste (Van der Wel, 1995; RIDEM, 2014). This is typically due to the diet of many dogs, which contains animal products (unlike herbivores such as deer).

EPA (2012) states that in watersheds up to 20 square miles or 12,800 acres (about the size of the Magothy River Watershed), two to three days of droppings from a population of about 100 dogs may contribute enough bacteria to temporarily close a waterway to swimming and shellfish harvesting. Unlike wildlife waste, pet waste is usually concentrated (e.g., in residential communities where people walk their dogs). Other harmful effects of dog waste include:

- Dog waste may take up to a year to fully decompose; therefore, there is a high likelihood of it being transported to local waterways
- Dog waste may potentially contain parasites and pathogens that remain infectious in contaminated soil and water
- Dog waste is a poor fertilizer and does not enrich the soil (in fact, it can seriously harm soil quality)
- Dog waste attracts rodents and nuisance insects
- Dog waste poses a public health risk, especially to children playing outside

Wildlife: Wildlife contribute bacteria through their waste products that are either directly deposited into streams or on land subject to stormwater runoff. In MDE's TMDL reports, the following are considered to be part of the "wildlife" category: beaver, deer, goose, duck, muskrat, raccoon, and wild turkey. Depending on the analysis method used, some TMDLs also identify foxes, rabbits, swans, squirrels, and herons as potential sources of bacteria. In general, most wildlife is distributed throughout the landscape wherever food and water resources are available. Wildlife diffuse bacteria widely, with the possible exception of Canada geese, which tend to congregate in small open water areas (e.g., a pond). Wildlife may occur in urban or non-urban settings. Some examples of urban wildlife include deer and fox in residential communities, waterfowl in urban ponds, and raccoons feeding on food scraps in poorly managed urban trash receptacles. Non-urban wildlife include beaver, deer, fox, and turkeys in wooded habitats, especially woods with abundant water resources.

Livestock: Livestock in pasture areas are another potential source of bacteria. This category includes farm animals such as horses, chicken, cattle, and sheep. During the grazing season, livestock may deposit their waste products directly into the stream (if the stream is unfenced), or on land near the stream that is subject to runoff. Livestock areas are limited in the County TMDL watersheds, which tend to be urbanized. Although there aren't significant livestock areas in the County TMDL watersheds, according to the Watershed Treatment Model (WTM), dairy cattle are assumed to contribute the highest per-animal loads of bacteria relative to other farm animals. The methodology used for estimating the number of livestock in the County TMDL watershed is included in Appendix A.

Humans: Bacteria from human sources are typically associated with aging urban infrastructure, which is more prone to failure than new infrastructure. Potential sources include sanitary sewer overflows, illicit sewer connections to the MS4, point source discharge from municipal WRFs, and poorly maintained or failing septic systems. Additional sources of human bacteria include homeless encampments, public facilities that lack adequate sanitary services, and marinas without sewage pumpout stations or where boaters do not utilize them. In general, human sources of bacteria pose a much greater public health risk than non-human sources (i.e., pets, wildlife, and livestock) due to the potential for waterborne disease transmission. Therefore,

strategies that reduce or mitigate human bacteria sources are considered a top priority in this Restoration Plan and are discussed in Section 4.

SECTION TWO: EXISTING CONDITIONS

This section describes the existing conditions in each of the 19 watersheds in the County with EPA-approved bacteria TMDLs. The description includes current land use (from the County's 2011 land use and impervious cover Geographic Information System [GIS] data), existing best management practices (BMPs), water resource conditions, and the TMDL bacteria source distribution from MDE's TMDL reports.

Existing land use information from the County GIS for the TMDL watersheds is summarized in Table 2-1. County land uses can be grouped into five broad categories: residential urban, non-residential urban, agricultural, forested, and open water. The residential urban category includes low-density, medium-density, and high-density residential land uses. The non-residential urban category includes urban open space, commercial airport, roadways, and industrial land uses. The agricultural category includes pasture/hay and row crops, and the forest category includes forests and forested wetlands type land uses. Land use maps of the TMDL watersheds are provided in their respective sub-sections (i.e., Sections 2.1 through 2.9).

Table 2-1: Existing Land Use in Anne Arundel County's Bacteria TMDL Watersheds

Bacteria TMDL Watershed	Residential Urban	Non-Residential Urban	Agricultural	Forested	Open Water	Total	Total Acres	Total % Impervious
Magothy River Mainstem	56%	15%	0.03%	28%	1%	100%	14,567	20%
Magothy River/Forked Creek	67%	6%	0.00%	26%	1%	100%	849	20%
Magothy River/Tar Cove	50%	14%	0.00%	34%	1%	100%	2,103	15%
Patapsco River Lower North Branch	26%	39%	0.23%	34%	1%	100%	15,022	27%
Patapsco River/Furnace Creek	34%	48%	0.07%	17%	0%	100%	8,579	34%
Patapsco River/Marley Creek	46%	23%	0.84%	30%	0%	100%	8,737	28%
Patuxent River Upper	24%	17%	19.77%	39%	1%	100%	10,449	6%
Rhode River/Bear Neck Creek	50%	16%	0.45%	33%	2%	100%	880	16%
Rhode River/Cadle Creek	70%	9%	0.00%	20%	2%	100%	320	20%
Severn River Mainstem	44%	19%	1.59%	35%	1%	100%	37,011	19%
Severn River/Mill Creek	47%	15%	3.47%	34%	1%	100%	3,256	14%
Severn River/Whitehall and Meredith Creeks	37%	15%	12.63%	35%	1%	100%	2,945	12%
South River Mainstem	32%	15%	6.08%	46%	1%	100%	33,549	12%
South River/Duvall Creek	76%	14%	0.00%	9%	1%	100%	601	23%
South River/Ramsey Lake	65%	17%	0.00%	17%	2%	100%	384	21%
South River/Selby Bay	62%	12%	2.01%	22%	3%	100%	349	20%
W. Chesapeake Bay/Tracy and Rockhold Creeks	18%	15%	14.68%	52%	1%	100%	7,962	5%

Bacteria TMDL Watershed	Residential Urban	Non-Residential Urban	Agricultural	Forested	Open Water	Total	Total Acres	Total % Impervious
West River Mainstem	25%	8%	20.72%	45%	1%	100%	6,304	6%
West River/Parish Creek	41%	25%	0.00%	31%	4%	100%	324	18%
Average:	**46%**	**18%**	**4%**	**31%**	**1%**			**18%**

Residential Urban = low-density, medium-density, and high-density residential land uses
Non-Residential Urban = urban open space, commercial, airport, roadway, and industrial land uses
Agricultural = pasture/hay and row crops
Forested = forests and forested wetlands

The existing BMPs located in the TMDL watersheds were identified using County GIS data and grouped into the following three performance categories based on their bacteria removal efficiency: non-performing (0 percent bacteria removal efficiency), mid-performing (50 percent removal efficiency), and high-performing (75 percent or greater removal efficiency). Drainage areas for the BMPs were obtained using the County GIS data and available BMP inspection database. The County is in the process of compiling the drainage areas for all the BMPs, and as result, drainage areas and impervious areas associated with some of the BMPs were not populated. The Restoration Plan database will be updated when the information becomes available.

The bacteria removal efficiency for each type of practice was obtained from the County's NPDES MS4 Annual Report (Anne Arundel County, 2013). Based on the information provided in the report, infiltration and filtering practices such as infiltration trenches, bioretention systems, step pool conveyance systems, and environmental site design (ESD) practices have high bacteria removal efficiencies. Stormwater management practices that provide limited water quality management, such as extended detention dry pond and underground storage, are mid-performing BMPs in terms of bacteria removal efficiency. Stormwater management facilities that provide runoff quantity control, such as dry ponds, are categorized under non-performing BMPs and have 0 percent bacteria pollutant removal. Bacteria removal efficiencies are provided in Table 2-2, as well as Table A-8 in Appendix A.

Table 2-2: Anne Arundel County BMPs and Pollutant Removal Efficiencies

BMP Type	Bacteria Pollutant Removal Efficiency (%)	Category
Attenuation Trench	0	non-performing
Bioretention	90	high-performing
Check Dam	0	non-performing
Disconnection of Non-Rooftop Runoff	75	high-performing
Disconnection of Rooftop Runoff	75	high-performing
Dry Pond	0	non-performing

BMP Type	Bacteria Pollutant Removal Efficiency (%)	Category
Dry Wells	75-90	high-performing
Environmental Site Design	75	high-performing
Extended Detention	50	mid-performing
Extended Detention Structure, Dry	50	mid-performing
Extended Detention Structure, Wet	75	high-performing
Forestation on Pervious Urban	0	non-performing
Infiltration Trench with Complete Exfiltration Microbasin	90	high-performing
Infiltration Basin	90	high-performing
Infiltration Berms	75	high-performing
Infiltration Trench	90	high-performing
Infiltration Trench with Partial Exfiltration	90	high-performing
Infiltration Trench with Water Quality Exfiltration	90	high-performing
Landscape Infiltration	75	high-performing
Level Spreader	0	non-performing
Micro Pool	75	high-performing
Micro-Bioretention	75	high-performing
Oil-Grit Separator	50	mid-performing
Other	0	non-performing
Permeable Pavement	75	high-performing
Porous Pavement	90	high-performing
Rain Gardens	75-80	high-performing
Rainwater Harvesting	75	high-performing
Regenerative Step Pool Storm Conveyance	90	high-performing
Sand Filter	0	non-performing
Shallow Marsh	75	high-performing
Sheetflow to Conservation Areas	75	high-performing
Submerged Gravel Wetlands	75	high-performing
Swales	75	high-performing
Underground Storage	50	mid-performing
Vegetated Buffer	80	high-performing
Wet Pond	75	high-performing
Wet Structure	75	high-performing

2.1 MAGOTHY RIVER WATERSHED – MAGOTHY RIVER MAINSTEM, FORKED CREEK, AND TAR COVE

The Magothy River Watershed is located in the northeastern portion of the County near Pasadena and Severna Park. The Magothy River flows southeast into the Chesapeake Bay near Gibson Island. Forked Creek is a small tidal creek located along the south shoreline of the river near its mouth and has a mainstem about 2.5 miles long. Tar Cove is on the opposite shoreline (north), adjacent to Sillery Bay. The primary land use category in all three watersheds is residential (Table 2-1 and Figure 2-1).

The Magothy River Watershed has approved bacteria TMDLs for the Magothy River Mainstem, Forked Creek, and Tar Cove. All three of these waterways are designated as Use II waters and are classified as "restricted" shellfish harvesting areas (MDE, 2005c). The Magothy River Mainstem is restricted only in the upper portion; the lower 12.4 miles of the river is unrestricted and is not considered part of the listed bacteria TMDLs.

The bacteria TMDL source distribution provided in MDE's TMDL report for Magothy River Watershed, as shown in Table 2-3, identifies pet waste as the largest bacteria source in all three watersheds: Magothy River Mainstem, Forked Creek, and Tar Cove (MDE, 2005e).

Table 2-3: Bacteria Source Distribution in the Magothy River Watershed

Bacteria TMDL Watershed	Percent of Fecal Coliform Source Loads				Total
	Pets	Wildlife	Livestock	Human	
Magothy River Mainstem	65.2%	22.0%	10.8%	2.0%	100%
Magothy River/Forked Creek	85.8%	13.2%	0.4%	0.6%	100%
Magothy River/Tar Cove	54.4%	32.6%	9.9%	3.1%	100%

The Magothy River Mainstem has 1,294 existing BMPs, Tar Cove has 132, and Forked Creek has 86, most of which are high-performing BMPs with 75 percent or greater bacteria removal efficiency (Table 2-4).

Table 2-4: Number of Existing BMPs in the Magothy River Watershed

Bacteria TMDL Watershed	Non-Performing BMPs	Mid-Performing BMPs	High-Performing BMPs	No. (%) of BMPs Without Drainage Area Data	Total
Magothy River Mainstem	62	58	1119	55 (4%)	1,294
Magothy River/Forked Creek	2	0	83	1 (1%)	86
Magothy River/Tar Cove	5	3	122	2 (2%)	132

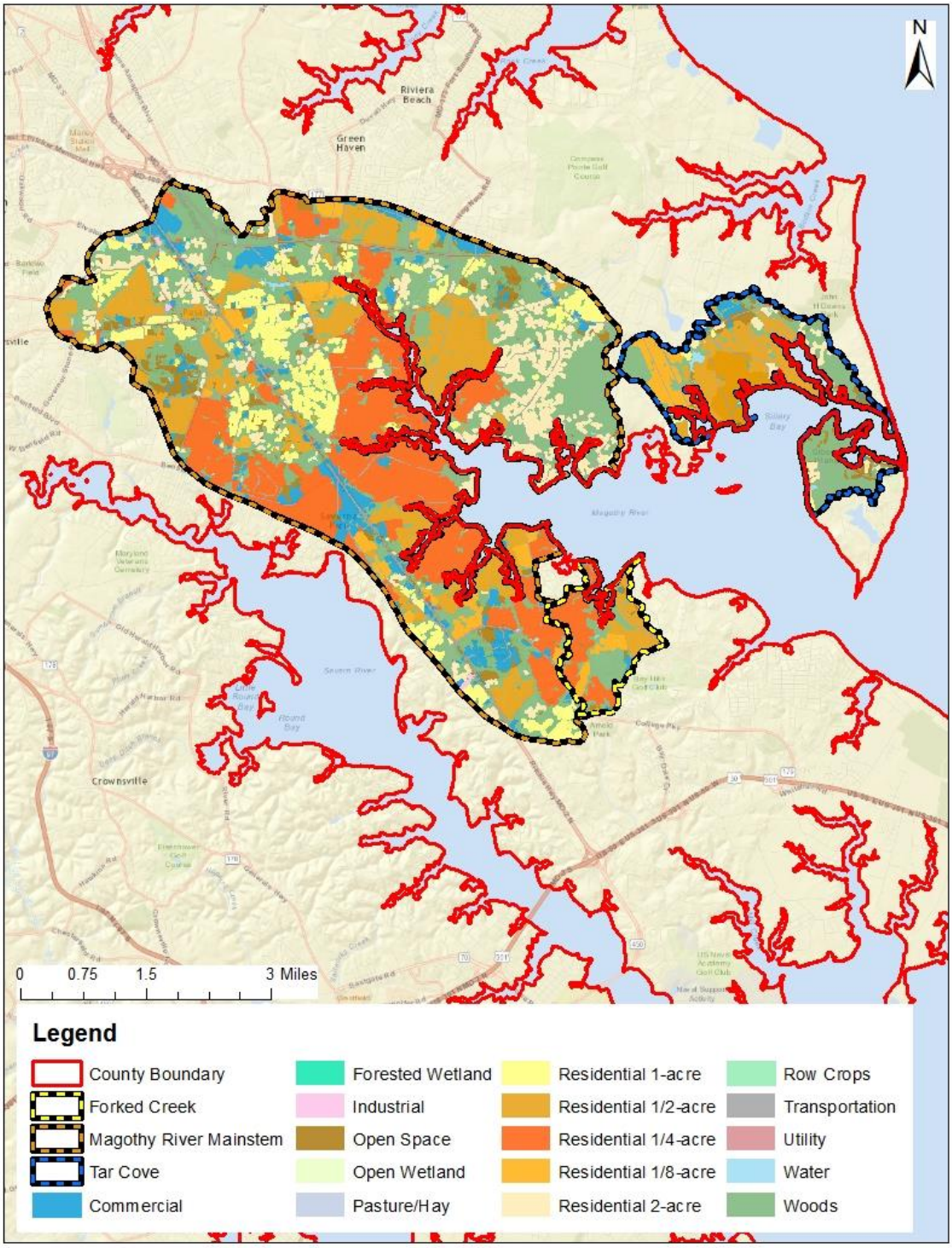


Figure 2-1: Land Use Map of Magothy River Watershed

2.2 PATAPSCO RIVER LOWER NORTH BRANCH

The Patapsco River Lower North Branch (LNB) forms the northwestern boundary of Anne Arundel County. The Patapsco River LNB TMDL covers Baltimore County, Carroll County, Howard County, and Baltimore City in addition to Anne Arundel County. The County's portion of the watershed (15,022 acres) is on the south side of the Patapsco River and includes numerous tributaries that flow north to the mainstem of the LNB, which then flows into the Baltimore Harbor in Baltimore City. The Patapsco River LNB is generally nontidal, which differentiates it from tidal areas of the Patapsco drainage (e.g., Furnace and Marley Creeks; see Section 2.3 below). The County's portion of the watershed is highly developed, and much of it was built in the 1980s and early 1990s, before modern stormwater regulations (Anne Arundel County, 2011). The watershed is 34 percent forested and 26 percent residential (Table 2-1 and Figure 2-2). Total imperviousness is 27 percent. The Patapsco River LNB watershed also includes green spaces such as riverine wetlands, forested floodplains, greenways, and Critical Area lands which help protect water quality.

The Patapsco River LNB has an approved E. coli bacteria TMDL (MDE, 2009b) and is a State-designated Use I water (Water Contact Recreation, and Protection of Nontidal Warmwater Aquatic Life). The bacteria source distribution from MDE's TMDL report for Patapsco River LNB (MDE, 2009b) is shown in Table 2-5. Holiday Mobile Estates is the only Water Reclamation Facility (WRF) in the Patapsco River LNB; it is a privately owned and operated WRF with an average flow (based on their NPDES permit) of 0.108 million gallons per day and reported monthly average bacteria concentrations of 3.0 MPN/100 ml. Given the low daily average flow, this WRF is a relatively minor source of bacteria compared to other sources in the watershed.

Table 2-5: Bacteria Source Distribution in the Patapsco River Lower North Branch Watershed

Bacteria TMDL Watershed	Percent of Fecal Coliform Source Loads				Total
	Pets	Wildlife	Livestock	Human	
Patapsco River LNB	20.7%	36.7%	9.7%	32.9%	100%

There are 615 existing BMPs in the watershed, and the majority are high-performing BMPs (Table 2-6). Drainage area information is unavailable for three percent of the BMPs at this time.

Table 2-6: Number of Existing BMPs in the Patapsco River Lower North Branch Watershed

Bacteria TMDL Watershed	Non-Performing BMPs	Mid-Performing BMPs	High-Performing BMPs	No. (%) of BMPs Without Drainage Area Data	Total
Patapsco River LNB	107	102	387	19 (3%)	615

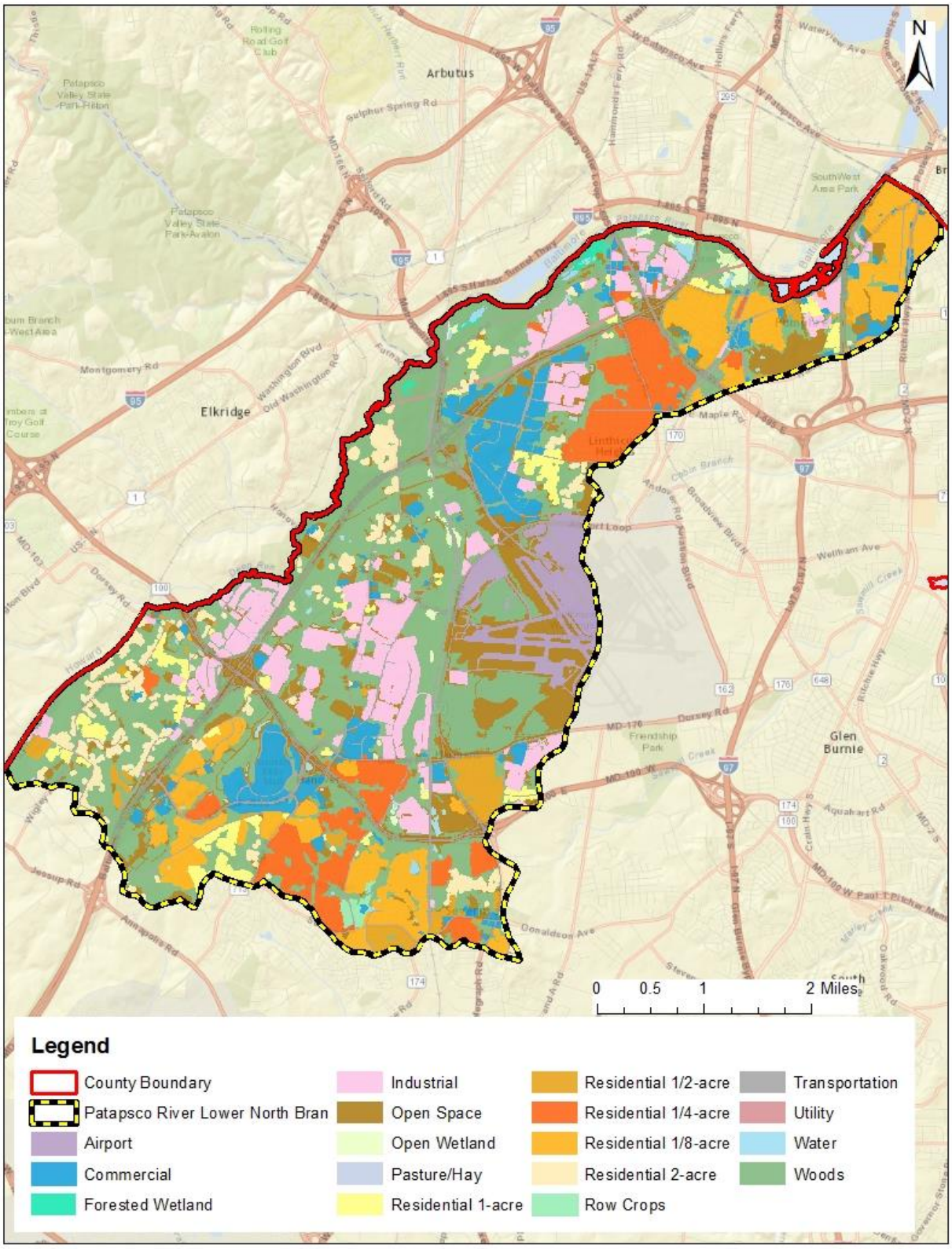


Figure 2-2: Land Use Map of the Patapsco River Lower North Branch Watershed

2.3 PATAPSCO RIVER – FURNACE CREEK AND MARLEY CREEK

Furnace Creek and Marley Creek are tidal creeks in the northern portion of the County, a few miles east of Baltimore-Washington International airport. The Furnace Creek and Marley Creek watersheds are similar in size (8,579 acres for Furnace Creek, 8,737 acres for Marley Creek), are highly urbanized with much residential development (Table 2-1 and Figure 2-3), and are each about 30 percent impervious. Some developments in these watersheds date back to the 1940s (Anne Arundel County, 2012b).

Furnace and Marley Creeks are MDE-designated Use I waters, and the bacteria TMDL impairment is Enterococci (MDE, 2010a). These are the only two watersheds in the County that have TMDLs for Enterococci (see Table 1-1 in Section 1).The Furnace Creek and Marley Creek watersheds have similar bacteria source distributions (Table 2-7 below) as identified by MDE (2010c). There are no livestock loads in either watershed. In each watershed, the contribution from human sources and wildlife is greater than 30 percent of total source loads. Pet waste contributes slightly less than 30 percent of the total loads in Furnace Creek and 34.6 percent of the total loads in Marley Creek. There are no point sources within the watersheds other than permitted MS4 stormwater discharges.

Table 2-7: Bacteria Source Distribution in the Furnace Creek and Marley Creek Watersheds

Bacteria TMDL Watershed	Percent of Fecal Coliform Source Loads				Total
	Pets	Wildlife	Livestock	Human	
Furnace Creek	29.4%	38.1%	0.0%	32.5%	100%
Marley Creek	34.6%	31.2%	0.0%	34.2%	100%

There are 451 and 570 existing BMPs in the Furnace Creek and Marley Creek watersheds, respectively (Table 2-8). A majority of them are high-performing BMPs for bacteria, which include various types of infiltration BMPs and ESD practices. Thirteen percent of the existing BMPs in the Furnace Creek watershed and 17 percent of the existing BMPs in the Marley Creek watershed do not have drainage area data.

Table 2-8: Number of Existing BMPs in the Furnace Creek and Marley Creek Watersheds

Bacteria TMDL Watershed	Non-Performing BMPs	Mid-Performing BMPs	High-Performing BMPs	No. (%) of BMPs Without Drainage Area Data	Total
Furnace Creek	52	26	314	59 (13%)	451
Marley Creek	114	33	328	95 (17%)	570

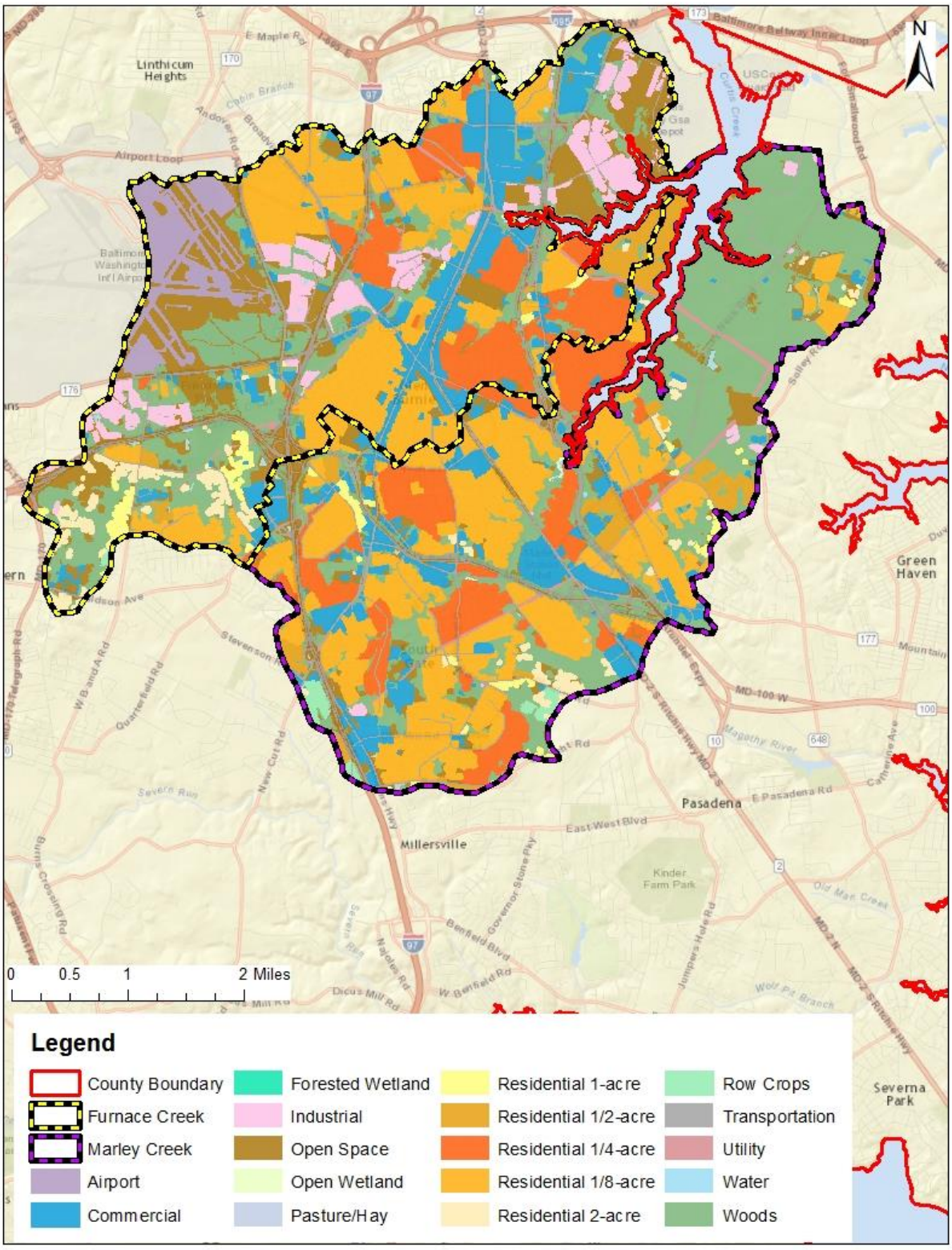


Figure 2-3: Land Use Map of the Furnace Creek and Marley Creek Watersheds

2.4 PATUXENT RIVER UPPER

The Patuxent River is one of the largest watersheds in Maryland. It flows from north to south and forms the boundary between Anne Arundel County to the east and Prince George's County to the west. The river is a designated Use I waterway. The impaired portion for the TMDL consists of a small subwatershed known as the Patuxent River Upper. This subwatershed is in the west central part of Anne Arundel County and extends across the river into Prince George's County. Anne Arundel County's portion is 10,450 acres and extends from the confluence with the Little Patuxent River in the north to the Queen Anne Bridge Road crossing in the south. Over 200,000 additional acres drain from upriver, outside the listed TMDL portion.

The Patuxent River valley is largely forested and includes numerous riparian wetlands. On the Anne Arundel County side of the river (eastern shore), there are several green spaces, including the Globecom Wildlife Management Area, Patuxent River Park, and Davidsonville Park. The upland area is agricultural interspersed with low- to medium-density residential developments (Table 2-1 and Figure 2-4). Major tributaries include Ropers Branch, Kings Branch, and Davidsonville Branch, which all flow from east to west into the Patuxent River Upper Mainstem.

The Patuxent River was placed on the State's 303(d) list in 2008 for fecal coliform impairments, and the bacteria TMDL was approved by EPA in 2011 (EPA, 2011). The TMDL is based on *E. coli*; however, the bacteria source distribution is based on *Enterococci*. This is because the monitoring datasets used to develop the TMDL included multiple pathogen indicators. MDE's TMDL report uses the generic term "fecal bacteria" to refer to all types of bacteria (MDE, 2010b).

MDE's bacteria source distribution in the Patuxent River Upper watershed is shown in Table 2-9 (MDE, 2010d). Wildlife (35.0 percent) and livestock (28.0 percent) are the dominant bacteria sources, but human (19.0 percent) and pet sources (18.0 percent) are also present. Wildlife are the largest source of bacteria in the Patuxent River Upper watershed, probably due to wildlife waste deposited in the river's riparian zone where there is abundant habitat and water resources for animals.

Livestock is the second largest contributor based on MDE's TMDL analyses, which includes not just cattle but also horses, sheep, chickens, and other farm animals. This part of the County has been identified to have a growing equestrian sector. Approximately 20 percent of the land use in the Patuxent River Upper watershed is agricultural. There are no point sources in the listed portion of the Patuxent River Upper watershed other than permitted MS4 stormwater discharges.

