Herring Bay, Middle Patuxent, and Lower Patuxent Watershed Assessment

Comprehensive Summary Report

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Prepared by

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

KCI Technologies, Inc.
936 Ridgebrook Road, Sparks, MD 21152

Coastal Resources, Inc.
25 Old Solomons Island Rd, Annapolis, MD 21401

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The following individuals were instrumental in providing field assessment, modeling, mapping, data analysis, quality control, and reporting. The contributions of each were vital to the successful completion of the project and have furthered the protection and restoration of natural resources in Anne Arundel County.

Raghu Badami | Anne Arundel County
Melissa Bragg | Anne Arundel County
Richard Fisher | Anne Arundel County
Melissa Harlinski | Anne Arundel County
Susanna Brellis | KCI Technologies, Inc.
Bruna Carvalho | KCI Technologies, Inc.
Megan Crunkleton | KCI Technologies, Inc.
Bill Frost | KCI Technologies, Inc.
Alex Kaczaniuk | KCI Technologies, Inc.
Katherine Myers | KCI Technologies, Inc.
Amanda O'Shea | KCI Technologies, Inc.
Robert Owen | KCI Technologies, Inc.
Michael Pieper | KCI Technologies, Inc.
Amanda Wagoner | KCI Technologies, Inc.
Matthew Drennan | Coastal Resources, Inc.
Michele Floam | Coastal Resources, Inc.
Jeff Gring | Coastal Resources, Inc.
Sylvan Klein | Coastal Resources, Inc.
Cal Novelli | Coastal Resources, Inc.
Sean Sipple | Coastal Resources, Inc.

For more information pertaining to this study, please contact:

Raghavenderrao Badami, P.E.
Engineer Manager
Watershed Protection and Restoration Program
Department of Public Works
Anne Arundel County Government, Maryland
2662 Riva Road, Annapolis, Maryland
410-222-0529|pwbada78@aacounty.org

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AHB	Advocates for Herring Bay
BIBI	Benthic Index of Biotic Integrity
BMPs	Best Management Practices
BSID	Biological Stressor Identification
CA	Chesapeake Bay Critical Area
CBP	Chesapeake Bay Program
CWP	Center for Watershed Protection
DEM	Digital Elevation Model
EMC	Event Mean Concentration
EPA	Environmental Protection Agency
ESD	Environmental Site Design
FEMA	Federal Emergency Management Agency
FHS	Final Habitat Scores
FIBI	Fish Index of Biotic Integrity
GIS	Geographic Information System
H&H	Hydrologic and Hydraulic
MBSS	Maryland Biological Stream Survey
MDE	Maryland Department of the Environment
MDNR	Maryland Department of Natural Resources
MEP	Maximum Extent Practicable
MPHI	Maryland Physical Habitat Index
MS4	Municipal Separate Storm Sewer
NPDES	National Pollutant Discharge Elimination System
NRCS	Natural Resources Conservation Service
OSDSs	On Site Sewege Disposal Systems
PCB	Polychlorinated Biphenyls
PMT	Professional Management Team
QAPP	Quality Assurance Project Plan
RCA	Resource Conservation Area
RSC	Regenerative Stormwater Conveyance
SHA	Maryland State Highway Administration
source	Nonpoint Source
SSOs	Sanitary Sewer Overflows
SSPRA	Natural Heritage Program's Sensitive Species Project Review Areas
SWM	Stormwater Management
TIS	Total Impact Score
TMDLs	Total Maximum Daily Loads
TSS	Total Suspended Solids
WIP	Watershed Implementation Plan
WLAs	Wasteload Allocations
WPRP	Anne Arundel County Watershed Protection and Restoration Program
WQS	Water Quality Standards
WRF	Water Reclamation Facility

GLOSSARY

Anadromous fish: A fish that is born in fresh water, spends most of its life at sea and returns to fresh water to spawn.

Anthropogenic: Caused by humans and their activity

Aquatic Habitat: A measurable description of the features of a stream which are necessary for insects, fish, and other creatures to thrive, including depth, flow, velocity, substrate, substrate size, and riparian cover.

Attenuation of runoff: The reduction of runoff from a rain event, typically using stormwater best management practices.

Bankfull discharge: A frequently occurring peak flow stage represents the incipient point of flooding. It is often associated with a 1-2 year storm event.

Bankfull stage: The elevation of the water surface at bankfull discharge. In stable streams this is generally at the top of the bank but in unstable, incised channels the bankfull stage could be contained entirely within the stream banks (i.e. does not flood over the banks).

Benthic Index of Biotic Integrity (BIBI): Developed by Maryland Department of Natural Resources. It takes physical, chemical, and biological data from stream surveys and compares it against reference (good) streams and comes up with a score or index value which can give a good indication of the health of the stream.

BMP Best Management Practice: A practice which prevents or reduces pollution to waterbodies or streams.

Channel: A natural or manmade waterway.

Chesapeake Bay Critical Area (CA): Critical Area is located 1,000 feet landward from mean high tide or the edge of tidal wetlands, as designated on the State Tidal Wetland maps, and all waters of and lands under the Chesapeake Bay and its tributaries. There are three Critical Area land use classifications: Intensely Developed Area (IDA), Limited Development Area (LDA), and Resource Conservation Area (RCA). Each area has its own regulations pertaining to development.

Confluence: The point where two or more streams join to create a combined, larger stream.

Discharge: The volume of water that passes a given location within a given period of time, usually expressed for stream flow and stormwater in cubic feet per second.

Drainage Area: The area of land draining to a single outlet point.

Dry Channel Regenerative Stormwater Conveyance (RSC) or Step Pool Conveyance System (SPSC): Open-channel conveyance structures that convert, through attenuation ponds and a sand seepage filter, surface storm flow to shallow groundwater flow. These systems safely convey, attenuate, and treat the quality of storm flow. These structures utilize a series of constructed shallow aquatic pools, riffle grade control, native vegetation, and an underlying sand/woodchip mix filter bed media.

Ephemeral: A stream with no baseflow which flows only periodically or occasionally, usually during and immediately after precipitation.

Epifaunal substrate: Structures on the streambed that provides surfaces on which animals (aquatic insects and bugs) can live.

Entrenchment: The vertical containment of a river

Environmental Site Design (ESD): 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.

Erodibility: The resistence or nonresistance to soils and rocks to erosion. As an example, sandy soil generally will be more erodible than hard clay material.

Erosion: The wearing away of the land surface by running water, wind, ice, or other geological agents. In streams, erosion is the removal of soil from the stream banks or streambed by rapid flows.

Event mean concentrations (EMCs): The flow proportional concentration of a given pollutant parameter during storm events. That is, the total mass discharged divided by the total runoff volume.

Fauna: As it relates to streams, fauna is the animals located within and around the stream.

FEMA floodplains: Floodplains developed by the Federal Emergency Management Agency. A 100-yr floodplain refers to area inundated by a 100-year storm event (i.e., 1 in 100 chance of being equaled or exceeded in any 1 year)

Fish Index of Biotic Integrity (FIBI): Developed by Maryland Department of Natural Resources. It evaluates the health of a stream based upon types of fish caught. Example: A site where the majority of the fish caught are pollution tolerant is an indicator the stream has poor water quality.

Floatables: Trash, debris, and other large pollutants that tend to float on the surface of streams, lakes, and ponds, and which are not removed by sedimentation, filtration, or other processes in most stormwater management facilities.

Floodplain: An ecosystem adjacent to a stream which undergoes fairly frequent inundation during high flows when the stream overtops its banks.

Geomorphology: The study of rivers and streams and the processes that shape and change them.

Head Cut: A type of incision in a streambed consisting of a sudden change in elevation from upstream to downstream, similar to a waterfall. High flows erode the upstream channel at a headcut, resulting in the erosion and incision migrating upstream.

Headwater Streams: Beginnings of rivers, the uppermost streams in the river network furthest from the river's endpoint or confluence with another stream

Hydraulics: The physical science and technology of the stationary and active behavior of fluids.

Hydrologic Soil Groups (HSG): Natural Resource Conservation Service (NRCS) grouped soils into four categories. Group A are sandy soils with low runoff potential and high infiltration rates. Group B are silt or silt loam soils with moderate infiltration rates and moderately well drained soils. Group C are sandy clay loam soils with low infiltration rates. Group D are clay soils with high runoff potential.

Hydrology: The science dealing with the distribution and movement of water, including the hydrologic cycle of rainfall, runoff, groundwater flow, surface water flow, and evaporation.

Illicit Discharge: To dump, spill, convey, or otherwise release pollutants to a waterway, storm drain system, or groundwater system.

Impervious Surface: A surface composed of any material that impedes or prevents infiltration of water into the soil. Impervious surfaces include roofs, buildings, streets, and parking areas.

Intermittent stream: Streams were water is present only during wetter portions of the year such as spring.

Manning's Roughness Number: Use to calculate flow in streams based upon the type of material in and on the banks of the stream. The roughness of a stream channel. Example: a stream with a concrete lined bottom will have a lower roughness factor than a stream with large rocks in it.

MEP: Designing stormwater management systems so that all reasonable opportunities for using ESD planning techniques and treatment practices are exhausted and only where absolutely necessary, a structural BMP is implemented.

Municipal Separate Storm Sewer System (MS4) Permit: An NPDES (National Pollutant Discharge Elimination System) permit issued to municipalities requiring the reduction in pollutants contributing to the discharges from the municipality's storm drain outfalls.

National Pollutant Discharge Elimination System (NPDES): The national program for issuing, modifying, monitoring, and enforcing permits under Sections 402 of the Clean Water Act. The NPDES permits regulate wastewater and stormwater discharges to the waters of the United States, and are administered by the Maryland Department of the Environment.

Onsite Sewage Disposal Systems (OSDS): These are sewage systems that use natural processes to treat sewage and are not connected to a sewerline.