Table 2-9: Bacteria Source Distribution in the Patuxent River Upper Watershed

Bacteria TMDL Watershed	Percent of Fecal Coliform Source Loads				Total
	Pets	Wildlife	Livestock	Human	
Patuxent River Upper	18.0%	35.0%	28.0%	19.0%	100%

There are 125 existing BMPs in the Patuxent River Upper watershed (Table 2-10). Of these, 113 are high-performing BMPs for bacteria. Seven percent of the existing BMPs do not have drainage area data.

Table 2-10: Number of Existing BMPs in the Patuxent River Upper Watershed

Bacteria TMDL Watershed	Non-Performing BMPs	Mid-Performing BMPs	High-Performing BMPs	No. (%) of BMPs Without Drainage Area Data	Total
Patuxent River Upper	1	2	113	9 (7%)	125

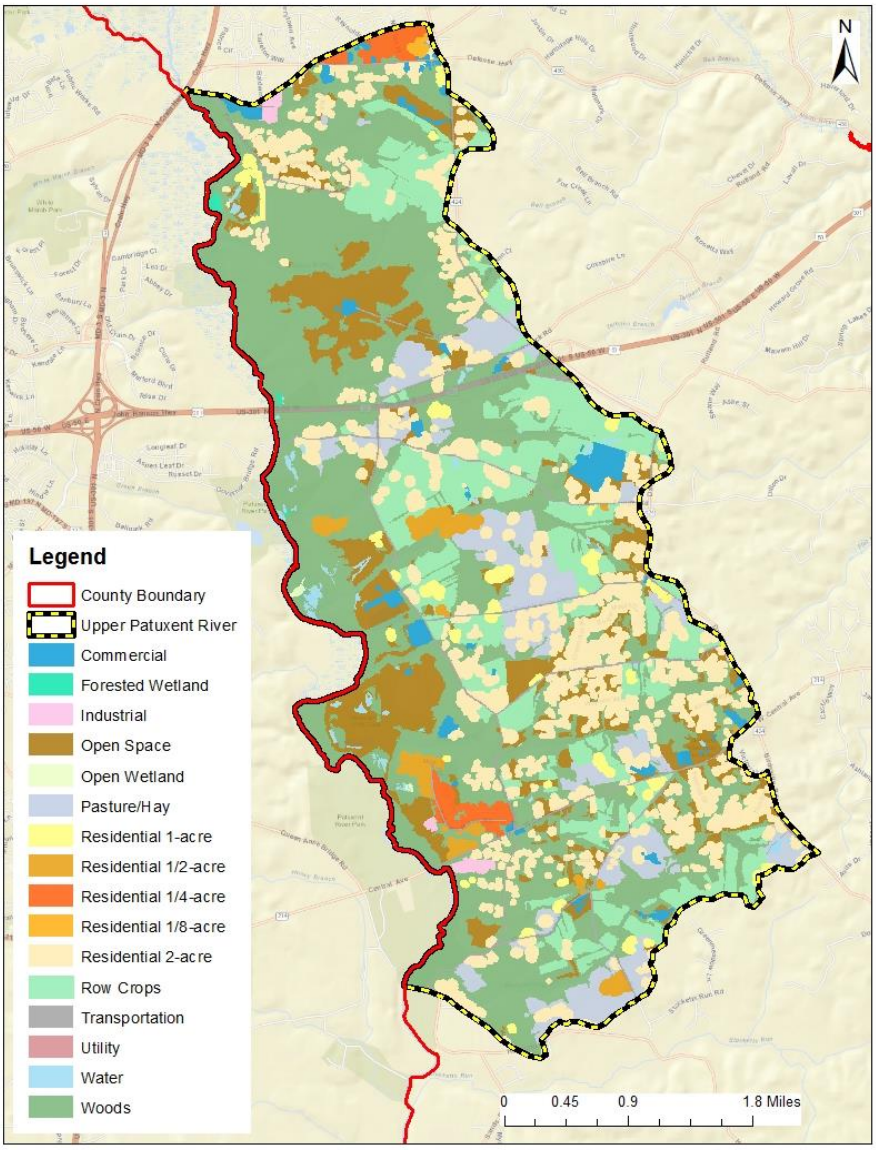


Figure 2-4: Land Use Map of the Patuxent River Upper Watershed

2.5 RHODE RIVER – BEAR NECK CREEK AND CADLE CREEK

Bear Neck Creek and Cadle Creek are located in the Rhode River Watershed. Even though Bear Neck Creek and Cadle Creek are tributaries of Rhode River, their TMDLs are not associated with Rhode River. According to MDE's TMDL report (MDE, 2005g), Bear Neck and Cadle Creeks are fairly large creeks at approximately 1,000 feet wide and about 3 feet deep on average. The Bear Neck Creek watershed is 880 acres with 50 percent of its land use being residential, mainly consisting of the community of Mayo. Most of the developments are on the east side of the creek, while the western shore is mainly forested (Table 2-1 and Figure 2-5). The Bear Neck Creek watershed as a whole is 16 percent impervious, which consists of roofs, driveways, roads, parking lots, and a few marina lots. The Cadle Creek watershed is 320 acres. Approximately 70 percent of the land use is residential and 20 percent is impervious.

Bear Neck Creek and Cadle Creek have approved TMDLs for bacteria. Both of the creeks are Use II waterways and are classified as "conditionally approved" for shellfish harvesting (MDE, 2005b).

The bacteria source distribution for Bear Neck Creek and Cadle Creek from the MDE's TMDL report (MDE, 2005g) are shown in Table 2-11. Livestock is listed as the primary source of bacteria at 46.3 percent in Bear Neck. However, this is not consistent with current land use, which is < 1 percent agricultural according to the County's 2011 GIS land use data. This discrepancy may be due to conversion of farmland in the watershed to urban developments in the last 10 or so years (i.e., since the TMDL was developed). It may be that livestock sources are less of a factor today. Pet waste contributes 33.9 percent of the bacteria load and is likely generated in residential communities. In the Cadle Creek watershed, pet waste contributes 80.2 percent of the total bacteria source loads.

Table 2-11: Bacteria Source Distribution in the Rhode River Watershed

Bacteria TMDL Watershed	Percent of Fecal Coliform Source Loads				Total
	Pets	Wildlife	Livestock	Human	
Bear Neck Creek	33.9%	19.7%	46.3%	0.1%	100%
Cadle Creek	80.2%	19.5%	0.0%	0.3%	100%

The Bear Neck Creek watershed has 77 existing BMPs and the Cadle Creek watershed has 54 existing BMPs (Table -12). These two are among the watersheds for which the County is currently updating the drainage area database for the BMPs, and as a result, drainage area data are unavailable for many of the BMPs as this report is being written. One restoration project in the Bear Neck Creek watershed is the Ponder Cove storm drain retrofit project in the Holly Hill Harbor community. To date, the County has been able to retrofit about 40 linear feet of storm drain pipe with perforated pipe to facilitate infiltration. The total drainage area treated is approximately 11.9 acres of which 2.6 acres are impervious.

Table 2-12: Number of Existing BMPs in the Rhode River Watershed

Bacteria TMDL Watershed	Non-Performing BMPs	Mid-Performing BMPs	High-Performing BMPs	No. (%) of BMPs Without Drainage Area Data	Total
Bear Neck Creek	1	0	17	59 (77%)	77
Cadle Creek	0	1	6	47 (87%)	54

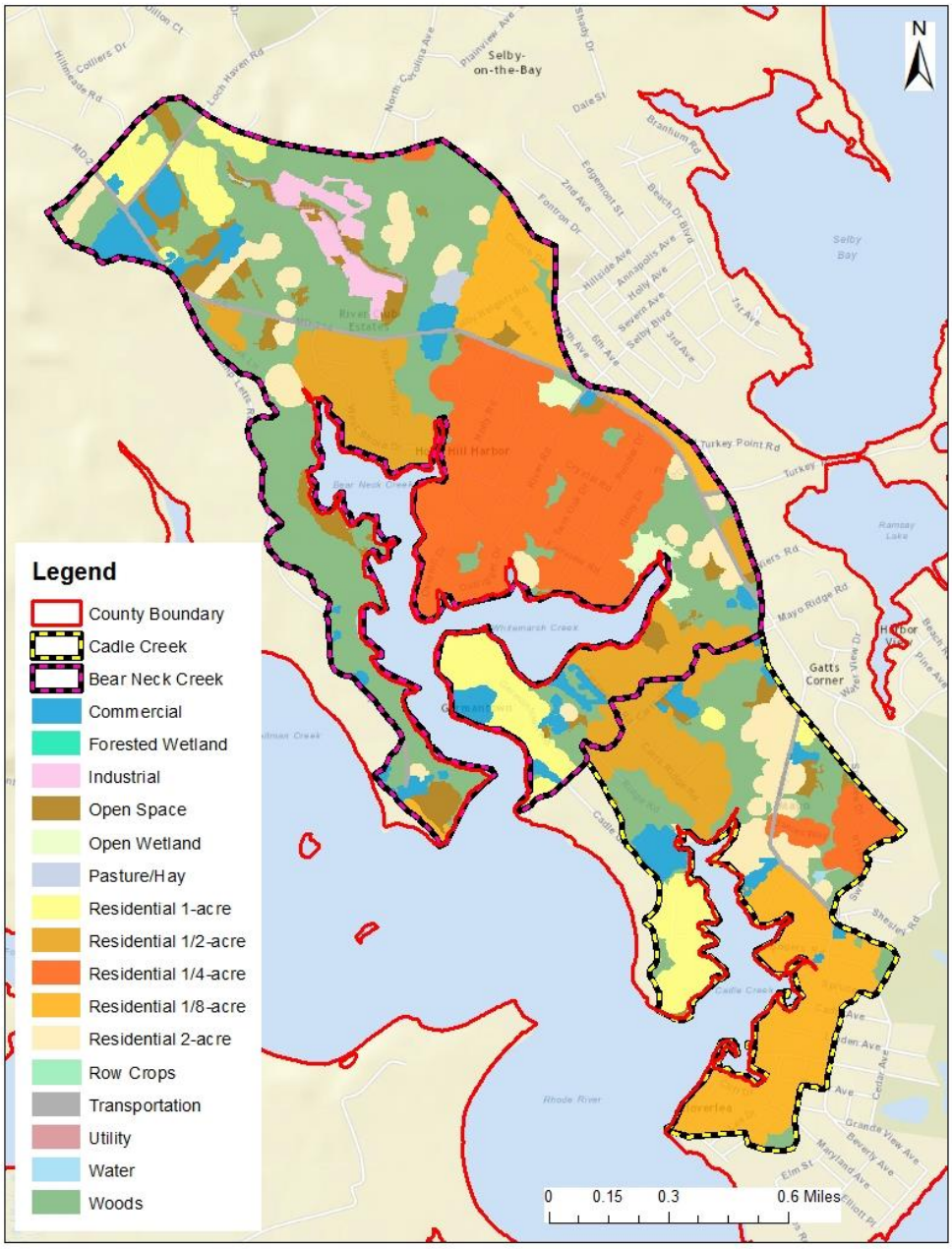


Figure 2-5: Land Use Map of the Bear Neck Creek and Cadle Creek Watersheds

2.6 SEVERN RIVER WATERSHED – SEVERN RIVER MAINSTEM, MILL CREEK, AND WHITEHALL / MEREDITH CREEKS

The Severn River Mainstem flows from northwest to southeast across the center of the County, from the community of Severn at the headwaters to the city of Annapolis near the mouth. According to MDE's TMDL report (MDE, 2008), the river is fairly deep, with an average depth of about 11 feet. The total watershed area is 37,011 acres, and the dominant land uses are residential at 44 percent and forested at 35 percent (Table 2-1 and Figure 2-6). Approximately 20 percent of the watershed is impervious.

Mill Creek, Whitehall Creek, and Meredith Creek are all located a few miles northeast of the Severn River's mouth and discharge into the Chesapeake Bay just west of the Bay Bridge. Mill Creek has a watershed area of 3,256 acres, of which 14 percent is impervious, and consists of residential developments along the shoreline. The Whitehall and Meredith Creeks' combined watershed is 12 percent impervious. These creeks are shallow with an average depth of approximately 3 feet (MDE, 2008).

The Severn River Mainstem, Mill Creek, and Whitehall/Meredith Creeks have approved TMDLs for fecal coliform. Whitehall and Meredith Creeks have one combined TMDL due to their proximity. The Severn River, Mill Creek, and Whitehall/Meredith Creeks are MDE-designated Use II waters and are "restricted" for shellfish harvesting (EPA, 2008). MDE's bacteria source distributions are shown in Table 2-13. The largest bacteria source in the Severn River Mainstem is pet waste (68.8 percent), while the largest source in Mill Creek and Whitehall and Meredith Creeks is wildlife at 59.0 percent and 71 percent, respectively. The Severn River Watershed has two permitted point sources: the Annapolis WRF and the U.S. Naval Academy. Dreams Landing WRF, a privately owned and operated facility, was listed as one of the point sources by MDE at the time of TMDL development; however, the WRF is now defunct. The total combined load from both point sources is 7.41 x 10^9 fecal coliform counts per day based on the allowable (NPDES-permitted) monthly median concentration of 14 MPN/100 ml. Aside from urban stormwater, which can also contribute substantial fecal coliform loads to the receiving waters, there are no other permitted point sources in the Whitehall/Meredith watershed.

Table 2-13: Bacteria Source Distribution in the Severn River Mainstem, Mill Creek, and Whitehall/Meredith Creek Watersheds

Bacteria TMDL Watershed	Percent of Fecal Coliform Source Loads				Total
	Pets	Wildlife	Livestock	Human	
Severn River Mainstem	68.8%	28.9%	1.4%	0.9%	100%
Mill Creek	38.0%	59.0%	1.0%	2.0%	100%
Whitehall/Meredith Creeks	26.0%	71.0%	2.0%	1.0%	100%

The Severn River Mainstem watershed has 1,999 existing BMPs, which include 1,294 high-performing BMPs (Table 2-14). The Mill Creek watershed has 216 existing BMPs of which 141

are high-performing. The Whitehall/Meredith Creek watershed has 130 existing BMPs with 74 high-performing BMPs. The number of BMPs without drainage area data is provided in Table 2-14.

Table 2-14: Number of Existing BMPs in the Severn River Mainstem, Mill Creek, and Whitehall/Meredith Creek Watersheds

Bacteria TMDL Watershed	Non-Performing BMPs	Mid-Performing BMPs	High-Performing BMPs	No. (%) of BMPs Without Drainage Area Data	Total
Severn River Mainstem	88	30	1,294	587 (29%)	1,999
Mill Creek	20	2	141	53 (25%)	216
Whitehall/Meredith Creeks	8	1	74	47 (36%)	130

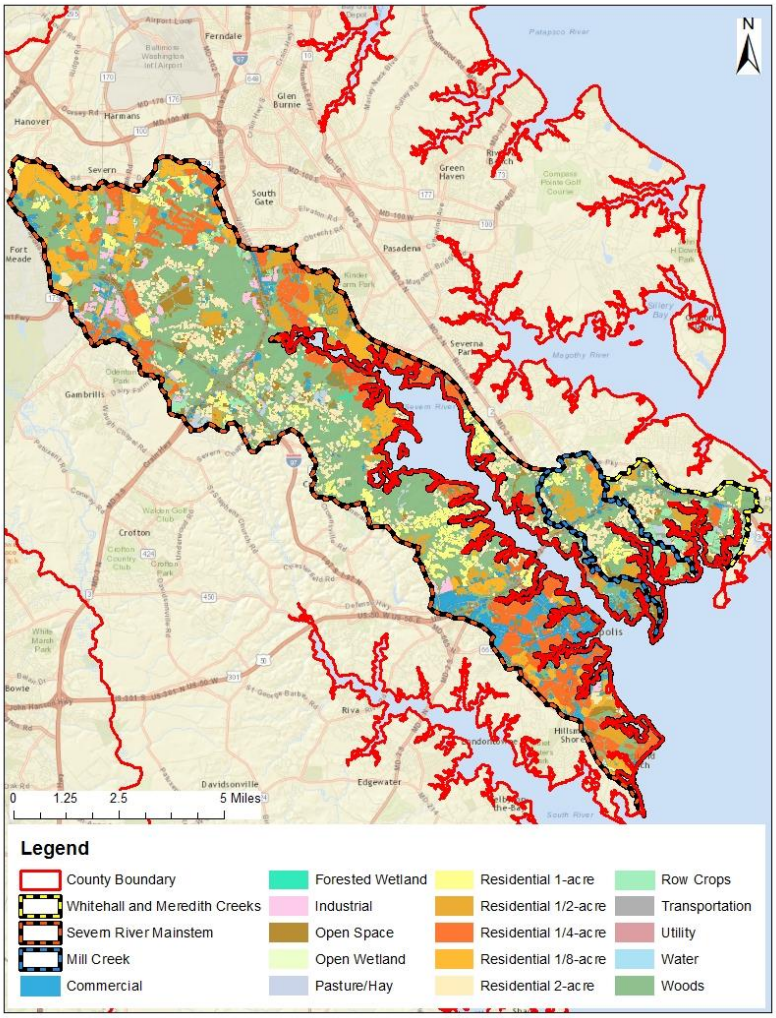


Figure 2-6: Land Use Map of the Severn River Mainstem, Mill Creek, and Whitehall-Meredith Creeks Watersheds

2.7 SOUTH RIVER WATERSHED – SOUTH RIVER MAINSTEM, DUVALL CREEK, RAMSEY LAKE, AND SELBY BAY

The South River Watershed has four impaired waterways with approved bacteria TMDLs: the South River Mainstem, Duvall Creek, Ramsey Lake, and Selby Bay. The South River is located immediately south of the Severn River in the central portion of the County. Like the Severn, it flows from northwest to southeast. The headwaters are near the town of Crownsville. The mouth, where it discharges to the Chesapeake Bay, is near Thomas Point Park. According to MDE's TMDL report (MDE, 2005f), the South River has an average width of 1.2 miles and an average water depth of 8.6 feet. The river drains 33,549 acres and has mixed land use consisting primarily of residential developments (32 percent) and forest (46 percent) (Table 2-1 and Figure 2-7). About 12 percent of the South River watershed is impervious. Duvall Creek, Ramsey Lake, and Selby Bay are small embayments near the mouth of the South River. Duvall Creek is on the north shore of the river and has 76 percent residential land use. Recreational activities in Duvall Creek include boating, canoeing, and windsurfing, and there are many individually moored vessels. Ramsey Lake and Selby Bay are on the south shore of the river. Like Duvall Creek, the majority of the land use in the Ramsey Lake and Selby Bay areas is residential.

The four TMDLs are mostly in restricted shellfish harvesting areas (designated Use II waters) due to fecal coliform impairments; the exception is the lower 3 miles of the South River Mainstem from near the mouth of Almshouse Creek to the mouth, which is not restricted and is currently open to shellfish harvesting according to MDE's shellfish harvesting closure area map (MDE, 2014e).

Based on MDE's TMDL report for South River Watershed (MDE, 2005f), the primary sources of fecal coliform bacteria in the South River Mainstem, Duvall Creek, Ramsey Lake, and Selby Bay are pet waste and wildlife (Table 2-15). Livestock sources also occur in the South River Mainstem and Duvall Creek watersheds. However, the County's GIS data from 2011 shows very little land in agricultural use, suggesting that some of the formerly agricultural land may have been converted to urban developments in the last 10 or so years. Therefore, livestock sources may be less significant today, although this cannot be quantified. Human sources are relatively minor (≤ 2 percent) in all the watersheds. There are no point sources other than permitted MS4 stormwater discharges.

Table 2-15: Bacteria Source Distribution in the South River Mainstem, Ramsey Lake, Selby Bay, and Duvall Creek Watersheds

Bacteria TMDL Watershed	Percent of Fecal Coliform Source Loads				Total
	Pets	Wildlife	Livestock	Human	
South River Mainstem	43%	34%	22%	1%	100%
Duvall Creek	68%	17%	15%	0.1%	100%
Ramsey Lake	63%	37%	0%	0.3%	100%
Selby Bay	63%	35%	0%	2%	100%

The South River Watershed has 1,320 existing BMPs (Table 2-16), of which 935 are high-performing; these are mainly infiltration type BMPs with 90 percent bacteria removal efficiency. Duvall Creek, Ramsey Lake, and Selby Bay also have high-performing BMPs, which make up 87, 80, and 70 percent of the total BMPs in the respective watersheds.

Table 2-16: Number of Existing BMPs in the South River Mainstem, Ramsey Lake, Selby Bay, and Duvall Creek Watersheds

Bacteria TMDL Watershed	Non-Performing BMPs	Mid-Performing BMPs	High-Performing BMPs	No. (%) of BMPs Without Drainage Area Data	Total
South River Mainstem	145	82	935	158 (12%)	1,320
Duvall Creek	2	0	41	4 (9%)	47
Ramsey Lake	3	2	54	7 (10%)	67
Selby Bay	5	1	57	18 (22%)	81

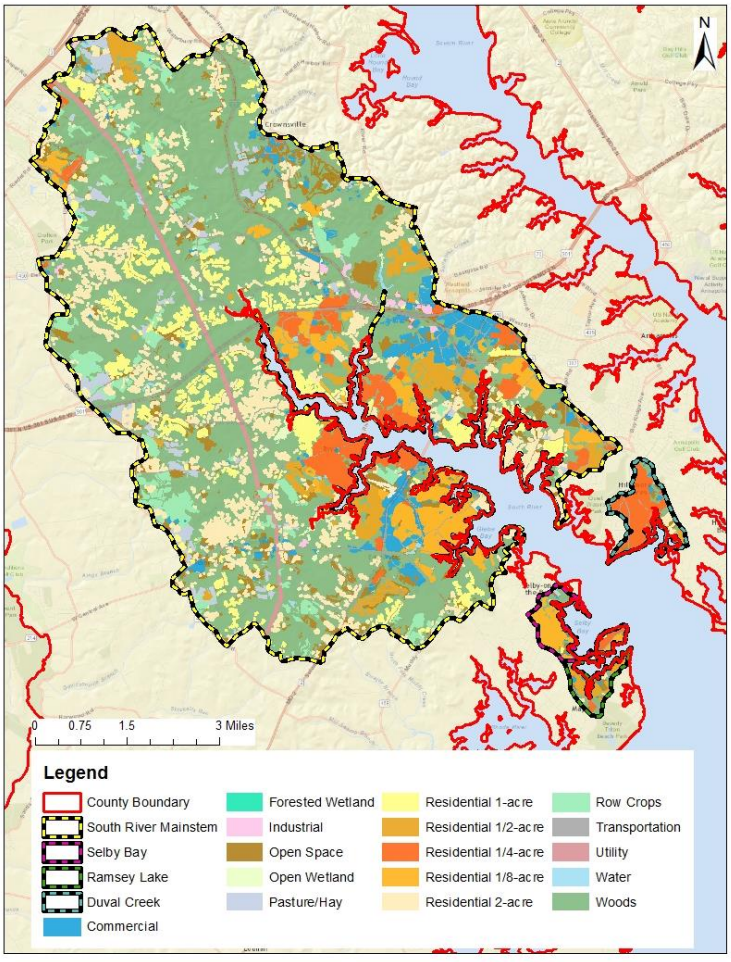


Figure 2-7: Land Use Map of the South River Mainstem, Duvall Creek, Ramsey Lake, and Selby Bay Watersheds

2.8 WEST CHESAPEAKE BAY – TRACY AND ROCKHOLD CREEKS

The West Chesapeake Bay Watershed, also known as the Herring Bay watershed is in the southeast corner of the County. Tracy Creek is lined with mature forests and riparian wetlands. Upland areas consist mainly of agricultural uses including livestock pastures. Rockhold Creek is located immediately east of Tracy Creek. The watershed is slightly more developed and includes the community of Deale along the eastern shoreline.

Tracy and Rockhold Creeks have a combined watershed area of 7,962 acres, about half of which is forest. Residential developments make up 18 percent of the watershed, and agricultural uses make up 15 percent (Table 2-1 and Figure 2-8). Imperviousness is approximately 5 percent.

The West Chesapeake Bay Watershed has an approved bacteria TMDL for Tracy Creek and Rockhold Creek due to fecal coliform impairment. Both are designated as Use II waters and are classified as "restricted" for shellfish harvesting area (MDE, 2005d). In MDE's TMDL report, Tracy and Rockhold Creeks are represented as one watershed and have one associated TMDL because they are close and both drain to Herring Bay (MDE, 2005h).

The bacteria source distribution for the Tracy and Rockhold Creeks watershed is shown in Table 2-17. Wildlife is the primary bacteria source at 72 percent, and pet waste is the secondary source at 21 percent. There are no point source facility discharges in the watershed other than permitted MS4 stormwater discharges.

Table 2-17: Bacteria Source Distribution in the Tracy and Rockhold Creeks Watershed

Bacteria TMDL Watershed	Percent of Fecal Coliform Source Loads				Total
	Pets	Wildlife	Livestock	Human	
Tracy and Rockhold Creeks	21%	72%	7%	<1%	100%

There are 67 existing BMPs in the watershed (Table 2-18). Thirteen of them are high-performing BMPs with 75 percent or greater bacteria removal efficiency. Drainage area data are unavailable for 73 percent of the BMPs.

Table 2-18: Number of Existing BMPs in the Tracy and Rockhold Creeks Watershed

Bacteria TMDL Watershed	Non-Performing BMPs	Mid-Performing BMPs	High-Performing BMPs	No. (%) of BMPs Without Drainage Area Data	Total
Tracy and Rockhold Creeks	5	0	13	49 (73%)	67

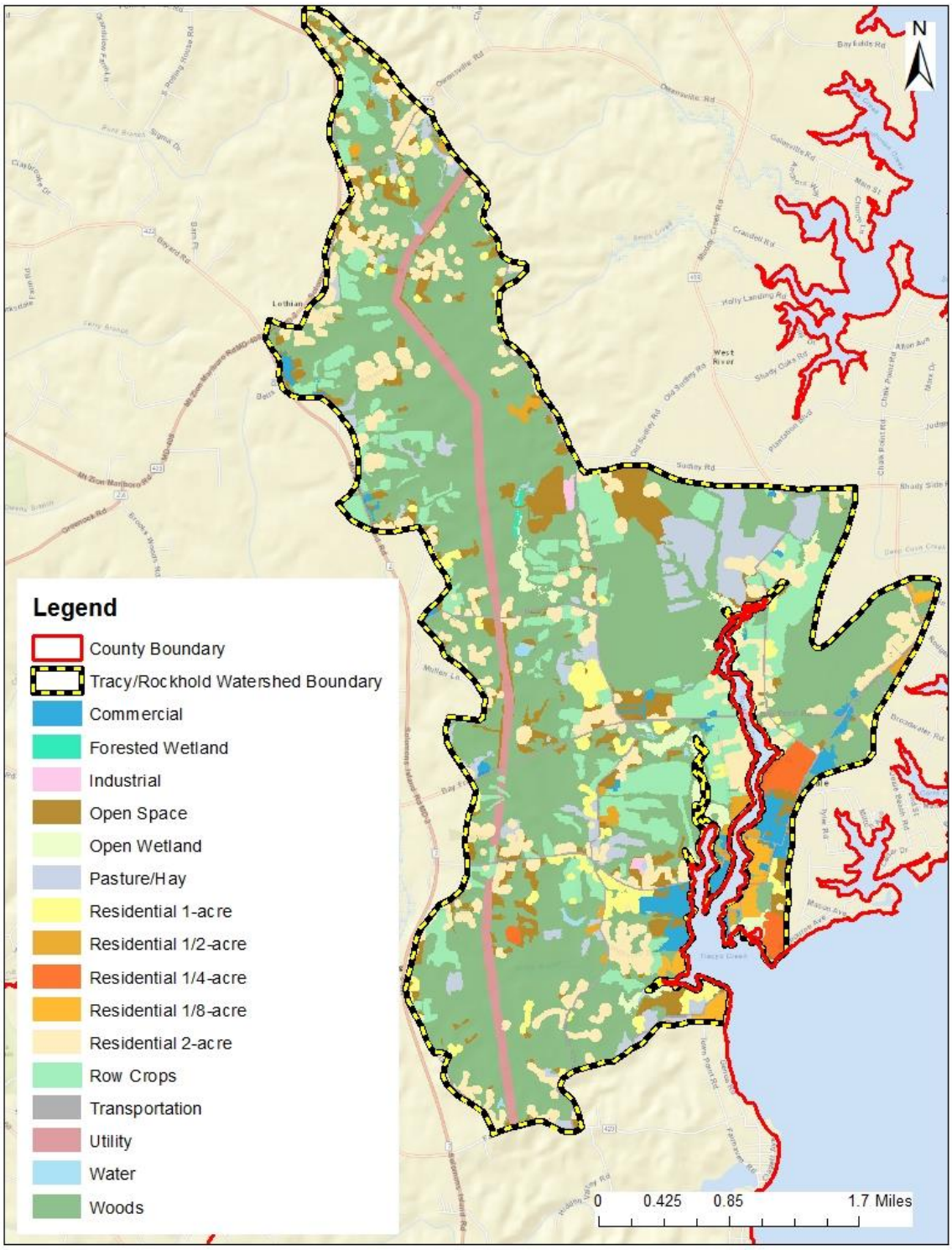


Figure 2-8: Land Use Map of the Tracy and Rockhold Creeks Watershed

2.9 WEST RIVER WATERSHED – WEST RIVER MAINSTEM AND PARISH CREEK

The West River is a tidal estuary and river system in the southeast portion of the County near the town of Galesville. The restricted portion is 0.6 mile wide and 3.2 feet deep on average. It flows northeast into the unrestricted lower river and then into the Chesapeake Bay. The watershed area is 6,304 acres, about 45 percent of which is forest. Residential developments make up 25 percent of the watershed, and agricultural land use (pasture/hay and row crops) makes up 20 percent (Table 2-1 and Figure 2-9). Imperviousness is relatively low compared to the other TMDL watersheds at 6 percent. Parish Creek is a small estuary east of the West River, near the town of Shadyside. Parish Creek drains an area of 324 acres, of which 41 percent is residential and 31 percent is forest.

The West River Watershed has approved bacteria TMDLs for the West River Mainstem and Parish Creek. Both are in restricted shellfish harvesting areas (designated Use II waters) due to fecal coliform impairments. Only the upper portion of the West River Mainstem is restricted; the lower river from Chalk Point to the mouth (a distance of about 1.5 miles) is unrestricted.