Peak Discharge: The maximum flow rate at a given location during a rainfall event. Peak discharge is a primary design factor for the design of stormwater runoff facilities such as pipe systems, storm inlets and culverts, and swales.

Peak flow (ex. From 1 year storm): The maximum rate of discharge during a 1 year storm event.

Perennial Streams: A body of water that normally flows year-round.

Pervious: Any material that allows for the passage of liquid through it. Any surface area that allows infiltration. Examples of pervious land is grass and wooded areas.

Reach: General term used to describe a length of stream. A stream reach usually has similar characteristics and appears uniform in shape and function.

Redevelopment: The substantial alteration, rehabilitation, or rebuilding of a property for residential, commercial, industrial, or other purposes.

Retrofit: The modification of stormwater management systems to improve water quality or to change characteristics of peak discharge control by adding storage, changing outflow characteristics, or adding water quality treatment elements.

Riparian Buffer: Strips of grass, shrubs, and/or trees along the banks of rivers and streams that filter polluted runoff. These buffers provide a transition zone between water and human land use. Buffers are also complex ecosystems that provide habitat and improve the stream communities they shelter.

Riprap: A protective layer of large stones placed on a stream bank to prevent erosion.

Runoff Volume (Ex. From 1 year storm): The volume of water that runs off the land during a 1 year storm event.

Sinuosity: The curve or bend in the stream. A stream with tighter bends or curves will be more sinuous.

Stormwater Best Management Practices (BMPs): A structural device or nonstructural practice designed to temporarily store or treat stormwater runoff in order to mitigate flooding, reduce pollution, or provide other amenities.

Stormwater Management (SWM) Facility: A structure, such as a pond, that controls the quantity and quality of stormwater runoff.

Stream bed substrate: The type of substrate on the bottom of a stream bed. Common substrates include: silt, sand, gravel, and riprap or very large stones.

Stream morphology: The form and shape of a stream.

Sub-watershed: A smaller subsection of a larger watershed, often delineated to describe a particular tributary to a larger water body.

Surface runoff yield: The amount of water that runs off of the landscape and into the stream and/or storm drain system when it rains. Areas with fewer trees, more impervious surface, or steeper slopes will have more runoff; therefore higher yields are expected in urbanized areas with more extensive impervious surface area. Areas with higher surface runoff yields are more likely to suffer from in-stream and land surface erosion. The amount of runoff is used in the study to evaluate the likely sensitivity of the study watersheds to gullying, stream erosion, and pollutant loading.

Time of concentration: The time required for runoff to travel from the most distant point in the watershed to the most downstream point or outlet

Total Maximum Daily Loads (TMDLs): A TMDL is the greatest amount of a pollutant that a waterbody can receive without violating water quality standards and designated uses.

Watershed: An area of land that drains directly, or through tributary streams, into a particular river or water body.

EXECUTIVE SUMMARY

Beginning in 2002, the Anne Arundel County Watershed Protection and Restoration Program (WPRP) has conducted systematic and comprehensive assessments of the County's watersheds. These assessments are conducted to assess current water quality conditions and prioritize the County's streams and subwatersheds for restoration and preservation to improve the conditions of the County's watersheds. Assessing current conditions helps the County determine where to focus resources for maintaining those water bodies in good condition and for mitigating problems to improve overall watershed health and quality.

The studies partially fulfill the watershed assessment and restoration requirements of the County's National Pollutant Discharge Elimination System (NPDES) Municipal Separate Storm Sewer (MS4) permit. Conditions of this permit, administered by the Maryland Department of the Environment, are required to be met by the County. One specific requirement of the permit is to address Total Maximum Daily Loads (TMDLs) which sets limits on stormwater pollutants such nitrogen, phosphorus, sediment, and bacteria. The County's watershed assessments support and prioritize watershed management and planning decisions and help develop detailed restoration plans and provide data crucial for meeting the requirements for the Chesapeake Bay TMDL for nitrogen, phosphorus and sediment, and for TMDLs for the County local streams and watersheds.

Assessment of the Herring Bay, Middle Patuxent, and Lower Patuxent watersheds was initiated in 2016, completing the comprehensive assessments of each of the County's twelve major watersheds, and is documented in this report.

The assessment included field investigations and characterization of the stream and watershed conditions. This involved requesting permission to access stream reaches within the study watersheds on private property. Field crews walked all stream reaches that permission was granted to access. This full-scale assessment was designed to catalog infrastructure, assess stream habitat for fish and aquatic insects, characterize stream channel stability and stream bank erosion, and assess water quality conditions of watershed streams. The assessment of the physical condition of the watershed's stream system took place over approximately 163 miles of streams.

Data were used to prioritize the watershed's individual stream reaches and subwatersheds for restoration and preservation measures to ultimately improve the conditions of the watershed. In addition to the stream assessments, indicators of watershed condition related to land use, stormwater best management practices (BMPs), and pollutant loading models were compiled in prioritization models that rank and prioritize the watersheds at the stream reach and subwatershed scales for restoration and preservation priorities. The prioritization models were developed by the County in previous watershed planning efforts and continued in this study to allow for a consistent approach.

Of the 586 reaches included in the prioritization model, a total of 41 reaches (7%) were prioritized as high priority for restoration between the three watersheds. Seven subwatersheds (33%) in Herring Bay and 6 subwatersheds (17%) in Middle and Lower Patuxent were rated high priority for restoration. Finally, subwatersheds were prioritized for preservation. Three subwatersheds (14%) in Herring Bay and 10 subwatersheds (28%) in Middle and Lower Patuxent were rated high priority for preservation.

Three parcel scale models were developed to identify parcels for management activities. The models identify parcels of high ecological value that are good candidates for preservation, parcels for tree planting and riparian

buffer restoration, and parcels with high levels of impervious area that may be good candidates for impervious treatment including removal and conversion to pervious surfaces or application of appropriate stormwater management practices.

This report serves to summarize the procedures and results to date of the Herring Bay, Middle and Lower Patuxent Watershed Assessment.

1 INTRODUCTION

1.1 PURPOSE AND SCOPE

Anne Arundel County began its current and systematic assessment of the County's watersheds with the completion of the Severn River Watershed Management Master Plan in 2002. The Anne Arundel County WPRP initiated assessment of the Herring Bay, Middle Patuxent, and Lower Patuxent watersheds in 2016, completing comprehensive assessments and management plans for each of the County's twelve major watersheds. The assessment includes characterization of the stream and watershed conditions through analysis of the biological community, water quality investigation, visual assessment of stream resources, and the subsequent modeling and analysis. The data are used to prioritize the watershed's streams and subwatersheds for restoration, and preservation measures to ultimately improve the conditions of the watershed. The study fulfills the watershed assessment requirements of the County's National Pollutant Discharge Elimination System (NPDES) Municipal Separate Storm Sewer (MS4) permit.

A small portion of the Lower Patuxent watershed falls within Anne Arundel County. The subwatersheds in the Lower Patuxent, namely MPC, MPY, MPX, have been grouped with the Middle Patuxent watershed for analysis and reporting. See section 1.3 and Maps 1.1 and 1.2 for details.

This full-scale assessment was designed to catalog infrastructure, assess stream habitat, inventory biological assemblages, characterize channel geomorphology, and assess water quality conditions of watershed streams. The assessment of the physical and biological condition of the watershed took place over approximately 163 miles of perennial, intermittent, and ephemeral streams. The collected data will allow County planners to understand the current environmental conditions of the Herring Bay, Middle and Lower Patuxent watersheds and waterways.

In addition to the stream assessments, indicators of watershed condition related to land use, stormwater best management practices (BMPs), and pollutant loading models were compiled in prioritization models that rank and prioritize the watersheds at the stream reach and subwatershed scales for restoration and preservation priorities. The prioritization models were developed by the WPRP group in previous County watershed planning efforts. A parcel level preservation model was developed and implemented during the current study. Overall, the results allow for targeted protection of high quality environmental features and restoration of areas with significant degradation.

The County convened a working group, the Professional Management Team (PMT), to provide input and review for most phases of the assessment and planning process including the stream and watershed assessments, water quality modeling procedures and results, the prioritization model and ultimately the recommendation of future studies and an implementation framework. This collaborative team was made up of technical experts from KCI Technologies and County staff from several work groups. This report serves to summarize the procedures and results to date of the Herring Bay, Middle and Lower Patuxent Watershed Assessment.

1.2 Regulatory and Planning Context

The regulatory and planning context for the watershed assessment includes state regulatory activities, legislative requirements, County actions, and programs aimed at restoration and preservation of water quality in the Herring Bay and Middle Patuxent watersheds as well as the greater Chesapeake Bay watershed.

1.2.1 Total Maximum Daily Loads

Section 303(d) of the Clean Water Act requires states to establish water quality standards (WQS), identify water bodies for inclusion on the state "303(d) list" that don't meet these standards, and establish the maximum allowable pollutant load (the total maximum daily load (TMDL) that would allow the listed water body to meet WQS. The Environmental Protection Agency (EPA) has designated Maryland Department of the Environment (MDE) as the regulatory authority in Maryland responsible for this process.

In addition to the TMDLs Maryland has developed, EPA has also published the Chesapeake Bay TMDL. This TMDL identifies the necessary pollution reductions of nitrogen, phosphorus and sediment across Delaware, Maryland, New York, Pennsylvania, Virginia, West Virginia and the District of Columbia and sets pollution limits necessary to meet applicable water quality standards in the Bay and its tidal rivers and embayments. Discussion associated with the Chesapeake Bay TMDL and "local" TMDLs is presented in the following sub-sections.

An online query was conducted using MDE's Searchable Integrated Report Database [Combined 303(d)/305(b) List], current as of the state's approved 2016 Integrated Report on November 1, 2017. The search yielded a list of 20 potential impairments in the study watersheds (database accessed March 23, 2018). Of these, 13 impairments are categorized as "4a-Impaired – TMDL completed" and are addressed by the Chesapeake Bay and Local TMDLs discussed below. Five others are in the category "5-Impaired, TMDL required", including one listing for PCB, that has been addressed by the PCB TMDL approved in September 2017, and listings for sulfate and Total Suspended Solids (TSS), related to impairment of aquatic biota. One other impairment was listed as "2-Meets water quality criteria for the cause specified" and one was categorized as "3-Insufficient data for assessment".