The bacteria source distribution in the West River Mainstem is shown in Table 2-19 below. The primary bacteria source is livestock (57.1 percent), which is consistent with the agricultural land use. In Parish Creek, the primary sources are wildlife at 59.0 percent and pets at 40.2 percent (Table 2-19). There are no point sources in either the West River Mainstem or Parish Creek watersheds other than permitted MS4 stormwater discharges.

Table 2-19: Bacteria Source Distribution in the West River Mainstem and Parish Creek Watersheds

Bacteria TMDL Watershed	Percent of Fecal Coliform Source Loads				Total
	Pets	Wildlife	Livestock	Human	
West River Mainstem	15.7%	26.8%	57.1%	0.4%	100%
Parish Creek	40.2%	59.0%	0.0%	0.8%	100%

The West River Mainstem watershed has 125 BMPs, and the Parish Creek watershed has 15. West River Mainstem and Parish Creek are among the watersheds for which the County is currently updating drainage area information for the BMPs, and as a result, drainage area data are unavailable for the majority of the BMPs (Table 2-20).

Table 2-20: Number of Existing BMPs in the West River Mainstem and Parish Creek Watersheds

Bacteria TMDL Watershed	Non-Performing BMPs	Mid-Performing BMPs	High-Performing BMPs	No. (%) of BMPs Without Drainage Area Data	Total
West River Mainstem	1	1	19	104 (83%)	125
Parish Creek	0	0	0	15 (100%)	15

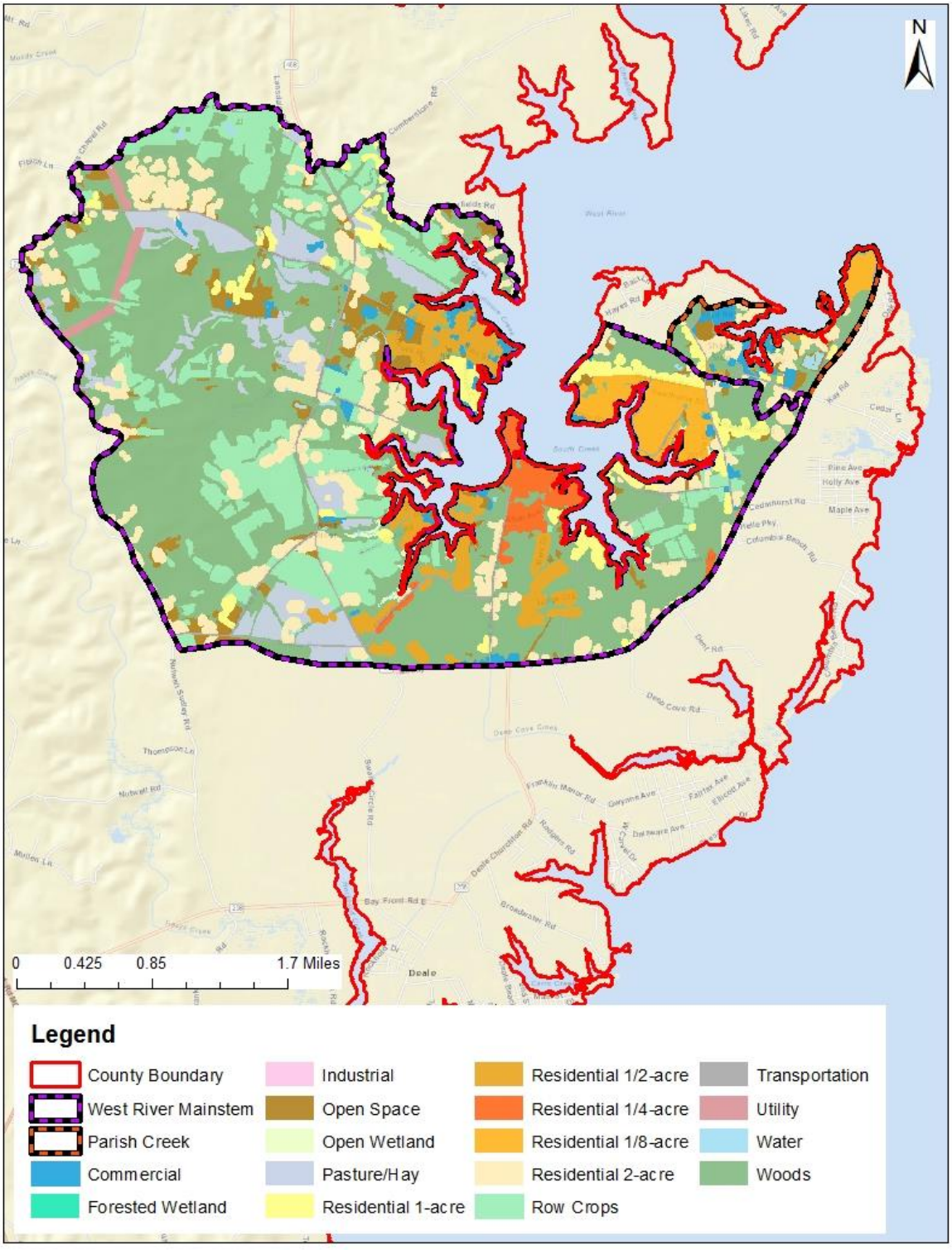


Figure 2-9: Land Use Map of the West River Mainstem and Parish Creek Watersheds

2.10 DEVELOPMENT OF EXISTING CONDITIONS WTM

As a part of development of TMDL Restoration Plan for bacteria impairments, water quality models were developed for all the study watersheds. The Watershed Treatment Model (WTM), a spreadsheet-based model developed by the Center for Watershed Protection (Caraco 2013) was used to characterize and quantify the bacteria loads for existing conditions from primary (land use) and secondary sources of pollutants (e.g. illicit discharges, sanitary sewer overflows) and estimate the potential bacteria load reductions from existing BMPs. The WTM models were developed using the County GIS data and literature review. Appendix A contains the approach adopted to develop the existing conditions model along with the results.

2.11 IMPACT OF TMDL RESTORATION PLAN TO TIER II WATERS

Maryland State water quality standards consist of three components:

- The designated use of the waterway (Use I or Use II in this case);
- Numerical water quality criteria (i.e., bacteria concentrations below certain levels) that are protective of that designated use; and
- An anti-degradation policy specifically for Tier II waters that maintains high quality waters so they do not degrade.

According to COMAR 26.08.02.04-1, high quality waters are where the water quality is better than the minimum requirements specified by the water quality standards. They are listed by MDE as "Tier II" waters. Based on MDE data, Tier II waters occur in two locations in the County:

- Lyons Creek, just west of the Tracy and Rockhold Creeks; it is not part of any TMDL watershed
- Patuxent River, just upstream of the Patuxent River Upper; it is not part of any TMDL watershed

Any watershed restoration or other activities that would affect the above Tier II waters, such as new or major modifications to discharges to the water bodies, are restricted by MDE. However, Lyons Creek flows west, away from Tracy and Rockhold Creeks, and the Tier II portion of the Patuxent River is upstream of the listed Patuxent River Upper TMDL portion. Therefore, the presence of Tier II waters is not expected to impact restoration plans for the 19 TMDL watersheds.

SECTION THREE: RESTORATION PLAN GOALS

The goal of this TMDL Restoration Plan is to reduce or mitigate existing sources of bacteria so that water quality standards and designated uses of the impaired waterways are restored. The approved TMDLs require significant reductions in bacteria loads ranging from 18 percent reduction to 90 percent reduction among the 19 TMDL watersheds (average 50 percent, see Section 3.1); therefore, extensive restoration efforts will be required to meet the TMDL goals.

In addition to meeting the TMDL goals as required by the County's NPDES MS4 permit, this restoration plan will help the County meet overarching goals, which include protecting environmental features such as riparian buffers, forests, and green spaces, as well as restoring water quality and improving habitat conditions. This restoration plan will help prevent further degradation of water resources and help to off-set any future load increases due to population growth and new development.

3.1 TMDL REDUCTION GOALS FOR BACTERIA

To restore the designated uses in each of the impaired waterways and ensure they meet State water quality standards, the MDE requires that loads from bacteria sources be reduced or mitigated by a specific amount. This is expressed in each of the MDE-published TMDLs as a required percent reduction in bacteria loads. The percent reduction is calculated as the difference between the current load (at the time the TMDL was developed) and the allowable load, divided by the current load, as follows:

$$Required\ Load\ Reduction = \frac{Current\ Load - Allowable\ Load}{Current\ Load}\ x\ 100\%$$

The current load is the mass of all bacteria sources in the watershed that drain to the water body and contribute to the observed impairment. It represents the "existing conditions" at the time the TMDLs were developed, typically in the early 2000s. The MDE calculated the current load using a pollutant load model calibrated with monitoring data collected at the base of each watershed.

The allowable load is the amount of pollutant a water body can take in without exceeding its maximum allowable water quality standard for that pollutant. The allowable load is computed using the same approach as the current load except that the applicable State water quality criteria are used instead of the monitoring data.

The State-approved TMDL water quality goals for all Anne Arundel County watersheds are presented in Table 3-1. The data presented in the table were obtained from the MDE published TMDL reports for each watershed and include the percent reductions required to restore the designated use and water quality of the waterways. These are the ultimate goals for this restoration plan and represent the end point of implementation for the County.

Table 3-1: TMDL Reduction Goals for Bacteria from MDE's TMDL Reports

TMDL Watershed	TMDL Current Load, Counts/Day	TMDL Allowable Load, Counts/Day	Required Percent Reduction
Magothy Mainstem	4.97×10^{12}	4.33×10^{12}	33 to 54 [1]
Magothy River/Forked Creek	1.83×10^{11}	1.35×10^{11}	26
Magothy River/Tar Cove	9.82×10^{11}	2.07×10^{12}	21 to 33[1]
Patapsco River/Furnace Creek	3.66×10^{12}	8.14×10^{11}	78
Patapsco River Lower North Branch	7.78×10^{11}	6.38×10^{11}	18[2]
Patapsco River/Marley Creek	6.19×10^{12}	1.50×10^{12}	76
Patuxent River Upper	7.61×10^{11}	4.02×10^{11}	47[2]
Rhode River/Bear Neck Creek	3.55×10^{11}	2.01×10^{11}	43
Rhode River/Cadle Creek	3.54×10^{11}	9.85×10^{10}	72
Severn River Mainstem	6.07×10^{12}	4.92×10^{12}	19
Severn River/Mill Creek	1.78×10^{12}	2.49×10^{11}	86
Severn River/Whitehall and Meredith Creek	4.92×10^{11}	4.92×10^{10}	90
South River/Duvall Creek	1.52×10^{11}	8.27×10^{10}	46
South River Mainstem	1.32×10^{13}	9.31×10^{12}	46
South River/Ramsey Lake	5.57×10^{11}	2.27×10^{11}	59
South River/Selby Bay	3.27×10^{11}	3.75×10^{11}	28
W. Chesapeake Bay/Tracy and Rockhold Creeks	1.67×10^{12}	3.06×10^{11}	82
West River Mainstem	1.77×10^{12}	1.15×10^{12}	35
West River/Parish Creek	2.56×10^{11}	1.2×10^{11}	53

1- A range of reduction percentages is presented because of the method used by MDE to develop the TMDL.MDE used a segmented tidal prism model; therefore, it was not possible to present a single TMDL for the entire estuary.
2- Applies only to County's portion of drainage.

3.2 TIMELINE FOR MEETING BACTERIA TMDL

The EPA-approved TMDL reports do not include a specific final date for bacteria TMDL compliance. MDE, through the NPDES MS4 Permit, requires that the TMDL Restoration Plan be an iterative process until the TMDL goals are met. It is proposed that the restoration schedule be integrated with the Chesapeake Bay TMDL implementation schedule; therefore, 2025 can be considered the target timeline for meeting the bacteria TMDL. Merging the bacteria restoration activities with the Bay TMDL implementation is proposed because its bacteria reduction strategies are similar to those required by the County's Phase II Watershed Implementation Plan (WIP) (Anne Arundel County, 2012). For example, retrofitting impaired pipe outfalls and degraded stream channels with step pool storm conveyances (SPSCs), a requirement of the WIP, has a removal efficiency per acre of 57 percent for nitrogen, 66 percent for phosphorus, and 70 percent for sediment (MDE, 2014d). For bacteria, the removal efficiency is 90 percent, which

makes it a highly desirable BMP to meet goals for bacteria and Bay TMDLs. A detailed implementation schedule for meeting the County's bacteria TMDLs is provided in Section 7.

SECTION FOUR: RESTORATION STRATEGIES

This section outlines restoration strategies proposed to meet the required TMDL load reductions and restore State water quality standards in the County's impaired waterways. The proposed restoration strategies were developed in consultation with several County departments, including the Department of Health, the Department of Public Works' (DPW) Watershed Protection and Restoration Program (WPRP) and Utility Planning divisions, using existing County data and reports. This section also includes planning-level implementation costs for each restoration strategy along with potential load reductions estimated using Center for Watershed Protection's WTM and literature review. The proposed strategies address both point and nonpoint bacteria sources as identified in MDE's bacteria TMDL reports for all 19 TMDL watersheds.

The proposed strategies are broadly grouped into Tier A and Tier B strategies. Tier A strategies are proposed to reduce human bacteria sources and Tier B strategies are proposed to reduce non-human sources (i.e. from wildlife waste, pet waste, and livestock waste). Tier A strategies are considered high priority for the County because human sources of bacteria pose a higher potential public health risk (MDE, 2014b), and these strategies are already part of the County's NPDES MS4 program (e.g., illicit discharge detection and elimination) and the County DPW wastewater program (e.g., sanitary sewer repairs and septic system retirement). However, per the MDE guidance document for developing restoration plans for addressing bacteria TMDL, jurisdictions have considerable flexibility in selecting the order of implementation of the proposed strategies, provided that the required TMDL load reductions are achieved in a reasonable time frame (MDE, 2006; MDE, 2014a; J. White pers. communication, January 8, 2015). Therefore, it is recommended that the County initially implement additional and new strategies that are the most cost-effective while concurrently continuing the existing programs (e.g. illicit discharge detection and elimination and the DPW wastewater program); these new strategies are identified below and more specific recommendations are provided in this section.

Certain strategies are not proposed in this restoration plan because preliminary modeling and information in the TMDL reports indicated that the bacteria load reductions achievable with these strategies is minimal. These strategies include upgrades to County-owned WRFs and management of deer populations. The preliminary modeling results indicated that the County-owned WRFs were a relatively minor bacteria point source in the TMDL watersheds where they occur due to the low effluent concentrations permitted by their WRF NPDES point source discharge permits (14 MPN/100 ml) for fecal coliform bacteria. Further, MDE's TMDL reports assume that deer waste represents a relatively minor source of bacteria relative to other wildlife species such as waterfowl.

4.1 PROPOSED STRATEGIES

4.1.1 Tier A Strategies

Tier A strategies are those that address potential human sources of bacteria such as septic system effluent from poorly maintained septic systems, sanitary sewage overflows, and illicit connections that discharge household human wastewater into the MS4. For all Tier A strategies, bacteria load reductions were estimated using WTM, one of MDE's recommended tools for identifying source loads and estimating pollutant load reductions (MDE, 2014b). County GIS data and related reports were used to develop the existing and proposed conditions WTM to produce a representative estimate of bacteria load reductions. Details on the modeling methodology are included in Appendix A. The Tier A strategies are described below.

Elimination of Household Illicit Connections

Residential household illicit connections are sanitary sewers connected directly to the storm drain instead of to the sanitary sewer, leading to discharge of raw untreated human wastewater into the local waterway. Wash water illicit connections occur when either commercial washwater (from carwashes, fleet washing, commercial laundry wastewater, or floor washing of shop drains) or residential grey water (laundry) is discharged into the MS4 rather than being disposed of properly (CWP, 2004). Commercial washwater and residential grey water primarily contain pollutants such as detergents/surfactants, ammonia, and others, and has an insignificant percentage of bacteria (CWP, 2004).

The County's NPDES MS4 permit (11-DP-3316, MD0068306) requires the County to conduct dry weather field screening and outfall sampling of 150 outfalls annually to detect potential illicit residential household and commercial waste water connections. This Tier A strategy assumes that all illicit connections detected by the County will be enforced and eliminated. From 2005 to 2013, the County-wide illicit detection rate was approximately 2 percent. This was based on 29 illicit connections detected out of 1,350 outfalls surveyed, as documented in the County's Annual NPDES MS4 Reports. It is assumed that the same detection rate of illicit connections would continue through 2020. The County-wide rate of 2 percent was apportioned among the 19 TMDL watersheds based on the amount of impervious cover in each TMDL watershed relative to the total impervious cover in the County (based on 2011 impervious data). It was further assumed that half of the illicit connections detected would be from households that discharge bacteria. The obtained proportioned rate of illicit detection and elimination was modeled in the proposed conditions WTM for each watershed to estimate the potential bacteria load reductions from this Tier A strategy.

Abatement of Sanitary Sewer Overflows

In the County, Sanitary Sewer Overflows (SSOs) generally occur as a result of power and mechanical failures at sewage pump stations (SPSs). According to data provided by the County, 533 SSOs of varying intensity and duration have occurred in the last 14 years (2001 to 2014); of

these, approximately 101 have occurred in areas that affected the bacteria TMDL waterways. Table 4-1 below provides a summary of the County data related to SSOs.

Table 4-1: List of Sanitary Sewer Overflows Occurring in Bacteria TMDL Watersheds from 2001 to 2014

TMDL Watershed	TMDL Subwatershed	Number	Frequency (times per year on average)	Volume Range (gallons)
Magothy River	Mainstem	12	1.0	0 – 3,000,000
	Forked Creek	1	n/a (only one occurrence)	4,500
	Tar Cove	n/a	n/a	n/a
Patapsco River	Furnace Creek	8	0.7	100 – 78,000
	Marley Creek	13	1.2	0 – 222,000
Patapsco River Lower North Branch	Patapsco River Lower North Branch	2	0.7	290 – 1,200
Patuxent River Upper	Patuxent River Upper	2	0.6	0 – 50,000
Rhode River	Bear Neck Creek	11	1.0	0 – 79,600
	Cadle Creek	8	1.1	100 - 550
Severn River	Mainstem	14	2.0	0 – 54,000
	Mill Creek	2	0.3	200 - 350
	Whitehall and Meredith Creeks	1	n/a (only one occurrence)	200
South River	Mainstem	7	0.9	0 – 11,000
	Duvall Creek	3	0.6	200 – 2,000
	Ramsey Lake	10	1.3	0 - 500
	Selby Bay	4	0.8	200 – 2,000
West Chesapeake Bay Mainstem	Tracy and Rockhold Creeks	1	n/a (only one occurrence)	800
West River	Mainstem	2	0.5	300 – 8,000
	Parish Creek	n/a	n/a	n/a

This Tier A strategy proposes to reduce the number of SSOs and thereby reduce the discharge of human bacteria to surface waters. Specific wastewater projects that are considered SPS upgrades or otherwise designed to improve the reliability of the sanitary system were identified by the County (G. Heiner, pers. Communication November 6, 2014). A total of 35 wastewater projects in 12 of the 19 TMDL watersheds are currently listed as active in the County's Wastewater Capital Budget and Program annual reports (see Table 4-2 below). The projects were entered into the proposed conditions WTM to estimate the bacteria load reductions from implementing

the SPS upgrades. Table 4-2 lists the SPS projects in the TMDL watersheds as identified by the County's Wastewater Capital Budget and Program annual reports along with cost estimates.

Table 4-2: List of Active Sewage Pump Station Upgrade Projects in 12 of the 19 TMDL Watersheds

Project	Project Title	Current Status	Description	TMDL Watershed	Qty. of Pump Stations Being Upgraded	Estimated Annual Cost[1]
S804700	Mill Creek SPS Upgrade	Active	Various upgrades to the Mill Creek sewage pumping station	Magothy River Mainstem	1	$300,000
S806700	Cinder Cove FM Rehab	Active	Construction of 10,000 linear feet of 30" force main to improve operational reliability	Patapsco River/Furnace Creek	1	$1,342,000
S805400	Marley SPS Upgrade	Active	Construction of various upgrades to Marley Sewage Pumping Station to improve operation and reliability	Patapsco River/Marley Creek	1	$900,000
S804900	Parole SPS Upgrade	Active	Construction of miscellaneous improvements to the Parole Sewage Pumping Station to increase operation and reliability	South River Mainstem	1	$100,000
S804000	Sylvan Shores PS Upgrade	Active	Construction of improvements to Sylvan Shore Sewage Pumping Station to improve reliability and efficiency of system	South River Mainstem	1	$407,000
S799200	Mayo Collection Sys Upgrade	Active	Expansion of Mayo Wastewater Collection and Conveyance System to accommodate planned growth within Mayo Sewer service area	Rhode River/Cadle Creek	1	$500,000
S806200	SPS Fac Gen Replacement	Active	Generator replacement	Magothy River Mainstem	3	$782,000
S806200	SPS Fac Gen Replacement	Active	Generator replacement	Magothy River/Forked Creek	1	$260,667
S806200	SPS Fac Gen Replace	Active	Generator replacement	Patapsco River LNB	2	$521,333
S806200	SPS Fac Gen Replace	Active	Generator replacement	Patapsco River/Furnace Creek	1	$260,667
S806200	SPS Fac Gen Replace	Active	Generator replacement	Patapsco River/Marley Creek	1	$260,667

Project	Project Title	Current Status	Description	TMDL Watershed	Qty. of Pump Stations Being Upgraded	Estimated Annual Cost[1]
S806200	SPS Fac Gen Replace	Active	Generator replacement	Severn River/Mill Creek	1	$260,667
S806200	SPS Fac Gen Replace	Active	Generator replacement	South River Mainstem	4	$1,042,667
S806200	SPS Fac Gen Replace	Active	Generator replacement	South River/Duvall Creek	1	$260,667
S791800	Upgr/Retrofit SPS	Multi-Year	Upgraded existing sewage pump stations	Magothy River Mainstem	1	$397,917
S791800	Upgr/Retrofit SPS	Multi-Year	Upgraded existing sewage pump stations	Patapsco River LNB	1	$397,917
S791800	Upgr/Retrofit SPS	Multi-Year	Upgraded existing sewage pump stations	Patapsco River/Furnace Creek	1	$397,917
S791800	Upgr/Retrofit SPS	Multi-Year	Upgraded existing sewage pump stations	Patapsco River/Marley Creek	1	$397,917
S791800	Upgr/Retrofit SPS	Multi-Year	Upgraded existing sewage pump stations	Severn River Mainstem	6	$2,387,500
S791800	Upgr/Retrofit SPS	Multi-Year	Upgraded existing sewage pump stations	West River/Bear Neck Creek	1	$397,917
S791800	Upgr/Retrofit SPS	Multi-Year	Upgraded existing sewage pump stations	West River/Parish Creek	1	$397,917
S805300	Cinder Cove SPS Mods	Active	Pump station reliability improvements necessary to minimize risks of sanitary sewer overflows	Patapsco River/Furnace Creek	1	$64,104[2]
S806300	Big Cypress SPS Retro	Active	Upgrades to Big Cypress sewage pump station	Magothy River Mainstem	1	$231,577[3]
S797800	Furnace Brn Swr Repl	Active	Construct new sewer line and replace existing sewer to relieve capacity problems	Patapsco River/Furnace Creek	1	$123,000[4]
				TOTALS:	**35**	**$12,392,018**

1-Annual costs were estimated from the wastewater CIP budget for FY2015 except where noted.
2-Cost estimate represents funds expended between April 1, 2013 and April 1, 2014. No fiscal year annual budget information was available.
3-Cost estimate represents funds expended between April 1, 2013 and April 1, 2014. No fiscal year annual budget information was available.
4-Cost estimate represents FY2009 annual budget. No fiscal year annual budget information was available.

Retirement of County Septic Systems

Retirement of failing septic systems by connecting them to the public sanitary system reduces human bacteria sources in the watershed. The number of septic systems to be retired was identified in each TMDL watershed based on GIS data provided by the County DPW. A total of 16,007 septic systems were identified in 10 of the 19 TMDL watersheds. These septic systems were previously identified by the County as contributing nitrogen discharges to the Chesapeake Bay and were selected for retirement for the purposes of meeting the Chesapeake Bay TMDL. The number of septic systems to be retired is presented in Table 4-3 below. This information was entered into the proposed conditions WTM to estimate the bacteria load reductions that would be achieved by implementing this strategy.

Table 4-3: Number of Septic Systems Selected for Retirement as Identified by the County Department of Public Works

Bacteria TMDL Watershed	No. of Septic Systems to Be Retired
Magothy Mainstem	4,814
Magothy River/Forked Creek	113
Magothy River/Tar Cove	1,708
Patapsco River/Furnace Creek	252
Patapsco River LNB	174
Patapsco River/Marley Creek	0
Patuxent River Upper	289
Rhode River/Bear Neck Creek	0
Rhode River/Cadle Creek	0
Severn River Mainstem	5,475
Severn River/Mill Creek	1,168
Severn River/Whitehall and Meredith Creek	320
South River/Duvall Creek	0
South River Mainstem	1,694
South River/Ramsey Lake	0
South River/Selby Bay	0
W. Chesapeake Bay/Tracy and Rockhold Creeks	0
West River Mainstem	0
West River/Parish Creek	0

4.1.2 Tier B Strategies

Tier B strategies are those that address non-human sources of bacteria, such as pet waste, wildlife waste, and livestock waste. For the purposes of this TMDL Restoration Plan, urban

stormwater runoff is also considered a non-human bacteria source. Many of the Tier B strategies are non-structural measures that are expected to have relatively low implementation costs and are considered a cost-effective means for the County to achieve credit for bacteria load reductions. Non-human sources are considered secondary in importance relative to human sources for public health reasons (MDE, 2014b). Bacteria load reductions for Tier B strategies were estimated using the WTM, as well as literature review. Each of the Tier B strategies and the assumptions and methods used to develop each strategy are described below. The priority of implementing Tier A or Tier B strategies is at the County's discretion.

Tier B strategies that address urban stormwater retrofits were placed into two categories: restoration of 20 percent of currently unmanaged impervious cover and retrofit of pre-2002 ponds to meet current MDE stormwater criteria. This strategy was developed based on the Anne Arundel County's Urban Phase II Watershed Implementation Plan (2012) and requirements of the current NPDES MS4 Permit (11-DP-3316, MD0068306). The current NPDES MS4 Permit requires the County to treat 20% of the impervious area that currently has limited/no stormwater management. Even though the impervious areas draining to pre-2002 ponds can be categorized as impervious area with limited stormwater management and can be counted towards the NPDES MS4 impervious area restoration goals, they are not merged with the "Restoration of 20 Percent of Currently Unmanaged Impervious Cover" strategy in this restoration plan. The purpose of separating these two strategies is to evaluate the relative cost-benefit of each strategy. The objective is to assist the County in 1) identifying the most cost-effective approach to stormwater management, and 2) identifying the optimal combination of retrofits to meet the NPDES permit requirements and Phase II WIP recommendations.

Restoration of 20 Percent of Currently Unmanaged Impervious Cover

The County's NPDES MS4 permit requires the County to undertake efforts to restore 20 percent of currently unmanaged impervious cover. To simulate this requirement, the proposed conditions WTM were configured to treat 20 percent of unmanaged impervious cover in each TMDL watershed. The County's impervious cover data from 2011 which is the latest data available, was used for the development of this restoration plan. However, the County is in the process of deriving a new impervious area baseline assessment as a part of the NPDES MS4 requirements to identify managed and unmanaged areas. Therefore, the impervious information presented in the following sections does not reflect the most recent information. The updated data, when available, will be used to update this Bacteria TMDL Restoration Plan. BMPs with high bacteria removal efficiencies, such as SPSCs and infiltration practices, were selected to manage the 20 percent for consistency with the urban stormwater strategies recommended in the County's Phase II WIP (Anne Arundel County, 2012). As SPSCs are considered a relatively cost-effective BMP for treating larger drainage areas compared to BMPs such as bioretention (see Regenerative Stormwater Conveyance [RSC] factsheet on County's website, Anne Arundel County 2012c), they are considered a high priority for implementation. According to the County's Phase II WIP, SPSC retrofits are proposed for sites in the County that meet the following criteria: streams with physical habitat index rankings of "degraded" or "severely degraded"; and outfalls that are 24

inches or greater in diameter, have a D ranking for impairment, and occur in watersheds that are a high priority for restoration. Table 4-4 below presents the number of unmanaged impervious acres proposed to meet the 20 percent NPDES MS4 restoration goal in each TMDL watershed. This information was entered into the proposed conditions WTM to estimate the expected bacteria load reductions from implementing the 20 percent impervious restoration strategy.

Table 4-4: Number of Currently Unmanaged Impervious Acres[1] in Need of Treatment to Reach 20% Restoration Goal in NPDES Permit

Bacteria TMDL Watershed	Impervious Acres to Be Treated With High Pollutant Removal BMPs such as SPSC[2]
Magothy Mainstem	351.6
Magothy River/Forked Creek	25.5
Magothy River/Tar Cove	51.5
Patapsco River/Furnace Creek	427.1
Patapsco River LNB	491.5
Patapsco River/Marley Creek	368.5
Patuxent River Upper	77.0
Rhode River/Bear Neck Creek	19.2
Rhode River/Cadle Creek	11.6
Severn River Mainstem	877.4
Severn River/Mill Creek	43.1
Severn River/Whitehall and Meredith Creek	44.6
South River/Duvall Creek	25.2
South River Mainstem	349.1
South River/Ramsey Lake	13.6
South River/Selby Bay	13.2
W. Chesapeake Bay/Tracy and Rockhold Creeks	74.2
West River Mainstem	73.2
West River/Parish Creek	11.2

1 Impervious acres listed here are based on 2011 impervious data. The County is in the process of deriving a new impervious area baseline assessment. The updated impervious areas will be included in future evaluation and tracking of this Bacteria TMDL Restoration Plan's implementation.

2 SPSC=Step Pool Storm Conveyance

Retrofit of Pre-2002 Ponds to Meet Current MDE Stormwater Criteria

According to County's Phase II WIP, existing pre-2002 dry ponds in the TMDL watersheds are recommended to be retrofitted to meet current Maryland stormwater management criteria. Currently, dry ponds have a bacteria removal efficiency of 0 percent based on information in the County's 2012 Annual NPDES MS4 report. Converting the dry ponds to shallow wetland/marsh filtering systems or SPSCs, as recommended in the County's Phase II WIP, would increase the

bacteria removal efficiency to 75 percent or 90 percent, which in either case is considered a high-performing BMP for bacteria. Based on the WIP recommendations, only dry ponds with drainage areas of 10 acres or more were proposed for retrofit. The number of ponds proposed for retrofit for each TMDL watershed is shown in Table 4-5 below. This information was entered into the proposed conditions WTM to estimate the expected load reductions from implementing this strategy.