1.2.1.1 Chesapeake Bay TMDL

On December 29, 2010, EPA finalized the Chesapeake Bay TMDL, establishing pollutant reduction goals for nitrogen, phosphorus, and suspended solids for the 92 segments (52 of which are in Maryland) that make up the Chesapeake Bay watershed. The County was given nutrient and sediment allocations for regulated (MS4) and unregulated stormwater discharges, wastewater discharges, and septic systems. Although multiple Bay segments are located within Anne Arundel County (see Map 1.3), stormwater pollutant allocations for nitrogen and phosphorus were provided at the County scale rather than at the watershed scale. For planning purposes at the watershed level, the County is applying the same percent load reduction required for urban stormwater at the County level to each of its watersheds. For total nitrogen, this amounts to a 21% annual reduction from existing conditions load without credits by the 2017 interim target and a 35% annual load reduction by 2025. For total phosphorus, the interim target load reduction is 38% and the 2025 target load reduction is 63%. For total suspended solids, load allocations have not yet been provided (MDE, 2018).

To ensure the goals of the TMDL are met, EPA requested, and Anne Arundel County developed, a Watershed Implementation Plan (WIP) with two-year incremental milestones that allow close tracking and assessment of implementation progress. The County's July 2, 2013 Phase II WIP includes a three part strategy to achieve the necessary load reductions. Anne Arundel County's National Pollutant Discharge Elimination System (NPDES) MS4 permit is the regulatory mechanism to ensure tracking, verifying, and reporting of progress and compliance with the assigned stormwater allocation. Anne Arundel County's WIP was included within the broader State-wide plan and has been approved by the EPA. The County's WIP includes strategies and milestones associated with stream restoration, stormwater best management practice (BMP) retrofits, and other programmatic efforts.

MDE has instructed Maryland's Phase I NPDES MS4 Counties, which includes Anne Arundel County, to meet their Chesapeake Bay TMDL goals through the restoration, or treatment, of 20% of the County's untreated or undertreated impervious surfaces. Impervious surfaces include roadways, driveways, parking lots, rooftops, and sidewalks that do not allow runoff to infiltrate into the natural soils but instead generate stormwater runoff that carries pollutants and erosive flow to receiving streams and waterways. Stormwater management practices, implemented in various forms and under various regulations since the mid-1980s, help to capture stormwater runoff and remove pollutants before the flow reaches the stream system; however, many parts of the County were developed prior to current stormwater regulations and are therefore not treated to the maximum extent practicable. These untreated areas are targeted by the 20% impervious surface restoration requirement.

1.2.1.2 LOCAL TMDLS

Anne Arundel County has two approved local TMDLs in the study watersheds. The County's NPDES MS4 permit requires that implementation plans be developed to address the TMDLs within the first year of the County's current permit (dated February 12, 2014), and to develop plans to address any TMDLs approved after the permit date within one year of TMDL approval by the EPA.

Bacteria TMDL

Several portions of the Herring Bay watershed have Bacteria TMDLs (Table 1-1). The impairment listings for bacteria in the Herring Bay are related to shellfish waters in the mesohaline tidal area. Anne Arundel County developed a restoration plan for the bacteria plan in January of 2017. This plan proposes a suite of strategies in combination to achieve bacteria TMDL goals, including elimination of household illicit connections (sanitary sewers connected directly to the storm drain instead of to the sanitary sewer), abatement of sanitary sewer overflows (SSOs), septic retirement/connection to public sanitary system, stormwater retrofit to achieve bacteria load reductions, pet waste education in high pet waste areas, riparian buffer education, and localized waterfowl and wildlife management in specific areas.

TABLE 1-1: BACTERIA TMDL IN THE HERRING BAY, MIDDLE PATUXENT, AND LOWER PATUXENT WATERSHEDS

Location	Approval Date	% Reduction Required*
West Chesapeake Bay/ Tracy and Rockhold Creeks	February 20, 2006	81.6

*Based on the MDE published TMDL documents for bacteria impaired watersheds in Anne Arundel County and in Anne Arundel County's *Total Maximum Daily Load Restoration Plan for Bacteria, January 2017.*

Polychlorinated Biphenyls (PCB) TMDL

There is currently one EPA-approved PCB TMDL for the Patuxent River mesohaline, oligohaline, and tidal fresh segments (Table 1-2). Anne Arundel County is currently developing an implementation plan to address the PCB TMDL.

TABLE 1-2: PBC TMDL IN THE HERRING BAY, MIDDLE PATUXENT, AND LOWER PATUXENT WATERSHEDS

Location	Approval Date	% Reduction Required*
PAXOH (Lower Patuxent)	September 19, 2017	0.0%
PAXTF (Middle Patuxent)		99.9%

*Reduction required for Anne Arundel County nonpoint regulated stormwater sources, based on the MDE published TMDL for PCBs.

1.2.1.3 Other Impairments

In the Herring Bay, Middle and Lower Patuxent watersheds, aquatic life assessment scores consisting of the Benthic Index of Biotic Integrity (BIBI) and Fish Index of Biotic Integrity (FIBI) indicate that the biological metrics for the watershed exhibit a significant negative deviation from reference conditions based on Maryland's biocriteria listing methodology (MDE, 2014a). The biocriteria listing methodology assesses the condition of Maryland's 8-digit (MD 8-digit) watersheds by measuring the percentage of sites, translated into watershed stream miles, that are assessed as having BIBI and/or FIBI scores significantly lower than 3.0 (on a scale of 1 to 5), and then calculating whether this percentage differs significantly from reference conditions (i.e., unimpaired watershed <10% stream miles differ from reference conditions).

To evaluate whether aquatic life was impacted by elevated sediment loads or other factors, the State's Biological Stressor Identification (BSID) methodology was applied by MDE. The BSID analysis for the Herring Bay, Middle and Lower Patuxent watersheds concluded that biological communities are likely impaired due to sediment, in-stream habitat related stressors, and water quality (MDE- Watershed Report for Biological Impairment of the Patuxent River Middle Watershed in Anne Arundel, Calvert and Prince George's Counties, 2013; MDE- Watershed Report for Biological Impairment of the Patuxent River Lower Watershed in Anne Arundel, Prince George's, Calvert, Charles and Saint Mary's Counties, 2013; MDE- Watershed Report for Biological Impairment of the other West Chesapeake Ba6y Watershed in Anne Arundel and Calvert Counties, 2014).

1.2.2 NPDES

The Anne Arundel County NPDES MS4 permit issued in February 12, 2014 by MDE (MD0068306 (11-DP-3316)) covers all stormwater discharges to and from the MS4 owned and operated by the County. Assessments of the Herring Bay, Middle and Lower Patuxent watersheds have been conducted in partial fulfillment of these MS4 permit requirements.

- Section III.C.2 – Source Identification. Collecting and verifying urban BMP facility data including locations and delineated drainage areas.
- Section III.E.3 – Illicit Discharge Detection and Elimination. Reporting illicit discharges and connections to the County during the Physical Habitat Condition Assessment.
- Section III.F – Watershed Assessment and Planning. Developing watershed management plans for all watersheds in Anne Arundel County that:

  - Determine current water quality conditions;
  - Identify and rank water quality problems;
  - Identify all structural and non-structural water quality improvement opportunities;
  - Include the results of a visual watershed inspection;
  - Specify how the restoration efforts will be monitored; and
  - Provide an estimated cost and a detailed implementation schedule for those improvement opportunities identified above
- Section IV.E.2 Watershed Restoration Planning. Implementing restoration efforts to treat 20% of the County's impervious area that is not already treated to the maximum extent practicable (MEP) within the five-year permit cycle. Watershed plans developed in conjunction with these requirements will:
  - Include the final date for meeting applicable stormwater wasteload allocations (WLAs) and provide a detailed schedule for implementing structural and nonstructural water quality projects, enhanced stormwater management programs, and alternative stormwater control initiatives necessary for meeting applicable WLAs;
  - Provide detailed cost estimates for individual projects, programs, controls, and plan implementation;
  - Evaluate and track the implementation of restoration plans through monitoring or modeling to document progress toward meeting established benchmarks, deadlines, and stormwater WLAs; and
  - 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.

The current generation of MS4 permits in Maryland include greater emphasis on making progress towards meeting both local and Chesapeake Bay wide TMDL WLAs in association with Watershed Assessment and Planning efforts. This is addressed by the requirement to develop Watershed Restoration Plans that include pollutant load reduction benchmarks and deadlines that demonstrate progress toward meeting all applicable stormwater TMDL WLAs.

Anne Arundel County's current NPDES MS4 permit required an impervious area assessment to be submitted to MDE. As reported in the County's FY2014 MS4 Annual Report to MDE, the County's process for determining the restoration acreage goal was documented in its May 2015 impervious area assessment (Establishing Baseline - Impervious Area Assessment, Impervious Surfaces Treated to the MEP, submitted to MDE May 26, 2015). In July 2015, MDE approved this impervious surface area assessment and the associated baseline for impervious area restoration. The impervious area assessment identified 30,950 impervious acres under the County's MS4 jurisdiction. Of these acres, 1,639 were identified as managed to the MEP and 29,311 acres were identified as either having no stormwater management or only partial management. This resulted in 20% restoration acreage of 5,862 acres (20% goal), to be completed by the County on or before February 2019. The Permit requires the County to perform watershed assessments and to develop restoration plans to meet stormwater WLAs in EPA-approved TMDLs.

1.3 COMMUNITY PARTNERSHIPS AND PUBLIC INVOLVEMENT

Anne Arundel County works collaboratively with its residents and local watershed groups to further its progress towards the goals described above. Two groups in particular are active in the study watersheds and should be engaged in activities undertaken in the watershed as a result of this study.