Table 4-5: Number of Pre-2002 Dry Ponds Proposed for Retrofit in Each TMDL Watershed

Bacteria TMDL Watershed	No. of Dry Pond Proposed Retrofits
Magothy Mainstem	8
Magothy River/Forked Creek	0
Magothy River/Tar Cove	0
Patapsco River/Furnace Creek	8
Patapsco River LNB	5
Patapsco River/Marley Creek	11
Patuxent River Upper	0
Rhode River/Bear Neck Creek	0
Rhode River/Cadle Creek	0
Severn River Mainstem	13
Severn River/Mill Creek	3
Severn River/Whitehall and Meredith Creek	0
South River/Duvall Creek	0
South River Mainstem	14
South River/Ramsey Lake	0
South River/Selby Bay	0
W. Chesapeake Bay/Tracy and Rockhold Creeks	0
West River Mainstem	0
West River/Parish Creek	0

Riparian Buffer Education

Riparian buffers help reduce non-human bacteria source loads from the watershed by slowing down and filtering stormwater runoff before it discharges to the waterway. COMAR requires a 100-foot minimum riparian buffer, or larger if steep slopes, hydric soils, highly erodible soils, nontidal wetland, or a Nontidal Wetland of Special State Concern are present (see COMAR 27.02.01.01). Maintaining a minimum buffer size helps preserve the water quality function of the buffer. Development pressure may potentially alter the buffer over time, resulting in a reduced ability of the buffer to filter pollutants (Caraco, 2013a). For this Tier B strategy, the proposed

conditions WTM was used to estimate the expected bacteria load reductions from implementing a riparian buffer education program in areas where the buffer is reduced or altered, or where private property abuts the waterway. The education program is recommended to include buffer enhancement components, such as no mow areas, planting trees and shrubs, and promoting the growth of native vegetation.

Expanded Pet Waste Education Program

This strategy involves implementing a multi-media-based pet waste education program to encourage pet owners to pick up after their pets. Other related practices such as dog park improvements, more pet waste stations, and increased enforcement of leash laws may also help to instill behavior change in pet owners and reduce bacteria loads from pet waste. According to MDE's published TMDL reports, pet waste is one of the primary bacteria sources in many of the TMDL watersheds (see Table 2-11); therefore, implementing a strategy to reduce pet waste at its source may potentially have a large impact on improving water quality in the County's impaired waterways.

Some possibilities for an expanded pet waste education program and related practices include:

- Expanding the number of pet waste stations in residential areas and County public parks. Based on a website developed by Winters (2015), there are 11 mapped pet waste stations along the Baltimore and Annapolis Trail, 20 mapped stations in the Annapolis area, and 5 mapped stations in Crofton, although these are only the mapped stations and there are likely many more opportunities throughout the County.
- Increasing signage about leash laws and ranger presence at public parks to enforce leash laws and issue citations
- Developing Public Service Announcements (PSAs) for television and post professionally made videos to the County website. An example of a PSA video, which was developed by the state of Washington and cost $27,000 to develop, is available at http://mynorthwest.com/11/512462/Washington-uses-dog-doogity-music-video-to-encourage-pet-waste-cleanup
- Improving management of pet waste at existing dog parks
- Providing grants to communities to install pet waste stations on community properties.

Bacteria load reductions from implementing a pet waste education program were estimated using the methodology proposed in the Virginia Department of Environmental Quality's (DEQ's) *Bacterial Implementation Plan Development for the James River and Tributaries – City of Richmond Technical Report* (VA DEQ, 2011). The bacteria loads from pet waste were computed by applying the percent of bacteria load contribution from pet waste from the TMDL reports (Table 2-19). To estimate the load reduction, a 25 percent bacteria removal efficiency was used, again based on VA DEQ (2011). The amount of load reduction was subtracted from the total

load to get the adjusted load. The percent load reduction was then calculated as the difference between the total load and the adjusted load. This is summarized as follows:

1. $TMDL\ Total\ Load\ x\ \%\ Pet\ Sources\ from\ TMDL\ Bacteria\ Source\ Distribution\ x\ 25\%\ Removal\ Efficency = Amount\ of\ Load\ Reduction$
2. $TMDL\ Total\ Load - Amount\ of\ Load\ Reduction = Adjusted\ Load$
3. $\frac{(TMDL\ Total\ Load - Adjusted\ Load)}{TMDL\ Total\ Load} x\ 100 = \%\ Estimated\ Load\ Reduction$

Livestock Fencing (Two TMDL Watersheds Only)

This Tier B strategy proposes to install livestock fencing along streams in pasture areas to prevent grazing livestock from accessing the stream. A study by Zeckoski et al. (2012) in Virginia found that water quality improved once livestock fencing was installed, and the excluded livestock put on 5 to 10 percent additional weight over 9 to 10 months when provided with alternative water sources such as springs and wells. The study also states that livestock fencing may potentially reduce the risk of livestock disease associated with the livestock drinking from the same stream water that is contaminated with their waste.

There are various types of livestock fencing systems available. A simple solution is to provide a trough or alternative water source in the upland area away from the stream; this measure alone may reduce the amount of time the livestock spend in the stream by 80 to 99 percent because livestock prefer drinking from troughs (Zeckoski et al., 2012). More complex systems involve both streamside fencing and cross fencing, i.e., a hardened controlled access point where livestock may cross the stream to reach pasture on the other side without being able to drink from the stream.

The Tier B proposed strategy of livestock fencing is recommended in the Patuxent River Upper and West River mainstream watersheds because these are the only watersheds that have sufficient pastures to support livestock and have a relatively large contribution from livestock waste (see Table 2-19). Load reductions from implementing livestock fencing were estimated by reducing the existing loads from livestock waste by 50 percent.

Canada Goose Management (Site-Specific)

This Tier B strategy involves management of non-migratory Canada goose populations at sites that contain open water, such as ponds, parks, golf courses, campuses, and shorelines. There are many potential management techniques for Canada geese. These include lethal controls (euthanasia, egg addling/oiling, hunting), exclusion methods (fencing, vegetative barriers), habitat alteration (reducing mowing, planting less palatable grass species, steepening banks), public education (signs and handouts at public parks), bird dispersal methods (harassment with trained dogs), and molt capture programs where the captured geese can be processed for food through a program called Farmers and Hunters Feeding the Hungry**.** Multiple techniques are recommended, as geese readily adapt to any single technique. Over the long-term, the more

effective methods will be those that reduce the population rather than those that simply disperse the geese to other areas. According to French and Parkhurst (2009), geese often return to the same nesting areas unless transported at least 200 miles away. The U.S. Department of Agriculture's Wildlife Services and Maryland DNR's Wildlife and Heritage Services are potential partners for the County to work with to develop goose management programs.

For the purposes of this TMDL Restoration Plan, the bacteria load reductions were estimated by assuming that 25 percent of existing Canada geese would be removed through various management techniques similar to those described above. The potential bacteria load reductions from this strategy were calculated as follows:

- $TMDL\ bacteria\ load\ from\ geese\ =$
  $TMDL\ total\ load\ x\ \%\ wildlife\ x\ \%\ geese\ out\ of\ total\ wildlife$
- $Total\ bacteria\ load\ from\ geese\ x\ 25\%\ = Amount\ of\ load\ reduction$
- $TMDL\ total\ load - amount\ of\ load\ reduction\ = adjusted\ load$
- $\frac{(TMDL\ total\ load - adjusted\ load)}{TMDL\ total\ load}\ x\ 100\% = \%\ estimated\ load\ reduction$

4.2 IMPLEMENTATION COSTS OF PROPOSED RESTORATION STRATEGIES

The costs of the proposed Tier A and Tier B restoration strategies were estimated from local literature sources, the County's CIP annual budget reports, and in some cases best professional judgment based on a range of approximate costs from available literature. The costs of non-structural strategies such as pet waste education and goose management were generally more difficult to estimate due to the lack of available data. The available data unit costs were estimated as follows:

- **Dry pond retrofits**: $171,307 per pond, based on an average of past County expenditures for pond retrofits
- **SPSC retrofits**: $64,500 per impervious acre treated (King and Hagan, 2011)
- **Abatement of SSOs**: varies by SPS upgrade project. Average cost of 35 planned or active projects is $351,463, estimated from CIP wastewater budget reports
- **Retirement of County septic systems**: $51,000 per septic system, estimated from County Phase II WIP; this may be a higher estimate and would be revised in the annual progress report for this restoration plan based on actual implementation costs
- **Livestock fencing**: $12,400 per system, $4.00 per linear foot to install and maintain fencing (Zeckoski et al., 2012)
- **Elimination of household illicit connections**: $121,000 per year, estimated from County 2013 NPDES MS4 Annual Report (Anne Arundel County, 2014)

- **Expanded pet waste education program**: $150,000 per year (includes pet waste video for $27,000 and several television PSAs at $10,000 to $12,000 each)
- **Riparian buffer education program**: $60,000 per year, estimated from other types of education programs cited in the literature
- **Goose management program**: $25,000 to $300,000, depending on intensity of program

4.3 POLLUTANT LOAD REDUCTIONS

As mentioned previously, water quality models were developed using the Center for Watershed Protection's WTM to characterize and quantify the bacteria loads for existing conditions. The model was also used to estimate the pollutant load reductions from restoration measures as described in the following sections. Appendix A contains the WTM modeling approach and results.

4.3.1 Estimation of Load Reductions from Prior Management Measures

MDE (2014b) recommends estimating load reductions from prior management measures to account for progress toward TMDL goals made to date. In the case of the County's bacteria TMDLs, about 10 to 15 years have elapsed since the development of the TMDLs, during which time the County has implemented BMPs and retired septic systems, both of which provide credit for bacteria removal.

To estimate the credit for bacteria removal from the BMPs already implemented, a methodology was developed through correspondence with MDE staff. The methodology involved entering the original TMDL data from the MDE published TMDL reports from 2000 into the WTM and calibrating the WTM baseline loads to the MDE baseline loads. Then, the post-TMDL BMPs and the post-TMDL septic system retirements were entered in the model and the percent reduction relative to the MDE baseline was calculated. "Post-TMDL" refers to the period from 2000 to present. The year 2000 was used as the cut-off because that was the year of the land use data MDE used to develop the TMDLs.

The calculated bacteria load reductions from prior management measures are presented in Table 4-6 below for each of the TMDL watersheds. Some of the load reductions are under-estimated because drainage area data from some BMPs were unavailable, as the County is currently in the process of updating this information. Bacteria load reductions from septic system retirement were typically less than 1 percent (0.88 percent on average) because few have been retired since 2000. In many watersheds, no septic systems have been retired (Table 4-3).

The prior percent load reductions from post-TMDL BMPs and from post-TMDL septic system retirements were added together and subtracted from the overall TMDL-required percent load reduction. The resulting "adjusted" TMDL required percent reduction represents the remaining bacteria load reduction that is required to be achieved to meet the TMDL water quality goals (Table 4-6). On average, the adjusted TMDL reduction was 4.60 percent lower than the original TMDL reduction (Table 4-6).

Table 4-6: Estimates of Load Reductions from Prior Management Measures and Corresponding Adjustments to TMDL Required Percent Reductions

Bacteria TMDL Watershed	Prior Load Reductions Since 2000		TMDL Targets	
	Post-TMDL BMPs	Post-TMDL Septic System Retirement	TMDL Required % Reduction	Adjusted TMDL Required % Reduction
Magothy Mainstem	3.30%	0.61%	54.00%	50.09%
Magothy River/Forked Creek	4.91%	None	26.27%	21.36%
Magothy River/Tar Cove	2.44%	None	32.66%	30.22%
Patapsco River/Furnace Creek	4.47%	0.38%	77.79%	72.94%
Patapsco River LNB	3.70%	2.61%	56.1%	49.79%
Patapsco River/Marley Creek	5.41%	0.26%	75.70%	70.03%
Patuxent River Upper	8.36%	None	47.2%	38.84%
Rhode River/Bear Neck Creek	11.96%	None	43.32%	31.36%
Rhode River/Cadle Creek	3.43%	None	72.16%	68.73%
Severn River Mainstem	1.19%	0.35%	19.00%	17.46%
Severn River/Mill Creek	4.30%	None	86.00%	81.70%
Severn River/Whitehall and Meredith Creek	6.45%	0.43%	90.00%	83.12%
South River/Duvall Creek	3.77%	None	45.56%	41.79%
South River Mainstem	8.09%	0.06%	46.00%	37.85%
South River/Ramsey Lake	6.00%	None	59.30%	53.30%
South River/Selby Bay	1.20%	None	28.4%	27.20%
W. Chesapeake Bay/Tracy and Rockhold Creeks	0.35%	2.70%	82.00%	78.95%
West River Mainstem	0.27%	0.48%	35.41%	34.66%
West River/Parish Creek	None	None	53.04%	53.04%
Average:	4.38%	0.88%	Avg Adjustment = 4.60% lower	

4.3.2 Estimation of Load Reductions for Proposed Strategies

This section provides estimations of potential bacteria load reductions for the proposed Tier A and Tier B strategies described in Sections 4.1.1 and 4.1.2. The load reductions were estimated using modeling techniques, local literature sources, and County data.

The estimated bacteria load reductions are presented in Table 4-7A through Table 4-7I below for all of the TMDL watersheds. Each table includes the estimated load reductions associated with each strategy, the total estimated cost of the strategy, a cost-benefit ratio, and the Tiered Recommendation (either A or B). Also included are the total estimated load reductions for implementing all Tier A strategies, all Tier B strategies, all Tier A and Tier B strategies combined, and the adjusted TMDL required percent reduction, which reflects the remaining reductions needed to meet the TMDL after prior load reductions are accounted for (see Section 4.3.1). The Tier B strategy of livestock fencing is presented as a strategy for only two of the TMDL watersheds (the Patuxent River Upper and the West River Mainstem) since these are the only two where sufficient pasture exists to support livestock.

The load estimation tables show that the greatest bacteria reductions were attributed to the Tier B strategy of pet waste education in seven of the 19 TMDL watersheds (Magothy Mainstem, Forked Creek, Bear Neck Creek, Cadle Creek, Duvall Creek, Ramsey Lake, and Selby Bay), and pet waste education was also one of the most cost-effective strategies. In other watersheds, the highest load reductions were correlated with various Tier A (human sources) and Tier B (non-human sources) strategies, as follows:

- Septic system retirement resulted in the greatest load reductions in Tar Cove, Mill Creek, Whitehall-Meredith Creeks, and South River Mainstem watersheds
- Removal of household illicit connections resulted in the greatest load reductions in the Patapsco River LNB, Marley Creek, and Severn River Mainstem watersheds
- Restoration of 20 percent impervious cover with high pollutant removal efficiency practices such as SPSCs resulted in the greatest load reductions in the Furnace Creek watershed
- Riparian buffer education resulted in the greatest load reductions in the Patuxent River Upper watershed
- SSO abatement resulted in the greatest load reductions in the Parish Creek watershed
- Livestock fencing resulted in the greatest load reductions in the West River Mainstem watershed (of the two pasture watersheds where this strategy was applicable)
- Goose management resulted in the greatest load reductions in the Tracy and Rockhold Creeks watershed

Non-structural Tier B strategies such as pet waste education, riparian buffer education, and goose management were relatively cost-effective compared to structural Tier A strategies such as SPS

upgrades and septic system retirement. Livestock fencing was also highly cost-effective in the two pasture watersheds where it was proposed as a strategy (Patuxent River Upper and West River mainstem). Urban stormwater management, including retrofitting pre-2002 dry ponds and restoring of 20 percent of unmanaged impervious cover with SPSCs, was less cost-effective due to the high unit cost assumptions (see Section 4.2) of implementing these types of stormwater projects. Eliminating household illicit connections was also less cost-effective than the other strategies due to the low rate (2 percent, see Section 4.1.1) of detecting and eliminating bacteria sources from household illicit connections.

The magnitude of the load reduction requirements indicates that multiple strategies will need to be implemented in combination in each TMDL watershed to achieve the required TMDL percent reductions. In most of the watersheds, implementing all Tier A and all Tier B strategies is sufficient to meet, or come close to meeting, the TMDL goals. However, this is not the case in seven of the watersheds, where even implementing all the Tier A and Tier B strategies is still not enough to meet the TMDL required reductions. These watersheds include: Furnace Creek (Table 4-7C), Marley Creek (Table 4-7C), Cadle Creek (Table 4-7E), Mill Creek (Table 4-7F), Tracy-Rockhold Creek (Table 4-7H), Whitehall-Meredith Creek (Table 4-7F), and Ramsey Lake (Table 4-7G). In the first five of these watersheds, it is recommended to prioritize pet waste education in high-density residential areas. In the last two watersheds (Whitehall-Meredith Creek and Ramsey Lake), load reductions are limited by other factors, primarily the lack of pond retrofit, SPS upgrade, and septic system retirement opportunities in these watersheds. For example, in the Ramsey Lake watershed, there are no existing dry ponds and no planned SPS upgrade projects. To achieve the TMDL goals in these watersheds, additional restoration opportunities with bacteria removal benefits will need to be identified, and multiple non-structural strategies such as pet waste education and possibly goose management will need to be implemented on a large scale to restore the water quality standards of the impaired waterways.

Table 4-7A: Estimated Load Reductions for Proposed Strategies in the Magothy Mainstem, Forked Creek, and Tar Cove Watersheds

TMDL Watershed: Magothy Mainstem				
Proposed Strategy	**Expected % Load Reduction**	**Total Estimated Cost in Millions**	**Cost-Benefit Ratio**	**Tiered Recommendation**
Pre-2002 Pond Retrofits	4.27%	$1.37	32.1	B
Restore 20% Impervious Area with High Pollutant Removal Efficiency BMPs such as SPSC	4.48%	$22.68	506.2	B
Eliminate Household Illicit Connections	8.74%	$0.61	6.9	A
Abatement of SSOs	1.12%	$1.71	152.8	A
Septic Retirement/Connection	13.55%	$245.51	1811.9	A
Riparian Buffer Education	0.91%	$0.06	6.2	B
Expanded Pet Waste Education	16.30%	$0.15	0.9	B
Expanded Goose Management Program	2.88%	$0.03	1.0	B
All Tier A Strategies:	**23.41%**			
All Tier B Strategies:	**28.84%**			
All Strategies:	**52.25%**			
Adjusted TMDL Required % Reduction:	**50.09%**			
TMDL Watershed: Magothy River/Forked Creek				
Proposed Strategy	**Expected % Load Reduction**	**Total Estimated Cost in Millions**	**Cost-Benefit Ratio**	**Tiered Recommendation**
Pre-2002 Pond Retrofits	N/A	N/A	N/A	B
Restore 20% Impervious Area with High Pollutant Removal Efficiency BMPs such as SPSC	7.02%	$1.64	23.4	B
Eliminate Household Illicit Connections	1.13%	$0.61	53.5	A
Abatement of SSOs	12.40%	$0.26	2.1	A
Septic Retirement/Connection	6.14%	$5.76	93.9	A
Riparian Buffer Education	1.93%	$0.06	2.9	B
Expanded Pet Waste Education	21.45%	$0.15	0.7	B
Expanded Goose Management Program	1.73%	$0.03	1.7	B
All Tier A Strategies:	**19.67%**			
All Tier B Strategies:	**32.13%**			
All Strategies:	**51.80%**			
Adjusted TMDL Required % Reduction:	**21.36%**			

Table 4-7A Continued: Estimated Load Reductions for Proposed Strategies in the Magothy Mainstem, Forked Creek, and Tar Cove Watersheds

TMDL Watershed: Magothy River/Tar Cove				
Proposed Strategy	**Expected % Load Reduction**	**Total Estimated Cost in Millions**	**Cost-Benefit Ratio**	**Tiered Recommendation**
Pre-2002 Pond Retrofits	N/A	N/A	N/A	B
Restore 20% Impervious Area with High Pollutant Removal Efficiency BMPs such as SPSC	3.76%	$3.32	88.3	B
Eliminate Household Illicit Connections	0.67%	$0.61	90.3	A
Abatement of SSOs	N/A	N/A	N/A	A
Septic Retirement/Connection	25.25%	$87.11	345.0	A
Riparian Buffer Education	1.02%	$0.06	5.9	B
Expanded Pet Waste Education	13.60%	$0.15	1.1	B
Expanded Goose Management Program	4.27%	$0.03	0.6	B
All Tier A Strategies:	**25.92%**			
All Tier B Strategies:	**22.65%**			
All Strategies:	**48.57%**			
Adjusted TMDL Required % Reduction:	**30.22%**			

Table 4-7B: Estimated Load Reductions for Proposed Strategies in the Patapsco River Lower North Branch Watershed

TMDL Watershed: Patapsco River Lower North Branch				
Proposed Strategy	**Expected % Load Reduction**	**Total Estimated Cost in Millions**	**Cost-Benefit Ratio**	**Tiered Recommendation**
Pre-2002 Pond Retrofits	1.26%	$0.86	68.0	B
Restore 20% Impervious Area with High Pollutant Removal Efficiency BMPs such as SPSC	6.59%	$31.70	481.1	B
Eliminate Household Illicit Connections	11.60%	$0.61	5.2	A
Abatement of SSOs	4.90%	$0.92	18.8	A
Septic Retirement/Connection	5.60%	$8.87	158.5	A
Riparian Buffer Education	2.99%	$0.06	2.0	B
Expanded Pet Waste Education	6.50%	$0.15	2.3	B
Expanded Goose Management Program	0.79%	$0.03	3.2	B
All Tier A Strategies:	**22.10%**			
All Tier B Strategies:	**18.13%**			
All Strategies:	**40.23%**			
Adjusted TMDL Required % Reduction:	**49.79%**			

Table 4-7C: Estimated Load Reductions for Proposed Strategies in the Furnace Creek and Marley Creek Watersheds

Proposed Strategy	Expected % Load Reduction	Total Estimated Cost in Millions	Cost-Benefit Ratio	Tiered Recommendation
TMDL Watershed: Patapsco River/Furnace Creek				
Pre-2002 Pond Retrofits	8.16%	$1.37	16.8	B
Restore 20% Impervious Area with High Pollutant Removal Efficiency BMPs such as SPSC	9.00%	$27.55	306.1	B
Eliminate Household Illicit Connections	7.72%	$0.61	7.8	A
Abatement of SSOs	3.50%	$2.19	62.5	A
Septic Retirement/Connection	3.38%	$12.85	380.2	A
Riparian Buffer Education	1.47%	$0.06	4.1	B
Expanded Pet Waste Education	7.35%	$0.15	2.0	B
Expanded Goose Management Program	4.98%	$0.03	0.5	B
All Tier A Strategies:	**14.60%**			
All Tier B Strategies:	**30.96%**			
All Strategies:	**45.56%**			
Adjusted TMDL Required % Reduction:	**72.94%**			
TMDL Watershed: Patapsco River/Marley Creek				
Pre-2002 Pond Retrofits	4.47%	$1.88	42.2	B
Restore 20% Impervious Area with High Pollutant Removal Efficiency BMPs such as SPSC	8.42%	$23.77	282.3	B
Eliminate Household Illicit Connections	10.82%	$0.61	5.6	A
Abatement of SSOs	2.04%	$1.56	76.4	A
Septic Retirement/Connection	N/A	N/A	N/A	A
Riparian Buffer Education	1.63%	$0.06	3.7	B
Expanded Pet Waste Education	8.65%	$0.15	1.7	B
Expanded Goose Management Program	4.08%	$0.03	0.6	B
All Tier A Strategies:	**12.86%**			
All Tier B Strategies:	**27.25%**			
All Strategies:	**40.11%**			
Adjusted TMDL Required % Reduction:	**70.03%**			

Table 4-7D: Estimated Load Reductions for Proposed Strategies in the Patuxent River Upper Watershed. Note that a Livestock Fencing Strategy is included since this Watershed Contains Some Agricultural Land.

Proposed Strategy	Expected % Load Reduction	Total Estimated Cost in Millions	Cost-Benefit Ratio	Tiered Recommendation
TMDL Watershed: Patuxent River Upper				
Pre-2002 Pond Retrofits	N/A	N/A	N/A	B
Restore 20% Impervious Area with High Pollutant Removal Efficiency BMPs such as SPSC	5.42%	$4.97	91.6	B
Eliminate Household Illicit Connections	0.85%	$0.61	71.2	A
Abatement of SSOs	N/A	N/A	N/A	A
Septic Retirement/Connection	16.45%	$14.74	89.6	A
Riparian Buffer Education	17.20%	$0.06	0.3	B
Expanded Pet Waste Education	4.50%	$0.15	3.3	B
Expanded Goose Management Program	4.58%	$0.03	0.5	B
Livestock Fencing	14.00%	$0.13	0.9	B
All Tier A Strategies:	**17.30%**			
All Tier B Strategies:	**45.70%**			
All Strategies:	**63.00%**			
Adjusted TMDL Required % Reduction:	**38.84%**			

Table 4-7E: Estimated Load Reductions for Proposed Strategies in the Bear Neck and Cadle Creek Watersheds

TMDL Watershed: Rhode River/Bear Neck Creek				
Proposed Strategy	**Expected % Load Reduction**	**Total Estimated Cost in Millions**	**Cost-Benefit Ratio**	**Tiered Recommendation**
Pre-2002 Pond Retrofits	N/A	N/A	N/A	B
Restore 20% Impervious Area with High Pollutant Removal Efficiency BMPs such as SPSC	6.82%	$1.27	18.6	B
Eliminate Household Illicit Connections	0.50%	$0.61	121.0	A
Abatement of SSOs	2.50%	$0.40	15.9	A
Septic Retirement/Connection	N/A	N/A	N/A	A
Riparian Buffer Education	0.11%	$0.06	54.5	B
Expanded Pet Waste Education	8.48%	$0.15	1.8	B
Expanded Goose Management Program	2.58%	$0.03	1.0	B
All Tier A Strategies:	**3.00%**			
All Tier B Strategies:	**17.98%**			
All Strategies:	**20.98%**			
Adjusted TMDL Required % Reduction:	**32.12%**			
TMDL Watershed: Rhode River/Cadle Creek				
Proposed Strategy	**Expected % Load Reduction**	**Total Estimated Cost in Millions**	**Cost-Benefit Ratio**	**Tiered Recommendation**
Pre-2002 Pond Retrofits	N/A	N/A	N/A	B
Restore 20% Impervious Area with High Pollutant Removal Efficiency BMPs such as SPSC	9.40%	$0.75	8.0	B
Eliminate Household Illicit Connections	0.30%	$0.61	201.7	A
Abatement of SSOs	8.40%	$0.50	6.0	A
Septic Retirement/Connection	N/A	N/A	N/A	A
Riparian Buffer Education	0.80%	$0.06	7.5	B
Expanded Pet Waste Education	20.05%	$0.15	0.7	B
Expanded Goose Management Program	2.55%	$0.03	1.0	B
All Tier A Strategies:	**8.70%**			
All Tier B Strategies:	**32.80%**			
All Strategies:	**41.50%**			
Adjusted TMDL Required % Reduction:	**68.73%**			

Table 4-7F: Estimated Load Reductions for Proposed Strategies in the Severn River Mainstem, Mill Creek, and Whitehall-Meredith Creek Watersheds

TMDL Watershed: Severn River Mainstem				
Proposed Strategy	**Expected % Load Reduction**	**Total Estimated Cost in Millions**	**Cost-Benefit Ratio**	**Tiered Recommendation**
Pre-2002 Pond Retrofits	3.10%	$2.23	71.8	B
Restore 20% Impervious Area with High Pollutant Removal Efficiency BMPs such as SPSC	3.90%	$56.59	1451.1	B
Eliminate Household Illicit Connections	19.02%	$0.61	3.2	A
Abatement of SSOs	0.36%	$2.39	655.9	A
Septic Retirement/Connection	10.56%	$279.23	2644.2	A
Riparian Buffer Education	1.56%	$0.06	3.8	B
Expanded Pet Waste Education	17.20%	$0.15	0.9	B
Expanded Goose Management Program	3.78%	$0.03	0.7	B
All Tier A Strategies:	**29.94%**			
All Tier B Strategies:	**29.54%**			
All Strategies:	**59.49%**			
Adjusted TMDL Required % Reduction:	**17.46%**			
TMDL Watershed: Severn River/Mill Creek				
Proposed Strategy	**Expected % Load Reduction**	**Total Estimated Cost in Millions**	**Cost-Benefit Ratio**	**Tiered Recommendation**
Pre-2002 Pond Retrofits	4.34%	$0.51	11.8	B
Restore 20% Impervious Area with High Pollutant Removal Efficiency BMPs such as SPSC	4.20%	$2.78	66.2	B
Eliminate Household Illicit Connections	1.54%	$0.61	39.3	A
Abatement of SSOs	0.20%	$0.26	130.3	A
Septic Retirement/Connection	34.70%	$59.57	171.7	A
Riparian Buffer Education	2.80%	$0.06	2.1	B
Expanded Pet Waste Education	9.50%	$0.15	1.6	B
Expanded Goose Management Program	7.72%	$0.03	0.3	B
All Tier A Strategies:	**36.44%**			
All Tier B Strategies:	**28.56%**			
All Strategies:	**65.00%**			
Adjusted TMDL Required % Reduction:	**81.70%**			

Table 4-7F Continued: Estimated Load Reductions for Proposed Strategies in the Severn River Mainstem, Mill Creek Southern, and Whitehall-Meredith Creek Watersheds

TMDL Watershed: Severn River/Whitehall and Meredith Creek				
Proposed Strategy	**Expected % Load Reduction**	**Total Estimated Cost in Millions**	**Cost-Benefit Ratio**	**Tiered Recommendation**
Pre-2002 Pond Retrofits	N/A	N/A	N/A	B
Restore 20% Impervious Area with High Pollutant Removal Efficiency BMPs such as SPSC	4.20%	$2.88	68.5	B
Eliminate Household Illicit Connections	0.90%	$0.61	67.2	A
Abatement of SSOs	N/A	N/A	N/A	A
Septic Retirement/Connection	21.10%	$16.32	77.3	A
Riparian Buffer Education	2.24%	$0.06	2.7	B
Expanded Pet Waste Education	6.50%	$0.15	2.3	B
Expanded Goose Management Program	9.29%	$0.03	0.3	B
All Tier A Strategies:	**22.00%**			
All Tier B Strategies:	**22.23%**			
All Strategies:	**44.23%**			
Adjusted TMDL Required % Reduction:	**83.12%**			