The Advocates for Herring Bay (AHB) is a local group of citizens working to preserve the Herring Bay watershed and foster collaboration among the community. They monitoring water quality, identify and work to protect habitats, conduct community cleanup and invasive removal, and advocate for policies to protect Herring Bay.

The Patuxent Riverkeeper is another local nonprofit with the mission to conserve, protect, and replenish the Patuxent River through advocacy, restoration, and education. They enforce stormwater and wastewater regulation, advocate for land preservation and watershed management and planning, conduct cleanups, and engage and educate the public.

The County hosted two public meetings related to the watershed assessment. The first public meeting was held prior to initiation of fieldwork on September 27, 2016 and presented the goals and methods of the study. The second meeting was held on April 24, 2018 and included presentations of the results of the completed study element. Both meetings solicited feedback from the public. Questions and answer sessions followed each of the presentations.

The County solicited public review and comment of the draft watershed assessment report through the April, 24, 2018 public meeting and a 30-day public review period, which ran from May 26 through June 26, 2018. The documents for review were available on the County's website.

Appendix D presents the public comments received and the County's response to the comments.

1.4 PHYSICAL SETTING

The Middle Patuxent River watershed is one of twelve major watersheds in Anne Arundel County, Maryland, and is situated in the southern portion of the County (see Map 1.1 for orientation of the watershed within the County). The Middle Patuxent watershed shares political boundaries with Prince George's County along the Patuxent River to the west, and along Lyons Creek with Calvert County to the south.

The Middle Patuxent watershed is approximately 29,820 acres in area. The watershed includes several named streams including Lyons Creek, Cabin Branch, Ferry Branch, Wilson Owens Branch, and the middle branch of the Patuxent River. These named streams are distributed among 36 subwatersheds, as shown below in Table 1-3 and on Map 1.2. Subwatersheds in the Middle Patuxent are designated with an 'MP' in the subwatershed code. Although the average subwatershed size is 828 acres, the subwatersheds range in size from 237 in MPB to 1,665 in MPV.

Included within the Middle Patuxent are the three subwatersheds in Hall Creek (MPC, MPX and MPY) that drain to the Lower Patuxent River, but for county planning and organizational purposes, are included in the Middle Patuxent watershed.

The Herring Bay watershed shares political boundaries with Calvert County to the south, and its entire eastern shore is located on the mainstem of the Chesapeake Bay (Map 1.1). The watershed is approximately 14,682

acres, and includes a variety of named steams including Deep Cove Creek, Rockhold Creek, Trotts Branch and Tracys Creek. Twenty-one subwatersheds constitute the Herring Bay watershed, as shown in Table 1-3 and Map 1.2. The average subwatershed size is 699 acres, with units ranging from 119 in HBP to 2,401 acres in HB2.

In project planning stages, attempts are made to delineate subwatersheds to a uniform average size; however, natural drainage patterns often result in a wider variety of subwatershed areas across the study area. By corollary the channel length in each subwatershed also varies. These variations have been considered in the analysis, and whenever possible, results have been reported in a normalized fashion either by area or stream length. Care should be taken in drawing comparisons between subwatersheds using measures of area, length, or number of resources, impacts, BMPs etc.

TABLE 1-3: HERRING BAY, MIDDLE PATUXENT, AND LOWER PATUXENT SUBWATERSHEDS

Subshed Code	Subshed Name	Acres
HERRING BAY WATERSHED		
HB0	Rockhold Creek	1963.74
HB1	Tracys Creek I	1803.47
HB2	Tracys Creek II	2400.97
HB3	Jack Creek	228.84
HB7	Cedarhurst	492.89
HB8	Deep Creek	832.81
HB9	Deep Cove Creek	1002.27
HBB	Chesapeake Bay	156.72
HBC	Broadwater Creek	452.22
HBD	Carrs Creek	269.01
HBF	Parker Creek	447.60
HBL	Trotts Branch	1372.24
HBM	Herring Bay	183.41
HBO	Unnamed Tributary	335.55
HBP	Herring Bay II	118.87
HBQ	Unnamed Tributary II	1544.99
HBR	Herring Bay III	117.59
HBS	Unnamed Tributary III	317.02
HBT	Red Lyon Creek	249.98
HBU	Herrington Harbor	128.67
HBV	Chesapeake Bay II	243.83
MIDDLE AND LOWER PATUXENT WATERSHEDS		
MP0	Deep Creek	974.12
MP1	Unnamed Tributary	780.99
MP2	Rock Branch 1	1319.07
MP3	Rock Branch 2	1315.44
MP4	Ferry Branch 1	1123.96
MP5	Wilson Owens Branch 3	707.63