Table 4-7G: Estimated Load Reductions for Proposed Strategies in the South River Mainstem, Duvall Creek, Ramsey Lake, and Selby Bay Watersheds

TMDL Watershed: South River Mainstem				
Proposed Strategy	**Expected % Load Reduction**	**Total Estimated Cost in Millions**	**Cost-Benefit Ratio**	**Tiered Recommendation**
Pre-2002 Pond Retrofits	3.73%	$2.40	64.3	B
Restore 20% Impervious Area with High Pollutant Removal Efficiency BMPs such as SPSC	3.60%	$22.52	625.5	B
Eliminate Household Illicit Connections	11.30%	$0.61	5.4	A
Abatement of SSOs	0.30%	$1.55	516.6	A
Septic Retirement/Connection	15.60%	$86.39	553.8	A
Riparian Buffer Education	8.00%	$0.06	0.8	B
Expanded Pet Waste Education	10.83%	$0.15	1.4	B
Expanded Goose Management Program	4.44%	$0.03	0.6	B
All Tier A Strategies:	**27.20%**			
All Tier B Strategies:	**30.59%**			
All Strategies:	**57.79%**			
Adjusted TMDL Required % Reduction:	**37.85%**			
TMDL Watershed: South River/Duvall Creek				
Proposed Strategy	**Expected % Load Reduction**	**Total Estimated Cost in Millions**	**Cost-Benefit Ratio**	**Tiered Recommendation**
Pre-2002 Pond Retrofits	N/A	N/A	N/A	B
Restore 20% Impervious Area with High Pollutant Removal Efficiency BMPs such as SPSC	9.13%	$1.63	17.8	B
Eliminate Household Illicit Connections	0.65%	$0.61	93.1	A
Abatement of SSOs	6.40%	$0.26	4.1	A
Septic Retirement/Connection	N/A	N/A	N/A	A
Riparian Buffer Education	N/A	N/A	N/A	B
Expanded Pet Waste Education	17.00%	$0.15	0.9	B
Expanded Goose Management Program	2.16%	$0.03	1.2	B
All Tier A Strategies:	**7.05%**			
All Tier B Strategies:	**28.29%**			
All Strategies:	**35.34%**			
Adjusted TMDL Required % Reduction:	**41.79%**			

Table 4-7G Continued: Estimated Load Reductions for Proposed Strategies in the South River Mainstem, Duvall Creek, Ramsey Lake, and Selby Bay Watersheds

TMDL Watershed: South River/Ramsey Lake				
Proposed Strategy	**Expected % Load Reduction**	**Total Estimated Cost in Millions**	**Cost-Benefit Ratio**	**Tiered Recommendation**
Pre-2002 Pond Retrofits	N/A	N/A	N/A	B
Restore 20% Impervious Area with High Pollutant Removal Efficiency BMPs such as SPSC	2.90%	$0.88	30.2	B
Eliminate Household Illicit Connections	0.11%	$0.61	550.0	A
Abatement of SSOs	N/A	N/A	N/A	A
Septic Retirement/Connection	N/A	N/A	N/A	A
Riparian Buffer Education	0.14%	$0.06	42.9	B
Expanded Pet Waste Education	15.73%	$0.15	1.0	B
Expanded Goose Management Program	4.81%	$0.03	0.5	B
All Tier A Strategies:	**0.11%**			
All Tier B Strategies:	**23.58%**			
All Strategies:	**23.69%**			
Adjusted TMDL Required % Reduction:	**53.30%**			
TMDL Watershed: South River/Selby Bay				
Proposed Strategy	**Expected % Load Reduction**	**Total Estimated Cost in Millions**	**Cost-Benefit Ratio**	**Tiered Recommendation**
Pre-2002 Pond Retrofits	N/A	N/A	N/A	B
Restore 20% Impervious Area with High Pollutant Removal Efficiency BMPs such as SPSC	3.20%	$0.85	26.6	B
Eliminate Household Illicit Connections	0.16%	$0.61	378.1	A
Abatement of SSOs	N/A	N/A	N/A	A
Septic Retirement/Connection	N/A	N/A	N/A	A
Riparian Buffer Education	0.06%	$0.06	100.0	B
Expanded Pet Waste Education	15.68%	$0.15	1.0	B
Expanded Goose Management Program	4.58%	$0.03	0.5	B
All Tier A Strategies:	**0.16%**			
All Tier B Strategies:	**23.51%**			
All Strategies:	**23.67%**			
Adjusted TMDL Required % Reduction:	**27.20%**			

Table 4-7H: Estimated Load Reductions for Proposed Strategies in the Tracy and Rockhold Creek Watershed

TMDL Watershed: W. Chesapeake Bay/Tracy and Rockhold Creeks				
Proposed Strategy	**Expected % Load Reduction**	**Total Estimated Cost in Millions**	**Cost-Benefit Ratio**	**Tiered Recommendation**
Pre-2002 Pond Retrofits	N/A	N/A	N/A	B
Restore 20% Impervious Area with High Pollutant Removal Efficiency BMPs such as SPSC	2.60%	$4.79	184.1	B
Eliminate Household Illicit Connections	0.23%	$0.61	263.0	A
Abatement of SSOs	N/A	N/A	N/A	A
Septic Retirement/Connection	N/A	N/A	N/A	A
Riparian Buffer Education	8.20%	$0.06	0.7	B
Expanded Pet Waste Education	5.20%	$0.15	2.9	B
Expanded Goose Management Program	9.38%	$0.03	0.3	B
All Tier A Strategies:	**0.23%**			
All Tier B Strategies:	**25.38%**			
All Strategies:	**25.61%**			
Adjusted TMDL Required % Reduction:	**78.95%**			

Table 4-7l: Estimated Load Reductions for Proposed Strategies in the West River Mainstem and Parish Creek Watersheds. Note that a Livestock Fencing Strategy is included in the West River Mainstem Watershed since this Watershed Contains Some Agricultural Land.

TMDL Watershed: West River Mainstem				
Proposed Strategy	**Expected % Load Reduction**	**Total Estimated Cost in Millions**	**Cost-Benefit Ratio**	**Tiered Recommendation**
Pre-2002 Pond Retrofits	N/A	N/A	N/A	B
Restore 20% Impervious Area with SPSC	8.30%	$4.72	56.9	B
Eliminate Household Illicit Connections	1.21%	$0.61	50.0	A
Abatement of SSOs	N/A	N/A	N/A	A
Septic Retirement/Connection	N/A	N/A	N/A	A
Riparian Buffer Education	11.54%	$0.06	0.5	B
Expanded Pet Waste Education	3.93%	$0.15	3.8	B
Expanded Goose Management Program	3.51%	$0.03	0.7	B
Livestock Fencing	28.55%	$0.13	0.5	B
All Tier A Strategies:	**1.21%**			
All Tier B Strategies:	**55.82%**			
All Strategies:	**57.03%**			
Adjusted TMDL Required % Reduction:	**34.66%**			
TMDL Watershed: West River/Parish Creek				
Proposed Strategy	**Expected % Load Reduction**	**Total Estimated Cost in Millions**	**Cost-Benefit Ratio**	**Tiered Recommendation**
Pre-2002 Pond Retrofits	N/A	N/A	N/A	B
Restore 20% Impervious Area with SPSC	10.50%	$0.72	6.9	B
Eliminate Household Illicit Connections	0.19%	$0.61	318.4	A
Abatement of SSOs	12.90%	$0.40	3.1	A
Septic Retirement/Connection	N/A	N/A	N/A	A
Riparian Buffer Education	0.46%	$0.06	13.0	B
Expanded Pet Waste Education	10.05%	$0.15	1.5	B
Expanded Goose Management Program	7.72%	$0.03	0.3	B
All Tier A Strategies:	**13.09%**			
All Tier B Strategies:	**28.73%**			
All Strategies:	**41.82%**			
Adjusted TMDL Required % Reduction:	**53.04%**			

4.4 PROPOSED STRATEGIES WITH LARGEST IMPACT AND RECOMMENDED PRIORITIZATION OF STRATEGIES

The proposed Tier A strategies with the largest impacts are reducing the number of SSOs, retiring County septic systems, and eliminating household illicit connections to reduce human bacteria sources. The proposed Tier B strategies with the largest impacts are a pet waste education program and riparian buffer education program to reduce non-human bacteria sources.

In the 12 TMDL watersheds where SSO abatement is proposed, the bacteria load reductions ranged from 0.36 to 12.40 percent. In the 10 TMDL watersheds where County septic systems were identified for retirement based on County data, the bacteria load reductions ranged from 3.38 to 34.70 percent. Implementing a riparian buffer education program resulted in an estimated load reduction of 0.06 to 17.20 percent among 18 of the 19 TMDL watersheds where buffers occur.

Load reductions from implementing an expanded pet waste education program ranged from 4.50 to 21.45 percent in all 19 TMDL watersheds and were highest in the smaller watersheds with a large proportion of residential urban land, e.g., Forked Creek, Cadle Creek, and Duvall Creek, which have dense shoreline communities that could provide excellent case studies for implementing the pet waste education strategy. In addition, removal of pet waste from along or near the shoreline in these watersheds is likely to have an immediate impact on the water quality of the local impaired waterway due to the proximity of the bacteria sources to the receiving water body.

Prioritization of the proposed strategies considers that some are already part of existing County programs, such as eliminating illicit connections, urban stormwater management, and SPS upgrades, and retiring septic systems. The purpose of including these as strategies in this Bacteria TMDL Restoration Plan is to take advantage of the bacteria load reductions being achieved from the County's existing programs and operations, as well as future load reductions that will be achieved by these programs.

The magnitude of the TMDL required load reductions is such that many strategies will need to be implemented to restore TMDL water quality standards in the impaired waterways. In particular, implementation of a multi-media pet waste education program is strongly recommended due to the large bacteria load reductions that are likely to be achieved with this strategy. In addition, riparian buffer education is also recommended because it is also relatively cost-effective and has wide applicability.

Goose management and livestock fencing are generally cost-effective as well, but are not considered a priority since they have limited applicability, i.e., goose management is only relevant in small localized areas where geese are a nuisance and impact water quality, and livestock fencing is only applicable to the two TMDL watersheds where livestock occur (Patuxent River Upper and West River Mainstem).

The proposed strategies are prioritized as listed in Table 4-8 below. The priorities are based on whether the program is in place or not, the estimated magnitude of bacteria load reductions, the relative cost-effectiveness of the strategy, and the applicability of the strategy among the 19 TMDL watersheds.

Table 4-8: Priority of Proposed Strategies

Proposed Strategy	Tier (A or B)	Priority For Implementation	Relative Cost-Effectiveness	Current Status	Recommendation
Expanded Pet Waste Education Program	B - reduces non-human sources	1	High	Limited Implementation	Implement in all TMDL Watersheds
Riparian Buffer Education	B - reduces non-human sources	2	High	Limited Implementation	Implement in all TMDL Watersheds
Goose Management Program	B - reduces non-human sources	3	High	Limited Implementation	Implemented in Site-Specific Areas Only
Livestock Fencing	B - reduces non-human sources	4	High	Limited Implementation	Implemented in Two Pasture Watersheds Only[1]
Abatement of SSOs	A - reduces human bacteria sources	1 - already in place	Low	Being Implemented	Begin Accounting for Bacteria Load Reductions
Retirement of County Septic Systems	A - reduces human bacteria sources	1 - already in place	Low	Being Implemented	Begin Accounting for Bacteria Load Reductions
Eliminate Household Illicit Connections	A - reduces human bacteria sources	1 - already in place	Moderate	Being Implemented	Begin Accounting for Bacteria Load Reductions
Pre-2002 Pond Retrofits	B - reduces non-human sources	1 - already in place	Moderate	Being Implemented	Begin Accounting for Bacteria Load Reductions
Restore 20% Impervious Cover with SPSC	B - reduces non-human sources	1 - already in place	Moderate	Being Implemented	Begin Accounting for Bacteria Load Reductions

1-Patuxent River Upper and West River Mainstem

SECTION FIVE: PUBLIC AND STAKEHOLDER PARTICIPATION

Public participation and stakeholder engagement play an important role in the successful implementation of a TMDL restoration plan. As part of its NPDES MS4 permit, the County is required to engage the public in the TMDL restoration plan development, solicit their input, and incorporate any relevant ideas and program improvements that help achieve the TMDL goals (Part IV.E.3). According to the County's Phase II Watershed Implementation Plan (WIP; Anne Arundel County, 2012), approximately 64 percent of the land in the County is privately owned; therefore, increasing public awareness of TMDL impairment may result in fostering partnerships with private owners which would lead to greater pollutant load reductions. In addition, the participating public can offer useful on-the-ground information, such as confirmation of livestock and wildlife numbers (and locations where they occur), general knowledge of the local community (e.g., landowners' willingness to implement restoration projects), and information about the local impaired waterway (VA DEQ, 2011; EPA, 2013a).

According to the County, one of the major challenges to engaging the public is that "most citizens do not understand the degree that their individual actions affect waterway health and do not understand how they can be part of the solution" (Anne Arundel County, 2012). Specifically, many people are not aware that nonpoint source pollution can contribute to bacteria loads (WGCAC, 2011). Therefore, it is important to inform the public of the impacts of nonpoint source pollution, and to convey a sense of ownership so that individuals can be better stewards of the environment.

5.1 CURRENT OUTREACH PROGRAMS

The County currently directs several outreach programs led by various departments, including the Department of Public Works. These outreach programs are aimed at increasing public awareness on issues related to water quality and include activities such as conducting workshops and providing information through brochures, fliers, volunteer programs etc. The County is also promoting public awareness using social media such as Facebook. A list of current outreach programs is provided in the County's NPDES MS4 Annual Report (Anne Arundel County, 2014). Table 5-1 lists some of the County's current outreach programs that help increase public awareness related to bacteria impairment.

Table 5-1: Available County Outreach Programs/Materials that Promote Awareness Related to Bacteria Impairments

Department	Outreach Program/Outreach Materials	Media Type
Department of Public Works	• Rehabilitation and Maintenance of County Sewer Infrastructure • Information on Recent Wastewater Spills • Preventing Sewer Backups • Homeowner's Guide to Septic Tanks • Homeowner's Guide to Grinder Pumps • Recycling Programs/Waste Management • Watershed Stewards Academy • Stream Cleanups	Brochures, Fliers, Information Sessions, Presentation, Facebook, Workshops, Volunteer Programs
Department of Health	• Water Quality and Swimming or Fishing in Anne Arundel County Rivers and Creeks • On-Site Sewage Disposal Systems and Private Water Wells • Bay Restoration Fund (BRF) Program, for Nitrogen-Reducing Pretreatment Units for Septic Systems to Be Installed within the Chesapeake Bay Critical Area • Collapsed Septic Tanks, Overflowing Septic Systems and Failing Septic Systems Interim Health and Safety Requirements • Application Procedures for Property Improvements Where Well or On-Site Septic Systems are Utilized • Maryland Healthy Beaches Campaign	Factsheets, Brochures, Campaigns

5.2 POTENTIAL CHALLENGES AND SOLUTIONS TO IMPROVE THE COUNTY'S CURRENT OUTREACH PROGRAMS

Several agencies and jurisdictions have published cost-effective methods to engage the public and stakeholders in watershed restoration. Locally, the Watershed Steward Academy has been successful in training watershed stewards and implementing micro-scale stormwater practices, such as rain barrels, rain gardens, plantings, and forested buffers, and promoting pet waste management. However, they have had difficulty reaching the public on bacteria issues such as pet waste (Capital Gazette, 2014). Table 5-2 summarizes some of the challenges faced by the County's outreach programs and potential solutions for overcoming impediments to cooperative watershed restoration. This information was developed based on publications related to outreach from other jurisdictions and agencies. The proposed solutions apply to most types of watershed outreach and are recommended for this bacteria TMDL restoration plan.

Table 5-2: Challenges and Solutions to Public and Stakeholder Participation in the Watershed Restoration Process

Challenge	Solution
Loss of momentum	Setting small, achievable goals throughout the implementation process to show success and keep the project energized; keeping the public and stakeholders actively engaged by periodically checking in with them during slow times (EPA, 2010).
Poor coordination and planning	Conducting organizational planning activities prior to beginning implementation process. Clearly communicating goals and load reduction strategies to achieve those goals. Making sure that the public and stakeholders all agree on the Restoration Plan. Defining roles and responsibilities (EPA, 2010). Identifying the target audience and all stakeholders, and deciding what messages are to be conveyed and the appropriate conveyance method (i.e., type of media). Determining how success will be measured (e.g., website hits, surveys, water quality monitoring).
Lack of communication or infrequent communication	Keeping the public and stakeholders informed at all times. For example the public and stakeholders should be informed if any issues arise during the implementation process, if there are any changes to the original load reduction strategies, and if any lessons were learned along the way. Keeping the public and stakeholders informed of achievements, however small (e.g., website received 500 hits this week) (EPA, 2010). Making sure new information (e.g., technical reports) is conveyed to the technical team, County, public participation team, and stakeholders. When information becomes available, disseminating it quickly to keep participants informed and engaged (EPA, 2013a).
Political controversy	Avoiding heated political debate on controversial implementation projects. Working quietly with individual stakeholder groups to settle disagreements in a satisfactory manner (EPA, 2010).
Fear of the unknown	Accepting that there may be less data available than optimally preferred. Pursuing objectives aggressively despite lack of sufficient information and data (EPA, 2010).
Letting money drive the implementation process	Identifying types of restoration strategies first, and then pursuing funding to support the strategies. Avoiding pursuing funding opportunities for low-priority activities that may distract from the overall goals of the Restoration Plan (EPA, 2010).
Letting the implementation process bog you down	Keeping meetings short such that stakeholders who are usually volunteers can provide complete attention (EPA, 2013a). Avoiding situations where participants are spending more time on meetings than on actual watershed restoration work (EPA, 2010).
Not seeing any results/evaluation of effectiveness not showing anything	Considering different methods of communication. The County of Los Angeles (2002) recommends the following for effective communication: • Give specific, action-oriented messages (e.g., “do’s and don’ts”). • Emphasize personal responsibility and empowerment. Inspire and motivate people and convey that individuals can make a difference. • Emphasize aesthetic and health benefits of improving water quality (e.g., in the case of bacteria, removal of pet waste and other bacteria sources leads to cleaner neighborhoods and reduces health risk to children, swimmers, boaters). • Make information easily accessible on the Web so the public can follow up on initial interest. Alternatively, Bruce and Tiger (2009) suggest that the effectiveness of public outreach efforts may not be apparent immediately afterwards if the evaluation

Challenge	Solution
	method does not capture the full long-term effects. In general, outreach campaigns may result in only small, incremental behavior changes that are difficult to measure. Outreach programs should focus on changing behaviors rather than just raising awareness. Better knowledge about water quality issues is not well-correlated with better behavior (CWEP, 2009).

5.3 POTENTIAL NEW OUTREACH PROGRAMS

As described above, the County currently conducts numerous outreach/education programs. Additional outreach programs that can be considered to reduce bacteria loads include boater education with respect to marina pump out stations and reducing waste due to homelessness, via reduction in homeless populations or in providing routine cleanup of encampment areas. Estimating the bacteria load reductions due to these two programs is not possible at this time due to the limited amount of quantitative information available. However, based on other education and outreach programs, in general, these programs are likely to be relatively cost effective in terms of reducing bacteria loads.

A potential outreach program is education of boat owners to raise awareness about the importance of always using pump-out stations at marinas for proper sewage disposal. This would help reduce the amount of human bacteria discharged directly into waterways. In general, boat waste discharges can have a significant impact upon the aquatic environment, especially in small, poorly flushed waterways where pollutant concentrations may reach unusually high levels (Klein, 2007). It is estimated that a single weekend boater flushing untreated sewage into waterways produces the same amount of bacterial pollution as 10,000 people whose sewage passes through a treatment plant (CA DBW, 2014). Based on a survey of 227 Maryland boaters, Strand and Gibson (1990) determined that only 24.8% of boaters at marinas with pump-out facilities actually used the facility.

One of the best methods for conveying information about proper use of pump-out stations is posting signs, which are considered a more effective method of conveying information than distributing literature or conducting boater education workshops (EPA, 2014). Signs would be most beneficial at highly visible locations in marinas such as boat ramps, anchorages/moorings, fuel docks, and liveaboard docks. The cost of posting a sign is estimated to be $105 (RI Sea Grant, 1992). MD DNR currently conducts workshops and outreach for marina operators as a part of “Clean Marina Program” to promote environmentally friendly boating practices such as use of pump-outs for waste disposal, proper disposal of trash etc. County agencies can partner with MDDNR to promote environmentally friendly boating activities in watersheds with large number of community marinas such as Severn and South River watersheds. Additional boater outreach may also be conducted through the County’s social media and the County website. In addition to signage, installing additional pump-out facilities at marinas would help to reduce human bacteria discharges from vessels. Strand and Gibson (1990) found that the availability of a pump-out facility at a marina increased the likelihood of pumping by twofold.

Another potential outreach program is related to homeless populations in the County. Reducing homelessness helps to reduce human bacteria in runoff from homeless encampments. Based on a 2012 assessment of the County's homeless population, it was determined that 1,300 homeless individuals utilized existing emergency shelters, transitional housing, and permanent supportive housing during the 2012 Federal Fiscal Year (Anne Arundel County, 2012d). The MDE states that addressing homeless populations can take the form of surveys of other units of local government including social services, police, schools, the health department, and nongovernmental organizations, which also serve the purpose of educational outreach on the health concerns of bacteria (MDE, 2014b).

In other jurisdictions with similar bacteria TMDLs, homeless encampments are addressed by frequent river and green area clean-ups, enforcement by police and park rangers, and annual funding of social service programs that directly serve the local homeless population (CA Central Coast Regional Board, 2011). One local organization involved in ensuring the needs of persons who are homeless is the "Anne Arundel and Annapolis Coalition to End Homelessness," a community based planning and advocacy organization.

SECTION SIX: FUNDING SOURCES AND TECHNICAL ASSISTANCE

6.1 FUNDING SOURCES

Achieving proposed improvements to meet bacteria TMDLs requires adequate funding to cover the cost of project implementation, operating expenditures, administrative costs, and other programmatic costs. This section presents potential federal, state, and non-profit grants and loans that may be suitable for use for proposed restoration strategies. Many of the grant programs focus on reducing nonpoint source nutrients and sediment to improve general water quality, and a few of the programs include specific provisions for practices that address bacteria pollution. For example, the Maryland Department of Natural Resources has a grant program to fund installation of sewage pumpout stations at marinas, which reduce bacteria discharges from boats. Table 6-1 provides an overview of potential funding sources.

Table 6-1: Potential Funding Sources for Bacteria TMDL Implementation

Funding Type	Funding Agency	Restoration Activity	Purpose of Program	Available Funding
State	State Water Quality Revolving Loan Fund	Varies; implementation of NPS projects requiring capital investment, or replacement of failing septic tanks	To provide low interest loans to projects that improve water quality and public health	State allotments vary; in 2011, Maryland received $35.7 M
State	The Maryland Stormwater Pollution Control Cost-Share Program	Implementation of any urban stormwater BMPs	To fund the implementation of stormwater management retrofit projects to control pollutants from older developed areas	$20,000 - $500,000
Non-profit	Chesapeake Bay Trust	Varies: must contribute to the restoration of the Chesapeake Bay	To promote public awareness and participation in restoration and protection of the Chesapeake Bay	$2,000 - $50,000
State	Bay Restoration Fund - OSDS Grant Program	Sewer upgrades and connection of septic systems to public sewer	To upgrade septic systems with Nitrogen Reducing Units. Program has expanded to include connection of septic tanks to sewer system. Funding priority is given to Chesapeake Bay Critical Areas.	$5,000 - $15,000
Federal	EPA 319 Funds	Implementation of agricultural and residential BMPs	To restore impaired waters by implementing watershed-based plans	Varies
Federal	EPA Urban Waters Small Grants	Implementation of pet waste public education program	To help restore urban water quality and revitalize neighborhoods by engaging communities in activities that increase their connection to,	$40,000 - $60,000

Funding Type	Funding Agency	Restoration Activity	Purpose of Program	Available Funding
			understanding of, and stewardship of local urban waterways	
State	MACS Program	Installation of stream protection systems to limit livestock access to streams	To help farmers protect natural resources on their farms, maintain farm productivity, and comply with state and federal regulations	Provides farmers with grants to cover up to 87.5% of the cost to install conservation BMPs on their farms. More than 30 BMPs are currently eligible for MACS grants, including livestock exclusion fencing.
Federal	USDA EQIP (Cost-Share)	Installation of stream protection systems to limit livestock access to streams and reduce sediment into streams	To implement conservation BMPs on land used for livestock and crop production	Total payments not to exceed $10,000/year or $50,000 for length of contract; average payment is $15,000
Private Funds	National Fish and Wildlife Foundation/Wells Fargo Environmental Solutions for Communities	Implementation of local water quality improvement projects that encourage broad-based citizen participation in project implementation	To support projects linking economic development and community well-being to the stewardship and health of the environment	$25,000 - $100,000 (median: $40,000)
State	The Supplemental Assistance Program	OSDS upgrades, including connection of older OSDS to public sewers, correction of system deficiencies such as SSOs, excessive inflow and infiltration, or outdated pump stations	To fund local governments for planning, design, and construction of wastewater projects needed to address public health or water quality issues considered to be high priority to MDE	Varies
State	Linked Deposit Loan Program	OSDS upgrades or other NPS capital improvements on private lands	To provide a source of low-interest financing to encourage private landowners and water system owners to implement capital improvements that will reduce the delivery of nutrients to the Chesapeake Bay and its tributaries	Varies
State	Maryland DNR Boating Services Unit	Installation of marina pumpout stations	To reduce bacteria loads from marinas by providing boaters with a proper method of disposing of their sewage and thus prevent it from entering local waters	Up to $15,000

Funding Type	Funding Agency	Restoration Activity	Purpose of Program	Available Funding
State	Chesapeake and Coastal Bays 2010 Trust Fund Grants	Various restoration projects	To accelerate Chesapeake Bay restoration via innovative new technologies, by engaging the community, and accountability	$5,001 - $70,000 for Watershed Assistance Program grants; minimum $500,000 for Cost-Effective Non-Point Source Pollution Reduction grants (no maximum); up to $75,000 annually for *CoastSmart* Communities grants

BMP = Best management practice
CIP = Capital Improvement Program
DNR= Department of Natural Resources
EQIP = Environmental Quality Incentives Program
MACS = Maryland Agricultural Water Quality Cost-Share
MDE = Maryland Department of the Environment
NPS = Nonpoint source
OSDS = Onsite sewage disposal system (septic system)

Relatively recent changes to the legislative requirements for the Bay Restoration Fund allow the collected monies to be used to connect septic systems to public sewers. However, it is expected that use of this funding source will be limited because it is likely to cover only a portion of the cost (Anne Arundel County Phase II WIP, 2012). Therefore, additional funding sources will need to be identified to implement proposed restoration strategies for septic systems. An additional source of funding is the Maryland Supplemental Assistance Program administered by MDE, which finances repair and upgrade of existing septic systems.

For livestock source reduction practices, Maryland's Agricultural Water Quality Cost-Share, or MACS program, provides funding for various eligible agricultural BMPs, one of which is streamside livestock exclusion fencing (see MDA, 2013 and MDA, 2014). Funding source for improvements related to livestock are likely to have limited applicability in Anne Arundel County because livestock areas are limited in the TMDL watersheds and, further, agricultural land is increasingly being converted to residential uses.

Other grant programs are focused on community-based initiatives to improve water quality and are potentially applicable to pet waste outreach activities and associated installation of pet waste stations, doggy loos, etc. Two examples of community-based grant programs are EPA's Urban Waters Small Grants Program and the National Fish and Wildlife Foundation's Environmental Solutions for Communities. In addition, Chesapeake Bay Trust, a non-profit grant-making organization also awards funding for eligible restoration and outreach programs.

Implementing stormwater retrofits such as converting dry ponds to shallow marshes, or restoring degraded outfalls and stream channels with Step Pool Storm Conveyance (SPSC) systems are currently funded through the County CIP program. Funds are secured through revenue from the stormwater remediation fee that resulted from passage of County Bill 2-13. This provides a predictable source of dedicated funding for stormwater management purposes. Funding sources

such as the Chesapeake Bay Trust funds, may be used to supplement County funds for specific projects

Wastewater CIP projects implemented through the County DPW are currently funded through wastewater bonds and wastewater PayGo (i.e., pay-as-you-go funds from wastewater utility operations, as provided in the annual budget). Improvements to the sewer infrastructure that would abate SSOs are expected to continue to be funded through the County's wastewater CIP projects.

6.2 TECHNICAL ASSISTANCE

Technical assistance refers to staffing and resources needed to oversee and implement the TMDL restoration plan. Since the passage of the Chesapeake Bay TMDL in 2010, the County passed County Bill 2-13, which established the Watershed Protection and Restoration Fund to support Chesapeake Bay Restoration activities. As a result, the County has been aligning resources needed to meet the requirements of the Chesapeake Bay TMDL and individual TMDLs as required by the NPDES MS4 permit. The alignment consists of departmental reorganization, hiring additional County staff, and engaging consulting resources. This framework enables the County to move forward with design and installation of urban stormwater BMPs based on the Phase II WIP strategy proposed by the County. This includes pre-2002 dry pond retrofits, and especially SPSC retrofits that are likely to figure prominently in the County's restoration activities over the next decade, primarily in areas where degraded stream channels are observed.

The changes in the County's program will also support the implementation of restoration strategies to meet the bacteria TMDL. For example, County programs can be expanded to install and deploy the pet waste stations, doggy loos, etc. in the County park system; to ramp up outreach activities and notify owners of existing pet waste pick-up laws; and to engage specialized outreach personnel to develop videos, County website content, public service announcements for television, social media, etc. Expansion of the County's program can also include developing buffer education programs to instruct residential owners on acceptable and unacceptable practices in buffer areas, and developing educational materials and signage for posting in buffer zones.

SECTION SEVEN: IMPLEMENTATION SCHEDULE AND MILESTONES

Based on MDE's recommendations and published guidance document for developing restoration plans for bacteria impairment, TMDL restoration plans should begin by addressing controllable sources of bacteria in the watershed (e.g., from humans, livestock, and pets) (MDE, 2014b). Further, as mentioned previously, reductions in human sources are given a priority because they pose a greater public health risk than non-human sources. Even though wildlife is one of the contributing factors of bacteria impairment, elimination of wildlife is considered "undesirable and impracticable" by MDE and EPA and is not listed as an intended goal of the TMDL.

Load reduction strategies that address urban stormwater (Tier B) are structural in nature and are in line with the strategies proposed to meet the Chesapeake Bay TMDL. The County is required to meet the Chesapeake Bay TMDL requirements by 2025, therefore integrating bacteria Restoration Plan schedules with the Bay TMDL schedule has a beneficial impact on both programs. Adhering to the Bay TMDL schedule would result in 60 percent of the implementation efforts to reduce bacteria loads being implemented by 2017. Under this scenario, milestone review would occur every 2 years to determine whether the proposed strategies are being implemented, and to what extent.

A generalized implementation schedule is provided in Table 7-1. This schedule is based on implementing strategies incrementally to reduce bacteria loads with achievement of all of the TMDL required percent load reductions by 2025. Since all of the TMDLs require the same combination of load reduction strategies (i.e., highly cost-effective Tier B non-structural controls to reduce non-human bacteria sources, followed by less cost-effective Tier A structural controls to reduce human sources of bacteria), the schedule applies to all the bacteria TMDLs. The only watersheds where TMDLs need a slight adjustment to the strategies is Patuxent River Upper and West River mainstem, both of which have agricultural pastures that support livestock populations. In these cases, livestock fencing is recommended as a part of Tier B strategies. This is noted in the table below. In addition, there is considerable flexibility for conducting pet waste education. It is recommended that the County identify and prioritize specific high-density residential areas, especially those where the expected load reductions otherwise fall short of the TMDL (see Section 4.4).

Table 7-1: Bacteria TMDL Implementation Schedule by Milestone Year

Milestone Year	Programmatic Criteria
2015	• Begin securing any funding sources needed • Make programmatic adjustments and identify any additional staffing needs • Identify drainage areas for existing BMPs, as required • Begin planning and developing pet waste education program, prioritize watersheds, and identify funds needed • Conduct survey to determine pet waste education needs • Begin site identification and design process for new dry pond or SPSC retrofits (already underway)

Milestone Year	Programmatic Criteria
2017	• 25% of all planned SPS upgrades completed • 10% of impervious area managed with SPSC or other high-performing BMP • Continued triennial inspection and maintenance of constructed BMPs • 25% of planned septic systems connected to sewers, if funding allows • Pet waste education program fully planned and coordinated, begin media campaign via television PSAs, videos on County website, and social media • Implement livestock fencing in two agricultural watersheds*
2019 (end of NPDES permit cycle)	• 50% of all planned SPS upgrades completed • 20% of impervious area managed with SPSC or other high-performing BMP (meet NPDES/WIP goal) • Continued triennial inspection and maintenance of constructed BMPs • 50% of planned septic systems connected to sewers, if funding allows • Pet waste education program continues; implement additional television PSAs, videos, social media, etc. as funds allow • Streamside livestock fencing completed
2021	• 75% of all planned SPS upgrades completed • 30% of impervious area managed with SPSC or other high-performing BMP • Continued triennial inspection and maintenance of constructed BMPs • 75% of planned septic systems connected to sewers, if funding allows • Pet waste education program continues; implement additional television PSAs, videos, social media, etc. as funds allow • Maintain livestock fencing and inspect triennially
2023	• 100% of all planned SPS upgrades completed (wastewater CIP goals met) • 40% of impervious area managed (permit/WIP goal achieved) • 100% of planned septic systems connected to sewers, if funding allows (goal achieved) • Pet waste education program continues; implement additional television PSAs, videos, social media, etc. as funds allow
2025 (bacteria TMDLs achieved)	• 50% of impervious area managed (on track to meet 60% goal in 2027) • Conduct survey to evaluate effectiveness of pet waste education program • Continued triennial inspection of constructed BMPs/retrofits

*Patuxent River Upper and West River mainstem.

BMPs = best management practices
CIP = Capital Improvement Program
NPDES = National Pollutant Discharge Elimination System
PSAs = Public Service Announcements
SPS = Sewage Pump Station
SPSC= Step Pool Storm Conveyance
WIP = Watershed Implementation Plan

SECTION EIGHT: METHODS FOR EVALUATING PROGRESS

Establishing methods for tracking and evaluating progress toward TMDL water quality goals is important to determine whether the proposed restoration strategies are being implemented according to the stated schedule or if adjustments are required. The methods for evaluating progress vary depending on the restoration strategy. For strategies related to the NPDES MS4 permit program such as urban stormwater retrofits and Illicit Discharge Detection and Elimination (IDDE), it is recommended to use a water quality model that can estimate bacteria load reductions from proposed restoration strategies. Water quality models can also be used to estimate potential pollutant load reductions from SSO abatements and on-site disposal system (OSDS) retirements/connections. Potential options for water quality models include the WTM that was used to develop this restoration plan (see Section 4) or other water quality models that include bacteria loading. The County's Watershed Management Tool does not include a bacteria specific model module, so it is not proposed for use.

Data compiled for the NPDES MS4 annual report could be used to model the load reductions achieved over the previous year. Modeling the SSO abatement and septic system retirement would entail coordination with the County Department of Health to obtain the required information. Information on SSOs is compiled for Wastewater Capacity, Management, Operations, and Maintenance (CMOM) Program reports submitted to MDE.

Table 8-1 lists potential methods for tracking the progress of bacteria load reduction for each of the proposed strategies.

Table 8-1: Potential Methods to Evaluate Progress

Proposed Strategy	Potential Method to Evaluate Progress	Frequency	Data Source
Pre-2002 Pond Retrofits	Water Quality Modeling*	Annually	NPDES reporting
Restore 20% Impervious Area with SPSC	Water Quality Modeling*	Annually	NPDES reporting
Eliminate Illicit Connections (IDDE)	Water Quality Modeling*	Annually	NPDES reporting
Abatement of SSOs	Water Quality Modeling*	Annually	CMOM reporting
Septic Retirement/Connection	Water Quality Modeling*	Annually	Dept. of Health
Stricter Buffer Ordinance/Education	Walk-through of buffer area with adjacent homeowners	Annually	n/a
Expanded Pet Waste Education	Pre- and post-implementation surveys of residential pet owners	Would depend on implementation time frame, pre-implementation survey could occur in 2015	n/a
Expanded Goose Management Program	Annual survey of goose population by USFWS and Maryland DNR	Annually as part of waterfowl survey	USFWS/ Maryland DNR

Proposed Strategy	Potential Method to Evaluate Progress	Frequency	Data Source
Livestock Stream Exclusion Fencing	Pre- and post-implementation surveys of farmers	Annually	Soil Conservation District Office

*Watershed Treatment Model or other applicable water quality models
CMOM = Capacity, Management, Operations, and Maintenance
DNR = Department of Natural Resources
IDDE = Illicit Discharge Detection and Elimination
n/a = Not Applicable
NPDES = National Pollutant Discharge Elimination System
SSOs = Sanitary Sewer Overflows
USFWS = U.S. Fish and Wildlife Service

Because the proposed water quality models do not effectively capture restoration strategies related to non-human sources, alternative methods for evaluating progress of these strategies need to be developed.

The Tier B controls, including pet waste education, livestock fencing, buffer education, and goose management, are difficult to quantify in terms of load reductions. Some potential methods for tracking progress of each of these strategies include:

- Conduct pre- and post-implementation surveys of pet owners to determine how many people are picking up after their pets;
- Conduct pre- and post-implementation survey of farmers to determine if they have been successfully keeping livestock out of the stream and an annual walk-through of buffer areas to see if any improvements have occurred; and
- Review the annual waterfowl survey conducted by USFWS and Maryland DNR (Maryland DNR, 2014) to estimate the size of the local goose population.

Water Quality Monitoring

The above methods for evaluating TMDL Restoration Plan progress will provide a general measurement of the implementation progress and the resulting bacteria load reductions from the proposed strategies. However, to confirm whether on-the-ground actions in the watershed are leading to measurable water quality improvements in the impaired TMDL waterways, MDE recommends water quality monitoring.

The County's current NPDES MS4 permit-required monitoring at the Parole Plaza outfall and Church Creek in-stream station is designed to assess the cumulative effects of watershed restoration activities in this commercial and residential watershed. This could be a suitable starting point for the monitoring program, and monitoring could be expanded to capture the effects of the strategies in the other TMDL watersheds. Adding monitoring locations would require submitting the proposed monitoring program details to MDE for approval.

In general, water quality improvements related to watershed restoration can be difficult to detect due to such factors as potential time lags, wet and dry years, and uncertainty in the success of implementation (e.g., whether there is actual behavior change in dog owners leading to more pet

waste pickup). Therefore, EPA recommends at least 2 or more years of monitoring to acquire statistically significant results.

The proposed monitoring program would combine monitoring data from a number of existing sources/programs as a cost savings measure and to reduce duplication of effort among multiple organizations/agencies. It is recommended that the County conduct bacteriological monitoring of non-tidal waters in impaired TMDL watersheds. Monitoring can be conducted at representative stream locations to adequately characterize the bacteria loadings. Not all streams/watersheds would need to be monitored, only those with distinct differences in geographic setting and land use (see Section Two). Five years of monitoring is proposed during various conditions, including wet weather, dry weather, and different seasons to account for variations in flow and inter-annual changes related to wet years and dry years.

For tidal monitoring, it is proposed that the County utilize bacteriological monitoring data from the MDE's ongoing shellfish harvesting area monitoring program. Other sources of data include the County Health Department's monitoring of recreational beaches, and Operation Clearwater, another beach bacteria monitoring program. By integrating all of these programs, the County can leverage multiple monitoring efforts to save on costs while still gathering sufficient data to determine to what extent the implemented TMDL strategies are leading to actual water quality improvements in the impaired waterways.

Trend analysis is not required annually, as implementation of proposed restoration strategies is not likely to have an immediate impact on water quality. As an alternative, trend analysis should be conducted every 5 years, with 2015 as a baseline, 2020 as a mid-implementation assessment, and 2025 as a post-implementation assessment.

SECTION NINE: REFERENCES

Anne Arundel County. 2011. Patapsco Non-Tidal Watershed Assessment, Comprehensive Summary Report. Prepared by: Anne Arundel County Watershed Assessment & Planning Program, KCI Technologies, Inc., CH2M HILL. August 2011 Final.

Anne Arundel County. 2012. Chesapeake Bay TMDL Phase II Water Implementation Plan – FINAL. July 2, 2012.

Anne Arundel County. 2012b. Patapsco Tidal and Bodkin Creek Watershed Assessment – Comprehensive Summary Report. August.

Anne Arundel County. 2012c. RSC Fact Sheet. May. Available online at: http://www.aacounty.org/DPW/Watershed/StepPoolStormConveyance.cfm

Anne Arundel County. 2012d. Annual Homeless Assessment Report (2012). Available online at: http://www.aacounty.org/Homeless/Resources/Anne%20Arundel%20and%20Annapolis%20Annual%20Homeless%20Assessment%20Report%202012.pdf

Anne Arundel County. 2013. National Pollutant Discharge Elimination System Municipal Separate Storm Sewer System Discharge Permit 2012 Annual Report: Anne Arundel County, Maryland. Available online at: http://www.aacounty.org/DPW/Watershed/2012%20NPDES%20Documents/2012%20Anne%20Arundel%20Annual%20Report_No%20Appendices.pdf

Anne Arundel County. 2014. National Pollutant Discharge Elimination System Municipal Separate Storm Sewer System Discharge Permit 2013 Annual Report: Anne Arundel County, Maryland. Available online at: http://www.aacounty.org/DPW/Watershed/2012%20NPDES%20Documents/2012%20Anne%20Arundel%20Annual%20Report_No%20Appendices.pdf

Bruce, S. and M. Tiger. 2009. A Review of Research Relevant to Evaluating Social Marketing Mass Media Campaigns. Available online at: http://www.piedmontnutrientsourcebook.org/Assetts/outreach/evaluating-social-marketing-mass-media-campaigns.pdf

CA DBW (California Division of Boating and Waterways). 2014. Shipshape Sanitation, MSDS and Pumpouts. Available online at: http://www.dbw.ca.gov/pubs/sanitation/index.htm

CA (California) Central Coast Regional Board. 2011. Draft Comment Summary and Responses: Total Maximum Daily Loads (TMDLs) for Pathogens in the San Lorenzo River Watershed. February 1, 2011. Available online at: http://www.waterboards.ca.gov/water_issues/programs/tmdl/docs/sanlorenzo/comments010611/cmmnt_rpns010611.pdf

Capital Gazette. September 2, 2014 article by Brandi Bottalico. Watershed stewards find few takers for dog poop campaign. Available online at: http://www.capitalgazette.com/maryland_gazette/news/ph-ac-gn-poop-patrol-0903-20140902,0,6062570.story

Caraco, D. 2013. Watershed Treatment Model (WTM) 2013 "Custom" version. Center for Watershed Protection, Ellicott City, MD.

Caraco, D. 2013a. Watershed Treatment Model (WTM) 2013 Documentation. Center for Watershed Protection, Ellicott City, MD. Pages 1-114

Code of Maryland Regulations (COMAR). Critical Area Commission for the Chesapeake and Atlantic Coastal Bays. Available online at: http://www.dsd.state.md.us/comar/SubtitleSearch.aspx?search=27.02.01.*

County of Los Angeles. 2002. Department of Public Works, Storm Water/Urban Runoff, Public Education Model Program. Available online at: http://ladpw.org/wmd/npdes/Pipp/PIPP.pdf

CWEP (Clean Water Education Partnership). 2009. Pre- and Post-TV Campaign Surveys of Stormwater Awareness & Behavior in the Clean Water Education Partnership Service Area: Comparisons and Findings. Available online at: http://www.nccleanwater.org/pdf/cwep-final-survey-comparison-report.pdf

CWP (Center for Watershed Protection). 2004. Illicit Discharge Detection and Elimination – A Guidance Manual for Program Development and Technical Assessments. October. Available online at: http://www.cwp.org/online-watershed-library/cat_view/64-manuals-and-plans/79-illicit-discharge-detection-and-elimination

EPA (Environmental Protection Agency). 2001. National Menu of Best Management Practices for Storm Water Phase II, Public Education and Outreach on Storm Water Impacts. Available online at: http://www.georgiaplanning.com/watertoolkit/Documents/WaterProtectionIssues/PublicEdandOutreach.pdf

EPA. 2008. Decision Rationale: Total Maximum Daily Loads of Fecal Coliform for the Restricted Shellfish Harvesting Areas in Whitehall and Meredith Creeks, Mill Creek, and the Severn River Mainstem of the Severn River Basin in Anne Arundel County, Maryland. April 2008.

EPA. 2010. Getting in Step: A Guide to Conducting Watershed Outreach Campaigns, 3rd edition. Office of Water Nonpoint Source Control Branch (4503T), Washington, DC. November. Available online at: http://water.epa.gov/polwaste/npdes/stormwater/upload/getnstep.pdf

EPA. 2011. Decision Rationale: Total Maximum Daily Loads of Fecal Bacteria for the Patuxent River Upper Basin Anne Arundel and Prince George's Counties Maryland. August 9, 2011.

EPA. 2012. A: Pollution Prevention Management Measure. Available online at: http://water.epa.gov/polwaste/nps/czara/ch4-6.cfm

EPA. 2013a. Getting in Step: Engaging Stakeholders in your Watershed. 2nd edition. EPA 841-B-11-001. Office of Water, Nonpoint Source Control Branch (4503T) , Washington, DC 20460. May. Available online at: http://cfpub.epa.gov/npstbx/files/stakeholderguide.pdf

EPA. 2013b. Nonpoint Source Program and Grants Guidelines for States and Territories. US EPA Office of Water, Nonpoint Source Control Branch. April. Available online at: http://water.epa.gov/polwaste/nps/upload/319-guidelines-fy14.pdf

EPA. 2014. Search the NPS Outreach Toolbox. Available online at: http://cfpub.epa.gov/npstbx/index.cfm

French, L. and J. Parkhurst. 2009. Managing Wildlife Damage: Canada Goose (*Branta canadensis*). Virginia Cooperative Extension, publication 420-203.

King, D., and P. Hagan. 2011. Costs of Stormwater Management Practices In Maryland Counties – Draft Final Report. October 10.

Klein, R. 2007. The Effects of Marinas & Boating Activity Upon Tidal Waterways. July. Available online at: http://www.ceds.org/pdfdocs/Marinas.pdf

Maryland DNR (Department of Natural Resources). 2014. Maryland's Midwinter Waterfowl Survey Results Announced. March 7, 2014. Available online at: http://news.maryland.gov/dnr/2014/03/07/dnr-announces-midwinter-waterfowl-survey-results/

MDA (Maryland Department of Agriculture). 2013. MACS Manual 382 Fencing. October. Available online at: http://mda.maryland.gov/resource_conservation/Documents/macs_manual/2/382_fencing.pdf

MDA. 2014. Maryland Agricultural Water Quality Cost-Share Program. Available online at: http://mda.maryland.gov/resource_conservation/Pages/macs.aspx

MDE. 2005b. Comment Response Document (CRD) Regarding the Total Maximum Daily Loads of Fecal Coliform for Restricted Shellfish Harvesting Areas in Bear Neck Creek, Cadle Creek, West River, and Parish Creek for the West River Basin in Anne Arundel County, Maryland. July 25, 2005.

MDE. 2005c. Comment Response Document Regarding the Total Maximum Daily Loads of Fecal Coliform for Restricted Shellfish Harvesting Areas in Magothy River, Tar Cove, and Forked Creek and a Water Quality Analysis of Fecal Coliform for Deep Creek for Restricted Shellfish Harvesting Areas in the Magothy River Basin in Anne Arundel County, Maryland. July 25, 2005.

MDE. 2005d. Comment Response Document Regarding the Total Maximum Daily Loads of Fecal Coliform for the Restricted Shellfish Harvesting Areas in Tracy and Rockhold Creeks of the Other West Chesapeake Bay Drainages Basin in Anne Arundel County, Maryland. August 24, 2005.

MDE. 2005e. Total Maximum Daily Loads of Fecal Coliform for Restricted Shellfish Harvesting Areas in Magothy River, Tar Cove, and Forked Creek and a Water Quality Analysis of Fecal Coliform for Deep Creek of the Magothy River Basin in Anne Arundel County, Maryland. August.

MDE. 2005f. Total Maximum Daily Loads of Fecal Coliform for Restricted Shellfish Harvesting Areas in the South River, Duvall Creek, Selby Bay, and Ramsey Lake of the South River Basin in Anne Arundel County, Maryland. June.

MDE. 2005g. Total Maximum Daily Loads of Fecal Coliform for Restricted Shellfish Harvesting Areas in Bear Neck Creek, Cadle Creek, West River, and Parish Creek for the West River Basin in Anne Arundel County, Maryland. August.

MDE. 2005h. Total Maximum Daily Loads of Fecal Coliform for Restricted Shellfish Harvesting Areas in Tracy and Rockhold Creeks of the Other West Chesapeake Bay Drainages Basin In Anne Arundel County, Maryland. August.

MDE. 2006. Maryland's 2006 TMDL Implementation Guidance for Local Governments. May 24.

MDE. 2008. Total Maximum Daily Loads of Fecal Coliform for the Restricted Shellfish Harvesting Areas in Whitehall and Meredith Creeks, Mill Creek, and the Severn River Mainstem of the Severn River Basin in Anne Arundel County, Maryland. April.

MDE. 2009b. Total Maximum Daily Loads of Fecal Bacteria for the Patapsco River Lower North Branch Basin in Anne Arundel, Baltimore, Carroll, and Howard Counties, and Baltimore City, Maryland. August.

MDE. 2010a. Comment Response Document Regarding the Total Maximum Daily Loads of Bacteria for the Impaired Recreational Areas in Marley Creek and Furnace Creek of Baltimore Harbor Basin in Anne Arundel County, Maryland. July 27, 2010.

MDE. 2010b. Comment Response Document Regarding the Total Maximum Daily Load of Fecal Bacteria for the Patuxent River Upper Basin in Anne Arundel and Prince George's Counties, Maryland. September 16, 2010.

MDE. 2010c. Total Maximum Daily Loads of Bacteria for Impaired Recreational Areas in Marley Creek and Furnace Creek of Baltimore Harbor Basin in Anne Arundel County, Maryland. July.

MDE. 2010d. Total Maximum Daily Loads of Fecal Bacteria for the Patuxent River Upper Basin in Anne Arundel and Prince George's Counties, Maryland. September.

MDE. 2014a. General Guidance for Developing a Stormwater Wasteload Allocation (SW-WLA) Implementation Plan - Final. May.

MDE. 2014b. Guidance for Developing a Stormwater Wasteload Allocation Implementation Plan for Bacteria Total Maximum Loads –Final. May.

MDE. 2014c. Guidance for Developing Stormwater Wasteload Allocation Implementation Plans for Nutrient and Sediment Total Maximum Daily Loads – Final. November.

MDE. 2014d. Accounting for Stormwater Wasteload Allocations and Impervious Acres Treated. August.

MDE. 2014e. Maryland Shellfish Harvesting and Closure Area Map. Available online at: http://www.mde.state.md.us/programs/Marylander/CitizensInfoCenterHome/Pages/citizensinfocenter/fishandshellfish/pop_up/shellfishmaps.aspx

RIDEM (Rhode Island Department of Environmental Management). 2014. Pollution Prevention: Animal Waste Collection. Available online at: http://www.dem.ri.gov/programs/benviron/water/permits/ripdes/stwater/t4guide/fact1.htm

RI (Rhode Island) Sea Grant. 1992. Environmental Guide for Marinas: Fact Sheets. University of Rhode Island Bay Campus, Narragansett, RI. Available on-line at: http://seagrant.gso.uri.edu

Strand, I.E and G.R. Gibson. 1990. The Use of Pump-Out Facilities by Recreational Boaters in Maryland. *Estuaries*, Vol. 13, No. 3 (Sep., 1990), pp. 282 – 286. Available online at: http://www.beamreach.org/data/101/Science/processing/Kathryn/BEAM%20REACH/Sustainability%20Project/pump%20outs.pdf

Swann, C. 1999. A Survey of Residential Nutrient Behaviors in the Chesapeake Bay. Widener Burrows, Inc. Chesapeake Research Consortium. Center for Watershed Protection. Ellicott City, MD. 112 pp.

VA DEQ (Virginia Department of Environmental Quality). 2011. Bacterial Implementation Plan Development for the James River and Tributaries – City of Richmond Technical Report. Final Submitted: December.

Van der Wel, B. 1995. Dog Pollution. The Magazine of the Hydrological Society of South Australia. 2(1)1.

WGCAC (Wildcat Glades Conservation & Audubon Center). 2011. Connections. Summer 2011, Volume 5, Number 2. Available online at: http://www.wildcatglades.audubon.org/connections_v5no2.pdf

Winters, J. 2015. Annapolis and Anne Arundel County Pet Walks. Available online at: http://www.imrivers.org/annapolispetwalk/

Zeckoski, R., B. Benham, C. Lunsford. 2012. Streamside Livestock Exclusion: a tool for increasing farm income and improving water quality. December.

Appendix A: Watershed Treatment Model Methodology

A.1 INTRODUCTION

As a part of the development of the Total Maximum Daily Load (TMDL) Restoration Plan for bacteria impairments for the nineteen approved TMDLs in Anne Arundel County (County), the URS/ESA team developed water quality models for each of the 19 TMDL watersheds. The Watershed Treatment Model (WTM), a spreadsheet-based model developed by the Center for Watershed Protection (Caraco, 2013) was used to characterize and quantify the bacteria loads for existing conditions and estimate the pollutant load reductions from future Best Management Practices (BMPs) to meet the TMDL requirements.

The WTM is a planning level model that quantifies bacteria loads based on both point and non-point sources of pollution. The model calculates the fate and transport of bacteria from pollutant sources to the receiving water bodies. In addition to the bacteria loads, the model also has the capability to estimate annual loads for total nitrogen (TN), total phosphorus (TP), and total suspended solids (TSS). The model has several tabs where pollutant sources and treatment options can be input. The Pollutant Sources tabs estimate the pollutant loads from primary sources such as land use and secondary sources such as channel erosion, illicit connections etc. The Treatment Options tabs of the model estimate the pollutant load reductions from structural and non-structural treatment options for existing and future conditions.

The URS/ESA team used the Maryland Department of Environment (MDE)-provided watershed boundaries, County geographic information system (GIS) data, and additional information on County operations to develop the baseline models for the study watersheds. The sections below provide a detailed description of the inputs and the methodology adopted in developing the WTM models for the study watersheds.

A.2 EXISTING CONDITIONS MODELING

An existing conditions model was developed to estimate the pollutant loads from primary sources such as existing land use and secondary sources such as illicit discharges, on-site sanitary disposal systems, and sanitary sewer overflows and the current pollutant reductions from existing BMPs. The data that were used in the model to estimate the current pollutant loads were based on the following:

Primary Sources

The Primary Sources tab of the WTM estimates pollutant loads in the stormwater runoff from land uses such as residential, commercial, industrial, rural, forest, and water. It also has an option to include acreage of land under active construction as one of the land uses. The model uses Simple Method (Schueler, 1987) to estimate the annual pollutant loads from different type of land uses based on their event mean concentrations (EMCs) and impervious cover, annual rainfall, and runoff coefficients. A description of the input information for primary sources is provided below.

- **Land use:** GIS data for existing land cover and impervious cover developed by the County in 2011 was used to identify the acreage of each land use type in the study watersheds. The default impervious cover percentage per land use type was adjusted in the WTM model to reflect existing watershed conditions by intersecting the land use and impervious cover GIS data. The default EMCs for TN, TP, TSS, and bacteria for each land use category were modified in the WTM model based on literature review of the watershed management plans developed by the County. Land cover categories with similar runoff characteristics and EMC values were grouped for the model input. Table A-1 below provides information on the land use and the EMCs used in the model.

Table A-1: Land Use Classification and EMCs

County Land Cover Classification	WTM Land Use Category	Event Mean Concentration (EMC)			
		TN (mg/l)	TP (mg/l)	TSS (mg/l)	Bacteria (MPN/100 ml)
Airport	Airport	2.24	0.30	99	4500
Commercial	Commercial	2.24	0.30	43	4500
Forested Wetland	Forest	1.00	0.11	34	500
Industrial	Industrial	2.22	0.19	77	2614
Open Space	Open Space	1.15	0.15	34	3100
Open Wetland	Forest	1.00	0.11	34	500
Pasture/Hay	Pasture/Hay	7.83	2.09	341	500
Residential 1- acre	Medium Density Residential (1-4 DU)	2.74	0.32	43	7750
Residential 1/2-acre	Medium Density Residential (1-4 DU)	2.74	0.32	43	7750
Residential 1/4-acre	Medium Density Residential (1-4 DU)	2.74	0.32	43	7750
Residential 2-acre	Low Density Residential (<1DU)	2.74	0.32	43	7750
Residential 1/8-acre	High Density Residential (>4 DU)	2.74	0.32	43	7750
Row Crops	Row Crops	16.06	2.63	1,046	500
Transportation	Transportation	2.59	0.43	99	1400
Utility	Open Space	1.15	0.15	34	3100
Water	Water	1.20	0.03	43	500
Woods	Forest	1.00	0.11	34	500

DU-Dwelling Units
mg/l-milligrams per liter
MPN/100 ml = most probably number per 100 milliliters

- **Annual rainfall:** The average annual rainfall recorded the by National Oceanic and Atmospheric Administration at the Baltimore-Washington International Thurgood

Marshall Airport (BWI) was used as the input. An average annual rainfall of 42 inches was observed at BWI based on 143 years of recorded precipitation data.

- **Streams:** The stream GIS data obtained from the County website was used as the source to input stream length in miles in the study watersheds. The GIS data were analyzed, and features such as shoreline and pipes were not included in estimating the total stream length per watershed.
- **Soils:** The soils data downloaded from the U.S. Department of Agriculture (USDA) Natural Resources Conservation Service were used to estimate the percentage of each hydrologic soil groups in the study watersheds. The downloaded soils data was also used to determine hydric soils in the watershed to classify average depth to groundwater.

Secondary Sources

The input information for secondary sources was obtained from County GIS data, operations information, and research. The secondary sources are as follows:

- **Onsite sewage disposal system (OSDSs):** The model estimates the loads from OSDSs to surface water and groundwater based on the volume and concentration of pollutants in wastewater (Table A-2). The obtained pollutant loads are further adjusted based on several factors such as efficiency of the OSDSs, percent of OSDSs that are less than 100 feet away from any water bodies, general soil types, level of maintenance, and their density in the watershed. Based on the County-provided information, the following data were used as input for wastewater characteristics:

Table A-2: WTM Pollutant Concentration in Wastewater

Water Use (gallons/capita/day)	Wastewater Characteristics			
	TN (mg/l)	TP (mg/l)	TSS (mg/l)	Bacteria (MPN/100 ml)
75	60	10	400	10,000,000

mg/l-milligrams per liter
MPN-most probable number

- The Anne Arundel County Department of Health developed GIS coverage of all the properties in the County that have an OSDS, and this information was used to identify properties in the study watersheds with no sewer connection. The GIS data also categorized the OSDSs as Best Available Technology (BAT) and Engineering (ENG) Nitrogen Removal Units (NRUs). The performance efficiency of both the type of NRUs (Table A-3) was obtained based on research and WTM literature. Properties that were not categorized as an NRU type were assumed to have a conventional system. Based on the spatial analysis of the GIS stream layer with the OSDS properties, 10 percent of the properties were assumed to have an OSDS less than 100 feet from a waterway. A 5-foot separation from groundwater was assumed for all the systems. Based on research on the

Anne Arundel County website, a medium level of septic system management that includes inspection at installation and education to encourage ongoing maintenance were factored in to adjust the obtained pollutant loads through OSDSs.

Table A-3: Bacteria Pollutant Removal Efficiency of OSDSs

Nitrogen Removal Unit (NRU) Type	Bacteria Log Reduction
Conventional System	3.5
ENG	2.9
BAT	3.0

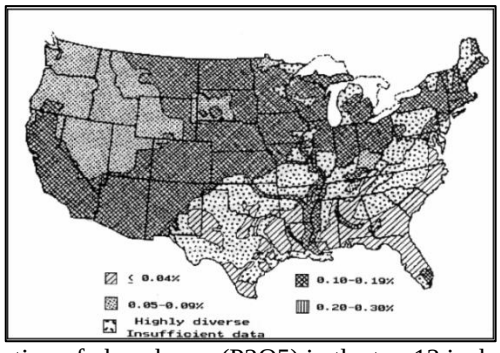
- **Sanitary sewer overflows (SSOs):** Pollutant loads due to SSOs are estimated based on total SSO volume and effluent concentration (Table A-2). Based on County-provided information, a volume of 55,650 gallons per SSO, which is the County-wide average, was used to estimate the loads, and approximately 30 SSOs were assumed to occur for every 1,000 miles of sewer line. The sanitary sewer GIS data obtained from the County website was used to estimate the total length in miles of the sewer system in each study watershed.
- **Combined sewer overflows:** None of the study watersheds have any combined sewer outfalls.
- **Illicit connections:** Pollutant loads due to illicit connections of residences and businesses were estimated based on the County's National Pollutant Discharge Elimination System (NPDES) MS4Annual Reports. According to the NPDES MS4 reports and illicit discharge detection and elimination annual report (IDDE, 2013), the County-wide detection rate of illicit connections is approximately 2 percent (29 cases out of 1,350 outfalls surveyed from 2005 to 2013). This detection rate was proportioned to each TMDL watershed based on the amount of impervious cover in the watershed relative to the total impervious area in the County. This obtained percent of illicit connections for each watershed was distributed equally among residential and commercial illicit connections. Among the percent of businesses illicitly connected, the majority (90 percent) was assumed to be illicit wash water connections, and 10 percent of the businesses were assumed to be illicit waste water connections. The concentrations of pollutants for business illicit connections used in the model are provided in Table A-4 below. The pollutant concentration of residential illicit connections is the same as that of wastewater (Table A-3).

Table A-4: Pollutant Concentrations for Illicit Business Connections

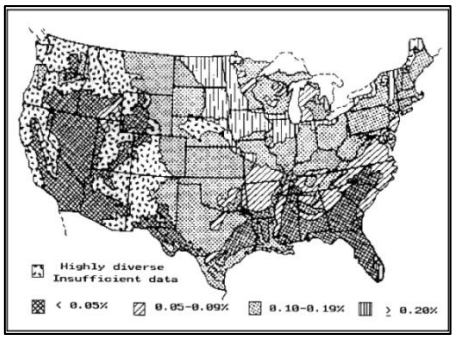
Pollutant	Pollutant Concentration	
	Wash Water	Wash Water and Wastewater
TN (mg/l)	15	30
TP (mg/l)	10	10
TSS (mg/l)	150	225
Bacteria (MPN/100ml)	0	3,300,000

mg/l-milligrams per liter
MPN-maximum probable number

- **Urban channel erosion:** Urban channel erosion is a required input parameter in the model, however it only affects nutrients and sediment, not bacteria. The sediment loads due to urban channel erosion in each study watersheds were assumed to be a fraction of total sediment loads from other urban sources in the watershed. Moderate rates of erosion (50 percent of total watershed sediment loads) in the channel were assumed to estimate the sediment loads for all the study watersheds. Phosphorus and nitrogen concentrations of 0.064 percent and 0.07 percent, respectively, were used to estimate the nutrient loads due to channel erosion. These are default percentages for the State of Maryland and were obtained using Figures 4.1 and 4.2 of the Watershed Treatment Model (Caraco, 2013a) documentation.



Distribution of phosphorus (P2O5) in the top 12 inch of soil
(Source: Figure 4.1, CWP 2013)



Distribution of nitrogen in the top 12 inch of soil
(Source: Figure 4.2, CWP 2013)

- **Livestock:** USDA's 2012 farm censuses were used to get the count of livestock such as horses, cattle (dairy and beef), broilers, turkeys, hogs, and pigs. The livestock numbers were associated with the County's rural land use (crops and pastures/hay). Based on the acreage of rural land use in the study watersheds, the livestock numbers were estimated proportionally. Table A-5 lists the census data obtained from USDA. The estimated bacteria loads per animal type were obtained from TMDL plans developed by MDE for various impaired watersheds.

Table A-5: Livestock Census Data for Anne Arundel County (USDA, 2012) and Associated Bacteria Loads (MDE)

Animal	Census Data for County	Fecal Coliform Production (count/animal/day)	Percent Manure Available for Washoff (%)
Dairy	586	1.01+10	40
Beef	584	1.20+10	40
Horse	1,791	4.20+08	40
Sheep	316	1.20+08	40
Broilers	300[1]	1.36+08	10
Turkeys	34	9.30+07	10
Chicken and Layers	1,133	1.36+08	10
Hogs and Pigs	42	1.08+10	40

1- 2007 data used as 2012 data was unavailable in the USDA Report

- **Marinas:** Pollutant loads from marinas were estimated based on the number of boats, flow rates, and number of boating days per year. The County-published document *Marinas of Anne Arundel County* (2010) was used to obtain information on type of marina and number of slips in each marina. For the model, 50 percent of the slips were assumed to be occupied during a 5-month boating season. The Maryland Department of Natural Resources' (DNR's) website was used to obtain information on the number of pumpouts in each TMDL watershed. Note that the model does not have a parameter for estimating bacteria load reductions due to educational outreach to the boating community about proper disposal of onboard sewage. Therefore, marinas are included as a source in the model, but not as a load reduction. Educational outreach is discussed in Section 5.3 of the main report.
- **Road sanding:** Based on County provided information; road sanding is not performed by the County.
- **Non-stormwater point sources:** Based on research and County-provided information, one of the seven County-owned water reclamation facilities (WRFs), Annapolis WRF, discharges to the TMDL watershed. The remaining WRFs do not discharge to any of the TMDL watersheds. In addition to the County-owned WRF, two other point sources listed in the MDE-published TMDL documents with permitted discharges for bacteria were included in the models. Table A-6 below lists all the point sources in the study watersheds with permitted discharges for bacteria that were included in the models.

Table A-6: Permitted Discharges of Non-stormwater Point Sources in the Study Watersheds

TMDL Watershed	Facility	Design Flow (MGD)	Permitted Bacteria Loads (MPN/100 ml)
Severn (Mainstem, Mill, Meredith and Whitehall Creeks)	Annapolis Water Reclamation Facility	13	14
Severn (Mainstem, Mill Southern, Meredith-Whitehall Creeks)	U.S. Naval Academy	1	14
Patapsco River Lower North Branch	Holiday Mobile Estates Wastewater Treatment plan	0.108	3.0

MGD = million gallons per day
MPN-maximum probable number

Existing Management Practices

Input data for existing management practices were developed based on County-provided information, research and GIS data, and other management practices data related to County operations.

- **Turf condition and management practices in residential and other land uses:** As field reconnaissance was not included as a part of this study, it was assumed that approximately 10 percent of the lawns in the watershed are bare or compacted and 10 percent were assumed to be highly managed as a result of excess fertilization to estimate the annual TN and TP loads. The turf management for other land uses such as commercial, transportation, and industrial was also assumed to be managed at the same level as residential areas.
- **Erosion and sediment control:** Active construction sites were not included as a part of the model input; therefore, sediment load reduction due to the County's existing erosion and sediment control program was not estimated in the model.
- **Pet waste education:** Based on the WTM documentation, bacteria loads from pet waste are calculated based on the assumption that 40 percent of the homeowners in a study area have dogs, and approximately 50 percent of the dog owners walk their dogs. Approximately 60 percent of the dog owners who walk their dogs are assumed to clean up after their pets. The pollutant load reductions achieved by a pet waste education program in the model are calculated based on its effectiveness in educating the pet owners. Table A-7 lists various media outlets used for educating the pet owners and their effectiveness in reducing the bacteria loads from pets.

Table A-7: Effectiveness of Media for Pet Waste Education Program

Media Outlet	Effectiveness (%)
Television	40
Radio	25
Newspaper	30
Billboard	13
Brochure	8
Workshop	7

- Based on research of current County outreach programs, it was observed that the County currently provides information on pet waste management through its website and that it includes some educational brochures. A corresponding effectiveness of 8 percent was used in the model to estimate the reduction in bacteria loads through pet waste education.
- **Street sweeping:** The model estimates the load reductions in TSS, TN, and TP that would be achieved by street sweeping based on acreage of streets swept and the type of street sweeping technique used. The pollutant load reductions are further adjusted by factoring in efficiency of the street sweeping program. According to the County, arterial, collector, and roads in business districts are swept four times a year. The County GIS data were used to input the acres of roads swept in each study watershed. A program efficiency of 75 percent was used in the model based on the assumption that operators are not effectively trained and that parking restrictions are in place during the street sweeping period.
- **Structural stormwater management (SWM) practices:** Information on existing structural SWM practices was obtained from County stormwater management GIS data and the BMP database and input in the model. The County is in the process of compiling the drainage areas for all the BMPs, and as result, drainage areas and impervious areas associated for some of the BMPs were not populated. The pollutant removal efficiencies of the practices were modified in the model to match the bacteria removal efficiencies listed in the County's NPDES MS4 Annual Report (2012) (Anne Arundel County, 2013). The pollutant load reductions achieved by structural SWM practices were further adjusted based on the assumptions that 90 percent of annual rainfall is captured by the structures (0.9), the County has design criteria that will result in high pollutant removal efficiencies for practices (1.2), and that regular maintenance of the practices is enforced and conducted by the County (0.9). Table A-8 shows the bacteria pollutant removal efficiencies of BMPs input into the model. Most of the TMDLs in the study watersheds were developed in the early 2000s. Therefore, the baseline WTM included BMPs that were implemented only until the year 2000 to account for load reductions that would be achieved from BMPs at the time of TMDL development.

Table A-8: Anne Arundel County BMPs and Pollutant Removal Efficiencies

BMP Type	Bacteria Pollutant Removal Efficiency (%)
Attenuation Trench	0
Bioretention	90
Check Dam	0
Disconnection of Non Roof-top runoff	75
Disconnection of Roof-top Runoff	75
Dry Pond	0
Dry Wells	75-90
Environmental Site Design	75
Extended Detention	50
Extended Detention Structure-Dry	50
Extended Detention Structure-Wet	75
Forestation on Pervious Urban	0
Infiltration Trench with Complete Exfiltration Microbasin	90
Infiltration Basin	90
Infiltration Berms	75
Infiltration Trench	90
Infiltration Trench with Partial exfiltration	90
Infiltration Trench with Water Quality Exfiltration	90
Landscape Infiltration	75
Level Spreader	0
Micro Pool	75
Micro-Bioretention	75
Oil-Grit Separator	50
Other	0
Permeable Pavement	75
Porous Pavement	90
Rain Gardens	75-80
Rainwater Harvesting	75
Regenerative Step Pool Storm Conveyance	90
Sand Filter	0
Shallow Marsh	75
Sheetflow to conservation areas	75
Submerged Gravel Wetlands	75
Swales	75
Underground Storage	50
Vegetated Buffer	80
Wet Pond	75

BMP Type	Bacteria Pollutant Removal Efficiency (%)
Wet Structure	75

- **Riparian buffers:** The effectiveness of riparian buffers in reducing pollutant loads is estimated based on stream length and buffer width. The County 2011 land cover data downloaded from the County website was used to identify all the forested areas in the study watersheds. A GIS analysis was conducted to identify stream length in study watersheds that had 100 feet and 50 feet of riparian buffers on either side. The default pollutant removal efficiencies in the model were modified to match the County-approved pollutant removal efficiencies for vegetated buffers (Table A-8). The estimated pollutant load reductions were further adjusted (to 60 percent) based on the assumption that the County does not have effective signage at all places that specify acceptable and unacceptable activities.
- **Catch basin cleanouts:** The model estimates the pollutant load reductions achieved by catch basin cleanouts based on the number of impervious acreage captured by the inlets. Based on the Phase II WIP developed by the County for the Chesapeake Bay TMDL, approximately 5,281 acres of impervious area was captured by cleaning 12,625 of the 34,095 inlets in the County. This data was used to find the proportion of inlets cleaned in each study watershed and to obtain the approximate impervious area captured by them. The County GIS data was used to identify the number of inlets in each study watershed.

The bacteria pollutant loads contributing to surface water from primary and secondary sources and subsequent load reductions from existing management practices for all the study watersheds is provided in Table A-9.

Table A-9: Baseline Bacteria Loads Contributing to Surface Water for Study Watersheds

Bacteria TMDL Watershed	Local Waterway	Bacteria Loads (billion/year)	Bacteria Loads (billion/day)
Chesapeake Bay Mainstem	Tracy and Rockhold Creeks	563,451	1,544
Magothy River	Forked Creek	78,605	215
Magothy River	Magothy River Mainstem	1,793,426	4,913
Magothy River	Tar Cove	262,717	720
Patapsco River Lower North Branch	Patapsco River Lower North Branch	1,207,758	3,309
Patapsco River	Furnace Creek	1,162,324	3,184
Patapsco River	Marley Creek	1,028,407	2,818
Severn River	Mill Creek	235,329	645
Severn River	Severn River Mainstem	5,034,108	13,792
Severn River	Whitehall and Meredith Creeks	182,911	501
South River	Duvall Creek	68,159	187
South River	Ramsey Lake	109,113	299
South River	Selby Bay	104,777	287
South River	South River Mainstem	2,105,817	5,769
Upper Patuxent River	Upper Patuxent River	1,688,688	4,627
West River and Rhode River	Bear Neck Creek	68,501	188
West River and Rhode River	Cadle Creek	32,488	89
West River and Rhode River	Parish Creek	22,862	63
West River and Rhode River	West River Mainstem	201,795	553

A.3 ESTIMATION OF LOAD REDUCTIONS FROM PRIOR MANAGEMENT MEASURES

Based on the MDE's TMDL guidance document, *Guidance for Developing a Stormwater Wasteload Allocation Implementation Plan for Bacteria Total Maximum Daily Loads* (May 2014), load reductions from prior management measures should be estimated to account for progress towards TMDL goals at the time the TMDL Restoration Plan is developed. Most of the TMDLs for bacteria in Anne Arundel County were developed in the early 2000s. The County has since implemented several BMPs. Additionally, based on the County-provided GIS data, several OSDS have also been retired in the TMDL watersheds since development of the TMDLs by MDE 15 years ago. Potential credits from both these management measures were estimated by developing a WTM using the TMDL data. This method was developed based on correspondence with MDE.

For the prior-load reductions WTM model, the 2000 land use data used by MDE to develop the TMDLs was input as the primary source. The secondary sources in the model remained unchanged. The annual bacteria loads in the model were calibrated such that the baseline loads from the WTM matched the MDE-published TMDL baseline loads.

Credits from Post-TMDL BMPs

The potential credits that would be achieved from the "Post-TMDL" BMPs were calculated by including all the BMPs that were implemented after the TMDL was published by MDE. Since the majority of the TMDLs were developed in the early 2000s, 2000 was used as the cut-off year to estimate the number of post-TMDL BMPs for each watershed. The drainage area and impervious cover for all the post-TMDL BMPs were obtained from the County-provided GIS data and IMP database. All the Post-TMDL BMPs were not accounted in the WTM as drainage area and impervious area information was not available for some of the BMPs. This is because the County is in the process of updating this information for the County wide BMPs. Impervious area treated was not available for some BMPs in the County IMP database. In such cases, it was assumed that 50 percent of the treated drainage area was impervious. The bacteria removal efficiencies provided in Table A-8 were used for the post-TMDL BMPs as well.

Credits from Retired Septic Systems

The County provided a GIS coverage of all the OSDS that were retired or connected to a public sewer from 2008 to 2013. The County-provided GIS data were clipped to the TMDL watersheds to obtain the number of retired OSDS in each watershed. The obtained numbers were input into the calibrated WTM to estimate the credits that would be achieved towards meeting the TMDL goals for all the study watersheds.

Table A-10 shows the TMDL credits that would be achieved for all the study watersheds from post-TMDL BMPs and retired septic systems.

Table A-10: Septic Systems Identified by the County to Be Connected to a Public Sewer System

Bacteria TMDL Watershed	Prior Load Reductions Since 2000		TMDL Targets	
	Post-TMDL BMPs	Post-TMDL Septic System Retirement	TMDL Required % Reduction	Adjusted TMDL Required % Reduction
Magothy Mainstem	3.30%	0.61%	54.00%	50.09%
Magothy River/Forked Creek	4.91%	None	26.27%	21.36%
Magothy River/Tar Cove	2.44%	None	32.66%	30.22%
Patapsco River/Furnace Creek	4.47%	0.38%	77.79%	72.94%
Patapsco River LNB	3.70%	2.61%	56.1%	49.79%
Patapsco River/Marley Creek	5.41%	0.26%	75.70%	70.03%
Patuxent River Upper	8.36%	None	47.2%	38.84%
Rhode River/Bear Neck Creek	11.96%	None	43.32%	31.36%
Rhode River/Cadle Creek	3.43%	None	72.16%	68.73%
Severn River Mainstem	1.19%	0.35%	19.00%	17.46%
Severn River/Mill Creek	4.30%	None	86.00%	81.70%
Severn River/Whitehall and Meredith Creek	6.45%	0.43%	90.00%	83.12%
South River/Duvall Creek	3.77%	None	45.56%	41.79%
South River Mainstem	8.09%	0.06%	46.00%	37.85%
South River/Ramsey Lake	6.00%	None	59.30%	53.30%
South River/Selby Bay	1.20%	None	28.4%	27.20%
W. Chesapeake Bay/Tracy and Rockhold Creeks	0.35%	2.70%	82.00%	78.95%
West River Mainstem	0.27%	0.48%	35.41%	34.66%
West River/Parish Creek	None	None	53.04%	53.04%

A.4 PROPOSED CONDITIONS MODELING

A proposed conditions model was developed to estimate the potential reductions in baseline loads that could be achieved from implementation of certain future management practices in the TMDL watersheds. The goal of this modeling was to identify and prioritize the most effective strategies. These strategies were categorized into Tier A and Tier B strategies.

Tier A included strategies such as elimination of illicit discharges, abatement of sanitary sewer overflows, and retirement of septic systems which addressed human sources of bacteria. Pollutant load reductions that would be achieved by implementing Tier A strategies were quantified using the WTM.

Tier B strategies were recommended to address non-human sources of bacteria and included strategies such as urban stormwater retrofits, improvement of the riparian buffer ordinance/education program, expanded pet waste education program, livestock stream exclusion fencing, and Canada goose management. Load reductions that would be achieved by implementing Tier B strategies were quantified using WTM and available literature. Load reductions from urban stormwater retrofits and a riparian buffer ordinance/education program were calculated using WTM, as it effectively captures loads from urban sources. As WTM does not effectively capture load reductions from an expanded pet waste education program, livestock stream exclusion fencing, and Canada goose management were quantified using available literature. Based on MDE's recommendations, Tier A strategies were given higher priority than Tier B strategies because they address human sources of bacteria.

Tier A Strategies

- **Retirement of County septic systems:** This Tier A strategy proposes retirement of existing septic systems in the TMDL watersheds and connecting them to public sanitary systems to reduce the bacteria loads from OSDSs. The County provided County-wide GIS coverage of all the OSDSs that would be retired to be connected to a WRF or to a cluster treatment system. This GIS coverage was based on the County's OSDS Evaluation Study (2008). The County-provided GIS layer was clipped to the TMDL watersheds to obtain the number of septic systems that are proposed to be retired in each watershed. Thus obtained data was entered into the future management practices of WTM under "Septic System Retirement (Convert to WWTP)" option to calculate the load reductions that would be achieved from this strategy. The table below (Table A-11) provides information on the number of septic systems proposed to be retired in each watershed.

Table A-11: Septic Systems Identified by the County to Be Connected to a Public Sewer System

TMDL Watershed ID	No. of Septic Systems Identified to Be Connected to Sewer	Portion in Each Watershed (%)
Magothy Mainstem	4,814	71
Magothy River/Forked	113	88
Magothy River/Tar Cove	1,708	94
Patapsco River Lower North Branch	174	15
Patapsco River/Furnace Creek	252	37
Patapsco River/Marley Creek	0	0
Patuxent River Upper	289	24
Rhode River/Bear Neck Creek	0	0
Rhode River/Cadle Creek	0	0
Severn River Mainstem	5,475	55
Severn River/Mill Creek	1,168	76
Severn River/Whitehall and Meredith Creek	320	45
South River Mainstem	1,694	20
South River/Duvall Creek	0	0
South River/Ramsey Lake	0	0
South River/Selby Bay	0	0
W. Chesapeake Bay/Tracy and Rockhold Creeks	0	0
West River Mainstem	0	0
West River/Parish Creek	0	0

- **Abatement of sanitary sewer overflows:** This strategy involved minimizing the volume of SSOs discharging to the waterways after a storm event. The County provided historic SSO data that included approximately 500 SSOs documented since 2001. Based on the County-provided information, the majority of the SSOs were primarily caused by sewage pump station (SPS) failure. The proposed strategy to reduce the SSOs included SPS "upgrades," which involves projects such as improving SPS operations and relieving capacity problems, and replacing SPS generators. Based on the County-provided capital improvement projects (CIP) for wastewater, approximately 35 projects related to SPS upgrades were identified in 12 of the 19 TMDL watersheds. The obtained information was entered in the future management practices under the "SSO Repair/Abatement" options to estimate the load reductions that would be achieved from the County CIP projects. The number of SPS upgrades in each TMDL watershed based on the County CIP data is provided in the table below (Table A-12).

Table A-12: List of SPS Upgrades in the TMDL Watersheds

Bacteria TMDL Watershed	No. of SPS Upgrades	SSO Goal Reduction (%)
Magothy Mainstem	6	27
Magothy River/Forked	1	100
Magothy River/Tar Cove	N/A	N/A
Patapsco Lower North Branch	3	75
Patapsco River/Furnace Creek	5	63
Patapsco River/Marley Creek	3	25
Patuxent River Upper	N/A	N/A
Rhode River/Bear Neck Creek	1	17
Rhode River/Cadle Creek	1	50
Severn River Mainstem	8	14
Severn River/Mill Creek	1	10
Severn River/Whitehall and Meredith Creek	0	0
South River Mainstem	6	9
South River/Duvall Creek	1	50
South River/Ramsey Lake	0	0
South River/Selby Bay	0	0
W. Chesapeake Bay/Tracy and Rockhold Creeks	0	0
West River Mainstem	0	0
West River/Parish Creek	1	100

- **Elimination of illicit connections:** The County currently conducts field screening of outfalls to identify illicit connections from residences and businesses. This is required to meet the County's NPDES MS4 permit requirement. As a part of this program, approximately 150 outfalls are sampled every year, and all identified illicit connections are enforced/eliminated immediately. Based on the County-provided data from 2005 to 2013, the rate of illicit connections detection/elimination is approximately 2 percent (29 cases out of 1,350 outfalls surveyed). Assuming the County will continue the illicit detection/elimination program at the same rate in the future, an average of 41 percent of outfalls would be surveyed by 2020 in all the TMDL watersheds, and all identified illicit connections are assumed to be eliminated. This proposed rate was input into the "Illicit Connection Removal" option under the future management practices of the WTM to quantify the load reductions from this strategy.

Tier B Strategies

Urban stormwater retrofits in Tier B strategies were categorized into: Restoration of 20 Percent of Currently Unmanaged impervious Cover and Retrofit of Pre-2002 Ponds to Meet Current MDE Stormwater Criteria. This strategy was developed based on the Anne Arundel County's Urban Phase II Watershed Implementation Plan (2012) and requirements of the current NPDES MS4 Permit. The current NPDES MS4 Permit requires the County to treat 20% of the impervious area that currently has limited/no stormwater management. Even though the impervious areas draining to pre-2002 ponds can be categorized under impervious area with limited stormwater management and can be counted towards the NPDES MS4 impervious area restoration goals, they are not merged with the "Restoration of 20 Percent of Currently Unmanaged Impervious Cover" strategy in this restoration plan. This was done so that cost-benefits of retrofitting ponds and implementing new practices in untreated areas can be compared and a combination of options can be selected by the County to meet the TMDL goals.

- **Restoration of 20 Percent of Currently Unmanaged Impervious Cover:** This Tier B strategy included implementing stormwater management practices to restore 20% of the impervious area that currently does not have adequate stormwater controls. Stormwater management practices with high bacteria removal efficiency such SPSCs and infiltration practices are proposed to be implemented. This proposed restoration measure is based on the County's NPDES MS4 permit requirements that require restoration of 20% of untreated impervious area by the end of the permit term i.e. 2019. Table A-13 provides information on the 20% of the untreated impervious cover that is proposed to be treated by this strategy.
- **Retrofit of Pre-2002 Ponds to Meet Current MDE Stormwater Criteria:** This strategy involved retrofitting all the pre-2002 dry ponds with more than 10 acres of drainage area to meet the current Maryland Stormwater Design criteria, thereby improving their bacteria removal efficiency to 75%-90%. This strategy is concurrent with the County's Phase II WIP (2012). The dry ponds are proposed to be upgraded to practices such as wetlands or step pool conveyance systems (SPCS). The drainage area for the dry ponds was obtained from the County GIS and IMP database. Based on County's direction, an impervious cover of 50% was assumed for all the drainage areas that were missing impervious cover information. The IMP database included several dry ponds in the TMDL watersheds where the drainage area was not populated. These ponds were not included in the restoration strategy. Table A-13 provides information on the number of dry pond retrofits proposed in each watershed and the area that would be treated.

The two proposed urban stormwater retrofit strategies were input in the "Retrofit Worksheet" of the WTM to estimate the load reductions that would be achieved from this strategy. The load reductions were further adjusted based on the assumptions that the proposed practices would capture 90 percent of annual rainfall, the County has design criteria that will result in

high pollutant removal efficiencies for practices (1.2), and that regular maintenance of the practices will be enforced and conducted by the County (0.9).

Table A-13: Proposed Urban Stormwater Retrofits in the TMDL Watersheds

Bacteria TMDL Watershed	No. of Dry Ponds	Impervious Area Treated by Dry Pond Retrofits (acres)	Impervious Area Treated by NPDES Requirement (acres)
Magothy Mainstem	8	255.4	351.6
Magothy River/Forked	0	0	25.5
Magothy River/Tar Cove	0	0	51.5
Patapsco Lower North Branch	5	51.9	491.5
Patapsco River/Furnace Creek	8	301.4	427.1
Patapsco River/Marley Creek	11	128.6	368.5
Patuxent River Upper	0	0	77.0
Rhode River/Bear Neck Creek	0	0	19.7
Rhode River/Cadle Creek	0	0	11.6
Severn River Mainstem	13	559.1	877.4
Severn River/Mill Creek	3	35.5	43.1
Severn River/Whitehall and Meredith Creek	0	0	44.6
South River Mainstem	14	293.4	349.1
South River/Duvall Creek	0	0	25.2
South River/Ramsey Lake	0	0	13.6
South River/Selby Bay	0	0	13.2
W. Chesapeake Bay/Tracy and Rockhold Creeks	0	0	74.2
West River Mainstem	0	0	73.2
West River/Parish Creek	0	0	11.2

- **Riparian Buffer Education:** This Tier B strategy aims at improving the buffer areas along the stream by implementing a riparian buffer education program for private property owners adjacent to buffer areas. The education programs will include buffer enhancement components such as no mow areas, planting trees and shrubs and promoting growth of native vegetation. The pollutant load reductions from this strategy were obtained by adjusting the buffer maintenance factor to 0.9 in future management practices of WTM indicating the County would have implemented a buffer education program.

The expected pollutant load reductions from Tier A and Tier B strategies that were quantified using WTM are provided in Table A-14 below.

Table A-14: Bacteria Load Reductions from Proposed Tier A and Tier B Strategies that Were Quantified Using WTM

Bacteria TMDL Watershed	Expected % Load Reduction					
	Septic Retirement/ Connection	Abatement of SSOs	Urban Stormwater Retrofits (Pre 2002-Pond Retrofits)	Urban Stormwater Retrofits (Restore 20% Untreated Impervious Area)	Eliminate Illicit Connections	Buffer Ordinance/Education
Magothy Mainstem	13.55	1.12	4.7	4.48	8.74	0.91
Magothy River/Forked	6.14	12.40	-	7.02	1.13	1.93
Magothy River/Tar Cove	25.25	-	-	3.76	0.67	1.02
Patapsco Lower North Branch	5.60	4.90	1.26	6.59	11.60	2.99
Patapsco River/Furnace Creek	3.38	3.5	8.16	9.00	7.72	1.47
Patapsco River/Marley Creek	-	2.04	4.47	8.42	10.82	1.63
Patuxent River Upper	16.45	-	-	5.42	0.85	17.20
Rhode River/Bear Neck Creek	-	2.50	-	6.82	0.50	0.11
Rhode River/Cadle Creek	-	8.40	-	9.40	0.30	0.80
Severn River Mainstem	10.56	0.36	3.10	3.90	19.02	1.56
Severn River/Mill Creek	34.70	0.20	4.34	4.20	1.54	2.80
Severn River/Whitehall and Meredith Creek	21.10	-	-	4.20	0.9	2.24
South River Mainstem	15.60	0.30	3.73	3.60	11.30	8.00
South River/Duvall Creek	-	6.40	-	9.13	0.65	-
South River/Ramsey Lake	-	-	-	2.90	0.11	0.14
South River/Selby Bay	-	-	-	3.20	0.16	0.06
W. Chesapeake Bay/Tracy and Rockhold Creeks	-	-	-	2.60	0.23	8.20
West River Mainstem	-	-	-	8.30	1.21	11.54
West River/Parish Creek	-	12.90	-	10.50	0.19	0.46

A.5 REFERENCES

Anne Arundel County. 2010. Marinas of Anne Arundel County.

Anne Arundel County. 2013. National Pollutant Discharge Elimination System Municipal Separate Storm Sewer System Discharge Permit 2012 Annual Report: Anne Arundel County, Maryland. Available online at: http://www.aacounty.org/DPW/Watershed/2012%20NPDES%20Documents/2012%20Anne%20Arundel%20Annual%20Report_No%20Appendices.pdf

Anne Arundel County. 2014. National Pollutant Discharge Elimination System Municipal Separate Storm Sewer System Discharge Permit 2013 Annual Report: Anne Arundel County, Maryland. Available online at: http://www.aacounty.org/DPW/Watershed/2012%20NPDES%20Documents/2012%20Anne%20Arundel%20Annual%20Report_No%20Appendices.pdfMaryland Department of the Environment. 2014. *MDE Guidance for Developing a Stormwater Wasteload Allocation Implementation Plan for Bacteria Total Maximum Daily Loads*.

Caraco, D. 2013. Watershed Treatment Model (WTM) 2013 "Custom" version. Center for Watershed Protection, Ellicott City, MD.

Caraco, D. 2013a. Watershed Treatment Model (WTM) 2013 Documentation. Center for Watershed Protection, Ellicott City, MD. Pages 1-114

Maryland Department of Natural Resources (MD DNR), Pumpout Locations in Maryland http://www.dnr.state.md.us/boating/pumpout/locations.asp (visited November 2014)

Natural Resources Conservation Services (NRCS), US Department of Agriculture, (USDA) *Soil Survey Geographic (SSURGO)* database. 2014.

Schueler, T. 1987. Controlling Urban Runoff: A Practical Manual for Planning and Designing Urban Best Management Practices. Metropolitan Washington Council of Governments. Washington, D.C.

ANNE ARUNDEL COUNTY RECREATION AND PARKS DEPARTMENT

INTEGRATED PEST MANAGEMENT PROGRAM

IPM PROGRAM PRACTICES AND NOTIFICATION PROCEDURES

IPM POLICY STATEMENT

Anne Arundel County Recreation and Parks (AACRP) is committed to providing parks with pest-free environments through the implementation of preventive methods and chemical strategies when necessary.

Beginning in 2013**,** AACRP adopted a pest prevention program known as Integrated Pest Management (IPM) for park grounds and athletic fields. The goal is to provide a safe and healthy recreational environment which is conducive to effective staff productivity, public enjoyment, and progressive resource conservation by managing pests and their environments while balancing costs and benefits with human health and environmental quality.

Since AACRP properties, facilities and programs are often contiguous physically, programmatically, geographically and operationally to Anne Arundel County Public School properties it was deemed imperative that there be a high degree of standardization, commonality and uniformity in pest management philosophy.

IPM PROGRAM OBJECTIVE

Pests and pesticides can pose significant problems and risks to people, property, and the environment. The incorporation of Integrated Pest Management (IPM) procedures for control of landscape pests will:

- Minimize the amount and toxicity of pesticides used in the park facilities;
- Eliminate unnecessary pesticide applications;
- Provide IPM education to the public, park users and park staff;
- Improve landscape and grounds cleanliness;
- Utilize only Licensed, Certified and Registered Technician pesticide applicators;
- Reduce or eliminate exposure of children, vulnerable adults, nursing mothers with infants and pets to pesticide applications;
- Provide universal public and staff notification.

IPM PROGRAM STRATEGIES

Pesticide Applications

AACRP may use pesticides after it is determined that non-toxic options are unreasonable or have been exhausted. The least hazardous pesticide is selected; the method and time of application is based on AACRP's goal to minimize the potential for exposure of park users and staff.

Pesticide applications made in or on park property are conducted by individuals licensed and certified as a pest control applicators or by a registered technician working under the supervision of a certified applicator.

Pesticide applications are made on park grounds only when:

- Weather and wind conditions (<5–10 mph) permit to prevent spray drifting;
- After normal school hours or summer dismissal for park/school conjoined properties;
- During staffed park scheduled closures, on weekends or after reviewing field use schedules.

Universal Notification

AACRP provides universal notifications in all parks, athletic facilities and managed natural areas as appropriate and includes specific information for the public at least twenty-four (24) hours in advance of the application.

Universal notification of planned pesticide spraying is accomplished through:

- The AACRP internet homepage re pesticide application schedules and pesticide product/safety information;
- Individual staffed park facility web sites re pesticide application schedules and pesticide product/safety information;
- Sign posting at all staffed parks, community parks and athletic facilities at least twenty four (24) hours in advance, allowing a 2 week application window, in addition to a rescheduling option in case of weather or circumstance difficulties, whenever a pesticide application is necessary;
- Forty eight hour posted Warning signage and closure of playground areas following pesticide application;
- Warning/closure of vehicular access to areas of community parks during applications;
- Restrict applications to public school conjoined-park properties to periods when children are not present.

Other supporting strategies:

- Inspection and monitoring of property for pests populations;
- Action thresholds to establish the point or the level of pest population at which pest control action will be taken;
- Sanitation and increased tidiness of park and athletic areas to prevent or minimize pest populations;

- Physical, cultural and mechanical controls as initial pest control techniques instead of pesticide applications;
- Biological controls as use of living organisms to control pests;
- Education of park staff and the public regarding potential park pest problems as well as how IPM policies and procedures will be used to achieve the desired pest management;
- Recordkeeping of pest surveys and pesticide use are maintained by Park Administration for 2 years to meet regulatory compliance;
- Material Safety Data Sheets (MSDS) and Product Labels are maintained by the Administration and pesticide applicators, warning information posted on notification signage and records are available for public review upon request;
- Pesticide Sensitive List ...Anne Arundel County residents registered on the Maryland Department of Agriculture Pesticide Sensitive List will receive written and oral notification of a scheduled pesticide application if the registered property abuts that of a park or athletic property that will be undergoing a pesticide application.
- Emergency Applications result in written universal notifications and postings issued within twenty-four (24) hours after the application or the next day.

TITLE 7. WATERSHED PROTECTION AND RESTORATION PROGRAM

Section

13-7-101. Definitions.
13-7-102. Watershed Protection and Restoration Program.
13-7-103. Stormwater remediation fee.
13-7-104. Appeals.
13-7-105. Exemptions – Property.
13-7-106. Exemptions – Substantial financial hardship.
13-7-107. Reduction of fee.
13-7-108. Competitive Grant Program.

§ 13-7-101. Definitions.

In this title, the following words have the meanings indicated.

(1) "Attached dwelling" means a duplex, semi-detached, or townhouse, dwelling as defined in § 18-1-101(30) of this Code.

(2) "Base rate" means the stormwater remediation fee to be charged for each equivalent residential unit per year.

(3) "Condominium" has the meaning stated in § 17-1-101(16) of this Code.

(4) "Detached single-family dwelling" has the meaning stated for "dwelling, single-family detached" in § 18-1-101(30) of this Code.

(5) "Dwelling unit" has the meaning stated in § 18-1-101(30) of this Code.

(6) "Equivalent residential unit" means 2,940 square feet.

(7) "Farm" means a property, or contiguous properties under the same ownership, with or without buildings, that is used for cultivating and managing the soil for composting, growing, harvesting, and selling of crops or the products of forestry, horticulture or hydroponics; processing agricultural products, regardless of whether there is a change in natural state of the product; breeding, raising, or managing livestock, including horses, cattle, poultry, fish, game, bees, or fur-bearing animals; dairying; or equestrian activities and events not conducted under a license issued by the State Racing Commission.

(8) "Homeowners Association" means an incorporated or unincorporated homeowners association, civic or community association, council of condominium unit owners, or similar entity.

(9) "Impervious surface" has the meaning stated in the Environment Article, § 4-201.1(d), of the State Code.

(10) "Multifamily residential property" means real property located in any zoning district that is improved by a "dwelling, multifamily", as that term is defined in § 18-1-101(30) of this Code.

(11) "Nonresidential property" means real property located in a commercial, industrial, maritime, mixed use, Odenton Growth Management Area, Open Space, Town Center, or Small Business zoning district as shown on the Anne Arundel County Digital Zoning Layer adopted in accordance with § 18-2-106 of this Code, and includes real property in those zoning districts improved by an attached dwelling or a detached single family dwelling. "Nonresidential property" also includes real property located in a residential zoning district as shown on the Anne Arundel County Digital Zoning Layer adopted in accordance with § 18-2-106 of this Code with a use other

than a dwelling; real property owned by not-for-profit entities such as Homeowners Associations, fraternal organizations, religious groups or organizations, healthcare facilities, and other real property devoted to non-governmental charitable, or institutional uses; and real property located partially in a residential district and partially in any district other than a residential zoning district as shown on the Anne Arundel County Digital Zoning Layer adopted in accordance with § 18-2-106 of this Code.

(12) "Religious group or organization" means a religious organization that is certified under § 501(c)(3) or (d) of the Internal Revenue Code and that is exempt from real property tax under § 7-204 of the Tax-Property Article of the State Code.

(13) Residential property, tier one" means real property located in Zoning District RA or RLD as shown on the Anne Arundel County Digital Zoning Layer adopted in accordance with § 18-2-106 of this Code, and improved with a detached single-family dwelling.

(14) "Residential property, tier two" means real property located in Zoning District R1, R2, or R5 as shown on the Anne Arundel County Digital Zoning Layer adopted in accordance with § 18-2-106 of this Code, and improved with a detached single-family dwelling.

(15) "Residential property, tier three" means real property located in Zoning District R10, R15, or R22 as shown on the Anne Arundel County Digital Zoning Layer adopted in accordance with § 18-2-106 of this Code, and improved with an attached dwelling or a detached single-family dwelling. "Residential property, tier three" also includes real property in Residential Zoning District RA, RLD, R1, R2, or R5 that is improved by an attached dwelling or is a mobile home space under a license issued pursuant to Article 11, Subtitle 9 of this Code.

(16) "Stormwater remediation fee" means the fee charged in accordance with this title to fund or support, in full or in part, the purposes set forth in § 4-11-119(c) of this Code.

(17) "Unimproved property" means real property that has no impervious surface.

(Bill No. 2-13; Bill No. 44-13; Bill No. 74-13)

§ 13-7-102. Watershed Protection and Restoration Program.

(a) **Program established.** There is a Watershed Protection and Restoration Program as mandated by § 4-202.1 of the Environment Article of the State Code.

(b) **Purposes.** The purposes of the Watershed Protection and Restoration Program are to support compliance with the requirements of the County's National Pollutant Discharge Elimination System Municipal Separate Storm Sewer System permit, Chesapeake Bay Total Maximum Daily Load and local watershed Total Maximum Daily Load, and stormwater Watershed Implementation Plans through stormwater management practices and stream and wetland restoration activities, and to maintain and administer the Watershed Protection and Restoration Special Revenue Fund established under § 4-11-119 of this Code.

(Bill No. 2-13; Bill No. 42-13)

§ 13-7-103. Stormwater remediation fee.

(a) **Fee established.** There is an excise tax known as the stormwater remediation fee imposed on the use of real property improved with impervious surface as required by § 4-202.1(e) of the Environment Article of the State Code. The stormwater remediation fee may not be imposed on real property in the City of Annapolis.

(b) **Base rate.** The base rate of the stormwater remediation fee for one equivalent residential unit shall be $85 per year.

(c) **Residential property fee.** The stormwater remediation fee for each real property in the following categories shall be:

(1) residential property, tier one - two times the base rate;

(2) residential property, tier two - the base rate; and

(3) residential property, tier three - 40% of the base rate for each dwelling unit or mobile home space.

(d) **Multifamily residential and nonresidential properties fee.** Except as provided in subsections (e), (f), (g), (h), (i) (j), (k), (l), and (m) the stormwater remediation fee for a multifamily residential property or a nonresidential property shall be determined in accordance with the following procedure:

(1) The Director determines the number of equivalent residential units assigned to the property by dividing the total impervious surface of the property by the value of one equivalent residential unit.

(2) For a non-residential property, the Director computes the stormwater remediation fee by multiplying the base rate by the number of equivalent residential units assigned to the property.

(3) For a multifamily residential property, the Director computes the stormwater remediation fee by multiplying the number of equivalent residential units assigned to the property by 40% of the base rate.

(e) **Condominiums fee.** If a multifamily residential property is a condominium, the stormwater remediation fee determined for buildings containing dwelling units in accordance with subsection (d) shall be divided by the number of dwelling units and that amount shall be billed separately to each condominium dwelling unit owner.

(f) **Private roads – fee.** If a nonresidential property is a private road with a separate tax account number and is not owned by a Homeowners Association, the stormwater remediation fee shall be the base rate.

(g) **Homeowners Associations – fee.** If a nonresidential property is owned by a Homeowners Association, the total stormwater remediation fee for all properties owned by the same Homeowners Association may not exceed the number of property tax accounts for the property owners within the boundaries of the Homeowners Association multiplied by 40% of the base rate.

(h) **Nonresidential properties – cap on fee.** The stormwater remediation fee for a nonresidential property may not exceed 25% of the State and County real property tax that would be levied based on the assessment of the property prior to any tax credits, deferrals, or exemptions that are applicable in accordance with the Tax-Property Article of the State Code or Article 4, Title 2 of this Code.

(i) **Certain marinas – fee.** Marinas in good standing with the Maryland Department of Natural Resources Clean Marina Initiative with more than seven-and-one-half acres of impervious surface shall pay a fee for each additional acre or fraction thereof in excess of seven-and-one-half acres equivalent to 25% of the base rate.

(j) **Private airfields or airports – fee.** If a nonresidential property is a private airfield or airport as defined in Article 18 of this Code, the stormwater remediation fee shall be two times the base rate.

(k) **Farms – fee.** The stormwater remediation fee for a farm shall be 40% of the base rate for each property tax account associated with the farm that has impervious surface.

(l) **Properties with certain permits – fee.** If a nonresidential property is subject to a National Pollutant Discharge Elimination System Permit including stormwater management controls, the stormwater remediation fee shall be 30 % of the rate calculated under subsection (d)(2).

(m) **Nonprofit organizations – fee.** Unless otherwise provided under this section, the stormwater remediation fee for nonresidential property owned by a nonprofit organization that is exempt from taxation under 501(c)(3) or (d) of the Internal Revenue Code and exempt from real property tax under the Tax-Property Article of the State Code shall be $1.00.

(n) **Implementation of fee.**

(1) For residential properties, the stormwater remediation fee shall be charged in the following manner:

(i) 60% of the fee beginning in fiscal year 2014;
(ii) 80% of the fee beginning in fiscal year 2015; and
(iii) 100% of the fee beginning in fiscal year 2016 and each fiscal year thereafter.

(2) For multifamily residential and non-residential properties, if the stormwater remediation fee calculated under subsection (d) is $500 or greater, it shall be charged in the following manner:
(i) 60% of the fee beginning in fiscal year 2014;
(ii) 80% of the fee beginning in fiscal year 2015; and
(iii) 100% of the fee beginning in fiscal year 2016 and each fiscal year thereafter.

(o) **Collection.** The stormwater remediation fee shall be billed annually to the owner of the real property on which it is imposed. The stormwater remediation fee shall be collected as provided in § 1-9-101 of this Code. The Controller shall include an explanation in each property tax bill that indicates that the stormwater remediation fee included on the property tax bill is a tax required by Maryland House Bill 987, enrolled as Chapter 151 of the Acts of the General Assembly, 2012, which was passed by the General Assembly and signed into law by the Governor on May 2, 2012, and is now codified as § 4.202.1(e) of the Environment Article of the State Code.
(Bill No. 2-13; Bill No. 40-13; Bill No. 42-13; Bill No. 43-13; Bill No. 44-13; Bill No. 45-13; Bill No. 74-13)

§ 13-7-104. Appeals.

(a) **Definitions.** In this section, the following words have the meanings indicated.
(1) "Median impervious surface of residential property, tier 2" means 2940 square feet.
(2) "Median impervious surface of residential property, tier 3" means 1200 square feet.

(b) **Administrative appeal.** A property owner may appeal a stormwater remediation fee to the Department. An appeal shall be submitted on or before September 30 in order to receive a correction of the stormwater remediation fee for the current billing year.

(c) **Grounds for appeal.** Grounds for appeal of the stormwater remediation fee include:
(1) incorrect classification of real property for purposes of determining the stormwater remediation fee;
(2) a property in the category residential property, tier 1 having less impervious surface than the median impervious surface of residential property, tier 2, for a charge at the tier 2 level;
(3) a property in the category residential property, tier 2 having less impervious surface than the median impervious surface of residential property, tier 3, for a charge at the tier 3 level;
(4) for nonresidential or multifamily residential property, errors in the calculation of the impervious surface of the property;
(5) mathematical errors in calculating the stormwater remediation fee;
(6) the real property is not subject to the stormwater remediation fee under § 13-7-105;
(7) the property owner is exempt from the stormwater remediation fee under § 13-7-106;
(8) errors in the identification of the property owner of real property subject to the stormwater remediation fee; or
(9) for nonresidential property owned by a Homeowners Association, errors in the number of property tax accounts for the property owners within the boundaries of the Homeowners Association.

(d) **Application.** An appeal must be submitted in writing on an application form provided by the Department. A property owner shall include a detailed statement of the grounds of the appeal and all information or supporting documentation as required by the Department. Failure to provide all information required on the application form or to attach any relevant documentation is a basis for a denial of an appeal. If the basis for appeal is:
(1) that the zoning district of the real property is incorrect, the property owner shall provide proof of the zoning district of the property as shown on the Anne Arundel County Digital Zoning

Layer adopted in accordance with § 18-2-106 of this Code;

(2) that there is an error in the calculation of the impervious surface of the property, the property owner shall supply documentation prepared and certified by a registered professional engineer or professional land surveyor of the impervious surface of the property; or

(3) that there is an error in the number of dwellings or dwelling units that may be billed by a Homeowners Association, the property owner shall provide proof of the number of property tax accounts for the property owners within the boundaries of the Homeowners Association.

(e) **Written decision.** The Director shall issue a written decision indicating whether the appeal is granted or denied and a copy shall be provided to the property owner, the Controller, and any counsel of record. The written decision of the Director shall set forth all reasons for the decision and shall set forth any change in the amount of the stormwater remediation fee. For fiscal year 2014, the Director shall issue the written decision within 90 days of the filing of the appeal. For any year after fiscal year 2014, the Director shall issue the written decision within 45 days.

(f) **Adjusted billing.** If the decision of the Director changes the amount of the stormwater remediation fee, the Controller shall issue a new bill to the property owner.

(g) **Stay.** An application for an appeal filed under subsection (d) shall act as an immediate stay on the collection of the stormwater remediation fee, without interest or penalty. A property owner shall pay the fee within 30 days of a final determination of the amount of fee.

(h) **Tax Court.** A property owner who is aggrieved by a decision of the Director on an appeal or by the imposition of a stormwater remediation fee shall pay the stormwater remediation fee and may request a refund in accordance with Local Government Article, § 20-113, of the State Code and may appeal to the Maryland Tax Court in accordance with Local Government Article, § 20-117, of the State Code.

(Bill No. 2-13; Bill No. 44-13; Bill No. 74-13; Bill No. 19-14)

§ 13-7-105. Exemptions – Property.

(a) **State and local government property.** A stormwater remediation fee may not be imposed on real property owned by the entities listed in the Environment Article, § 4-202.1(e)(2), of the State Code.

(b) **Unimproved property.** A stormwater remediation fee may not be imposed on unimproved property.

(Bill No. 2-13)

§ 13-7-106. Exemptions – Substantial financial hardship.

(a) **Program established.** There is a Substantial Financial Hardship Exemption Program. The purpose of the Program is to exempt from the payment of the stormwater remediation fee a property owner who is able to demonstrate substantial financial hardship as a result of the fee.

(b) **Qualifications for exemption.** To qualify for a substantial financial hardship exemption:

(1) the real property for which the exemption is requested shall contain a detached single family dwelling or a dwelling unit in an attached dwelling or multifamily residential property;

(2) at least one of the property owners shall be an occupant of the property; and

(3) at least two of the following four criteria shall be met to demonstrate substantial financial hardship:

(i) the combined gross income, as defined in the Tax-Property Article, § 9-104, of the State Code, does not exceed the poverty guidelines updated periodically in the Federal Register by the United States Department of Health and Human Services under the authority of 42 U.S.C. § 9902(2);

(ii) at least one of the property owners who resides at the property receives an energy

assistance subsidy in accordance with a Fuel and Utility Assistance Program established under the Human Services Article, § 5-5A-07, of the State Code;

(iii) at least one of the property owners who resides at the property receives supplemental Security Income under 42 U.S.C. § 1381, et seq. or food stamps under 42 U.S.C. § 2011, et seq.; or

(iv) at least one of the property owners who resides at the property receives veterans or Social Security disability benefits under the Social Security Act, the Railroad Retirement Act, any federal act for members of the United States Armed Forces, or any federal retirement system.

(c) **Mobile home park tenants.** A person with a valid lease or contract to use a mobile home space in a licensed mobile home park qualifies for the substantial financial hardship exemption if at least one of the persons listed on the lease or contract is an occupant of a mobile home in the mobile home space and at least two of the four criteria set forth in subsection (b)(3) are met. If a substantial financial hardship exemption is granted under this subsection and the stormwater remediation fee is charged to an owner of a mobile home park, the stormwater remediation fee for the mobile home park shall be reduced by 40% of the base rate.

(d) **Rules and regulations.** The Office of Finance shall administer the Substantial Financial Hardship Exemption Program and the Controller shall adopt rules and regulations governing the Program. The rules and regulations shall provide:

(1) the application deadline;

(2) that the application shall be made on a form provided by the Office of Finance;

(3) a description of documentation that shall be provided by an applicant; and

(4) any other matters deemed necessary by the Controller to administer the Substantial Financial Hardship Exemption Program.

(e) **Validity of exemption.** Any exemption granted is only valid for the year that payment of the stormwater remediation fee is due.

(Bill No. 2-13)

§ 13-7-107. Reduction of fee.

The Director shall adopt rules and regulations in accordance with the Environment Article, § 4-202.1(f)(1), of the State Code to reduce, in an amount not to exceed 50%, the stormwater remediation fee for a real property that has a National Pollutant Discharge Elimination System permit that includes stormwater management controls, or to account for existing on site systems, facilities, services, or activities that reduce the quantity or improve the quality of stormwater discharged from a property. Marinas covered under a current National Pollutant Discharge Elimination System permit with stormwater management controls for marinas shall be entitled to a 25% reduction of the stormwater remediation fee for the marina. Marinas in good standing with the Maryland Department of Natural Resources Clean Marina Initiative shall be entitled to a total reduction not to exceed 50% of the stormwater remediation fee for the marina. The Director may enter into an agreement for a fee reduction conditioned upon the successful implementation of an approved stormwater remediation project.

(Bill No. 2-13)

§ 13-7-108. Competitive Grant Program.

Beginning July 1, 2014, the Department may establish a grant program consistent with § 4-202.1(h)(4)(vi) of the Environment Article of the State Code to award grants on a competitive basis to an entity determined to be a 501(c) organization by the Internal Revenue Service for watershed restoration and rehabilitation projects relating to planning, design, and construction of stormwater management practices and stream and wetland restoration, consistent with § 4-202.1(h)(4)(vi) of the Environment Article of the State Code and the Department’s Watershed Implementation Program.

(Bill No. 2-13)

Project Name	Restoration Length	Year Built	Restoration Type	Watershed Code	Cost
Camp Woodlands Living Shoreline	540	Early 2014	Shoreline	02-13-10-03	$ 58,000
Cabin Branch SPSC Outfall Retrofit	600	Summer 2013	Stream	02-13-10-02	$ 338,333
Cabin Branch Sand Seepage Wetland	900	Spring 2013	Stream	02-13-10-02	$ 338,333
Crofton Storage-Mart Coastal Plain Outfall	200	Winter 2009	Stream	02-13-11-05	$ -
Homestead Gardens SPSC	350	Spring 2012	Stream	02-13-10-03	$ 95,000
Davidsonville Wildlife Sanctuary Wetland SPSC	300	Spring 2013	Stream	02-13-10-03	$ 80,000
Camp Letts SPSC	250	Spring 2013	Stream	02-13-10-04	$ 120,000
Saefern Outfall Stabilization Phase II	275	Spring 2013	Stream	02-13-10-02	$ 194,373
Hackerman-Patz House SPSC	100	Winter 2013	Stream	02-13-10-02	$ -
Arundel on the Bay Living Shoreline	200	Winter 2014	Shoreline	02-13-10-02	$ 80,000
Crofton Tributary Restoration Phase II	1,800	Fall 2012	Stream	02-13-11-05	$ 934,000
Crofton Tributary Restoration Phase I	1,494	2011	Stream	02-13-11-05	$ 1,404,000
Massing Residential Living Shoreline	200	2013	Shoreline	02-13-10-03	$ 80,000
South River Farm Park Living Shoreline	600	1995	Shoreline	02-13-10-03	$ 240,000
Homeport Farms Experimental Living Shoreline	200	2012	Shoreline	02-13-10-03	$ 80,000
Homeport Farms SPSC	250	2005	Stream	02-13-10-03	$ -
Lionsgate Stream Stabilization	200	Spring 2011	Stream	02-13-11-05	$ 55,000
Dulls Corner Stream Restoration	2,200	Summer 2004	Stream	02-13-10-02	$ 334,274
Gray's Creek Bog	1,100	2005	Stream	02-13-10-01	$ 446,222
Harundel SWM Facility	1,000		Stream	02-13-09-03	$ 453,548
Aurora Hills SWM Rehabilitation 1	360	Spring 2007	Stream	02-13-10-02	$ 297,667
Aurora Hills SWM Rehabilitation 2	250	Spring 2007	Stream	02-13-10-02	$ 297,667
Aurora Hills SWM Rehabilitation 3	750	Spring 2007	Stream	02-13-10-02	$ 297,667
Brockbridge Elem. Stream Restoration	950	Summer 2006	Stream	02-13-11-04	$ 480,000
Marley Station Wetland	500	2007	Stream	02-13-09-03	$ 412,164
Riva Annapolis Stormdrain & Outfall Rehabilitation	375	2009	Stream	02-13-10-03	$ 1,061,566
Sloop, Eli, & Long Coves Retrofits, Site 2	275	Winter 2006	Stream	02-13-09-03	$ 148,947
Riverdale Outfall Rehabilitation	285	Spring 2013	Stream	02-13-10-01	$ 370,000
Cypress Creek Retrofit	3,000	Spring 2013	Stream	02-13-10-01	$ 3,438,000
Ruppert Ravine Phase 2	900	Spring 2013	Stream	02-13-11-05	$ 714,000
North Carolina @ Severn Rd. Storm Drain Outfall.	175		Stream	02-13-10-01	$ 201,296
Wells Branch @ Aurora Hills	546	Spring 2007	Stream	02-13-10-02	$ 15,000
Four Seasons Stream Rehabilitation	2,016	Winter 2013	Stream	02-13-11-05	$ 1,238,000
Western Tributary Stream Restoration	1,000	Fall 2004	Stream	02-13-10-03	$ 379,108
Broadneck Rd. Stream Repair	475	Fall 2010	Stream	02-13-10-01	$ 425,000
Sunnyfield Outfall Restoration	275	Summer 2005	Stream	02-13-09-03	$ 271,676
Whitehall Creek Stream Rehabilitation	950	Summer 2013	Stream	02-13-10-01	$ 590,276
Windsor Ridge Stream Stabilization	450	Fall 2013	Stream	02-13-10-01	$ 785,000
Beacrane Road Bog Rehab.	500	Spring 2013	Stream	02-13-10-01	$ 74,000
Wilelinor SWM Rehabilitation	1,050	2004	Stream	02-13-10-03	$ 706,053
Central Sanitation Facility Stream Restoration	2,000	Fall 2009	Stream	02-13-10-02	$ 819,000

Project Name	Restoration Length	Year Built	Restoration Type	Watershed Code	Cost
Church Creek Stream Restoration	2,000		Stream	02-13-10-03	$ -
Fairoaks Outfall Retrofit	375	Summer 2011	Stream	02-13-10-01	$ 567,000
Severn Drive Stormdrain and Outfall Improvement	200	Spring 2012	Stream	02-13-10-02	$ 447,000
Saefern Outfall Stabilization	200	Spring 2010	Stream	02-13-10-02	$ -
National Business Park Downstream Mitigation 324	1,000	Fall 2011	Stream	02-13-11-05	$ -
Severnview Drive Outfall Restoration	185	Spring 2012	Stream	02-13-10-02	$ 717,986
Leelyn Drive SWM Retrofit	1,250	Fall 2011	Stream	02-13-10-01	$ 462,714
Severn Run Stream Stabilization	639	Spring 2011	Stream	02-13-10-02	$ 30,000
Picture Spring Branch Stream Stabilization	500	Spring 2011	Stream	02-13-11-05	$ 96,000
Science Drive In-Stream Riffle	650	Summer 2011	Stream	02-13-09-06	$ 121,000
Shady Cove Natural Area Wetland	1,050		Stream	02-13-10-04	$ -
Hammarlee Road SPSC	400		Stream	02-13-09-03	$ -
602 Hammonds Lane SPSC	100		Stream	02-13-09-06	$ -
Buena Vista Outfall	560	Winter 2012	Stream	02-13-10-01	$ 583,791
Millersville Elementary SPSC	300	Fall 2011	Stream	02-13-10-02	$ -
Ben Oaks Shoreline Restoration	200	2012	Shoreline	02-13-10-02	$ 150
Fairoaks Outfall Retrofit Phase II	300	Fall 2013	Stream	02-13-10-01	$ 434,209
Carriage Hills Outfall Stabilization & Stream Res	600	Spring 2010	Stream	02-13-10-02	$ 450,000
Longfellow Drive Pond Retrofit	-	4/15/2014	Pond Retrofit	02-13-10-01	$ 138,943
Copperwood Ct Pond Retrofit	-	5/15/2014	Pond Retrofit	02-13-10-01	$ 138,943
Sylvan Ave Pond Retrofit	-	2/28/2014	Pond Retrofit	02-13-10-01	$ 138,943
Lahinch Ct SWM Pond Retrofit	-	3/30/2014	Pond Retrofit	02-13-10-01	$ 138,943
Tarks Land Pond Retrofit	-	4/30/2014	Pond Retrofit	02-13-10-01	$ 138,943
Collington Court Pond Retrofit	-	5/30/2014	Pond Retrofit	02-13-10-01	$ 138,943
Mayfield Rd and Gladnor Rd Pond Retrofit	-	3/15/2014	Pond Retrofit	02-13-10-01	$ 138,943
Amesbury Ct. Pond Retrofit	-	6/15/2014	Pond Retrofit	02-13-10-01	$ 138,943
Pekin Road Impervious Surface Removal	-	11/1/2013	Impervious Removal	02-13-09-03	$ 138,943
Haskill Drive Stream Restoration	500	6/15/2014	Stream	02-13-10-01	$ 722,866
Forest Drive Stream Restoration	500	1/15/2014	Stream	02-13-10-02	$ 558,000
Street Sweeping	169	July 2013 - January 2014	Street Sweeping	Various	$ 20,696
Street Sweeping	106	February 2014 - June 2014	Street Sweeping	Various	$ 16,112