Subshed Code	Subshed Name	Acres
MP6	Lyons Creek 10	1082.00
MP7	Galloway Creek	1308.20
MP8	Cabin Branch 1	893.33
MP9	Two Run Branch 2	826.57
MPA	Pindell Branch	628.06
MPB	House Creek	237.26
MPC[1]	Hall Creek 1	1471.35
MPD	Wilson Owens Branch 1	527.33
MPE	Wilson Owens Branch 2	645.34
MPF	Lyons Creek 1	733.53
MPG	Lyons Creek 2	393.91
MPH	Lyons Creek 3	743.09
MPI	Lyons Creek 4	655.27
MPJ	Lyons Creek 5	1064.85
MPK	Lyons Creek 6	465.90
MPL	Lyons Creek 7	426.85
MPM	Lyons Creek 8	315.78
MPN	Lyons Creek 9	357.05
MPO	Ferry Branch 2	1072.43
MPP	Ferry Branch 3	858.81
MPQ	Cabin Branch 2	645.37
MPR	Cabin Branch 3	488.03
MPS	Cabin Branch 4	827.66
MPT	Cabin Branch 5	547.45
MPU	Unnamed Tributary	1060.13
MPV	Rock Branch 3	1665.46
MPW	Two Run Branch 1	729.73
MPX[1]	Hall Creek 2	932.87
MPY[1]	Hall Creek 3	812.61
MPZ	Wilson Owens Branch 4	1167.04

[1] Subwatersheds included in the Lower Patuxent

1.4.1 PHYSIOGRAPHY

The Middle Patuxent watershed is situated in the Prince Frederick Knobby Upland District and the Lower Patuxent Valley Area. The majority of the watershed is located within the northern portion of the Prince Frederick Knobby Upland, which represents a moderately to well-dissected upland district with numerous hillrocks. The western portion of the Middle Patuxent watershed is located within the Lower Patuxent Valley Area, also in the Upland District, where the valley and channel of the Patuxent markedly widen and include several broad and shallow bays, including Jug Bay, alternating with fringing marshes, and constricted and meandering channels. (Maryland Geological Survey, 2008). The western portion of the watershed contains the greatest concentration of steep slopes greater than 25%, while slopes greater than 15% and less than 24% are evenly spread throughout the Middle Patuxent watershed (Map 1.4).

In addition to its location within the Prince Frederick Knobby Upland District, the Herring Bay watershed is also situated in the Annapolis Estuaries and Lowlands District. The Annapolis Estuaries and Lowlands District is a relatively featureless lowland, mostly less than 50 feet elevation, with an indented coastline situated along the west-central shore of the Chesapeake Bay. (Maryland Geological Survey, 2008). Steep slopes greater than 25%, and slopes greater than 15% and less than 24% can be found in the central and western portions of the watershed. The eastern area of Herring Bay is dominated by slopes less than 14%, with very few slopes greater than 15% (Map 1.4).

The Middle Patuxent and the Herring Bay watersheds are located entirely within the Atlantic Coastal Plain Physiographic Province (Maryland Geological Survey, 2008). The majority of the slopes within the watersheds are less than 14%; however, the western part of the Middle Patuxent presents the highest elevations of the target area. The same is true for Herring Bay, with the greatest concentration of steep slopes greater than 25% being located in its western territories, while its eastern region is dominated by areas of low elevation. Maps 1.4 and 1.5 depict the steep slopes and topography found in both watersheds.

1.4.2 SOILS AND GEOLOGY

The geology of the Middle Patuxent watershed is dominated by the Chesapeake Group of the Miocene Period within the Calvert Formation, which is characterized by imbedded dark green to dark bluish-gray, fine-grained argillaceous sand and sandy clay; also containing prominent shell beds and locally silica-cemented sandstones (Maryland Geological Survey, 1968).

The geology of the Herring Bay watershed is also dominated by the Chesapeake Group of the Miocene Period within the Calvert Formation to the west, but the Lowland Deposits of the Quaternary Period dominate the east portion of the watershed. The Lowland Deposits are characterized by gravel, silt and clay; mostly cross-bedded, poorly sorted, medium to coarse grained white to red sand and gravel with boulders near the base and minor pink and yellow silts and clays. (Maryland Geological Survey, 1968).

Soils within the Middle Patuxent watershed are varied in their hydrologic properties and expected erodibility. As shown in Table 1-4, the hydrologic soil group A accounts for 7.3% of the soils in the watershed. These soils have low runoff potential when thoroughly wet and water is transmitted freely through the soil. The vast majority of soils (69.9 percent) are classified as hydrologic soil group B. These soils have moderately low runoff potential when thoroughly wet and water transmission through the soil is unimpeded. Hydrologic soil group D accounts for 14.5 percent of the soils, while soil group C represents 8 percent of the soils in the watershed. Soils C and D have the highest runoff potential. The hydrologic soil group is especially important when deciding

on placement of BMPs, especially infiltration type BMPs which should be limited to soil types A and B as they are not effective in soil types C and D.

Soils present in the Herring Bay watershed also hold diverse hydrologic characteristics. As displayed in Table 1-4 and Table 1-5, the majority of the soils present within the watershed are classified as group B (45.6 percent). However, group C and D soils together account for 54 percent of the watershed's area (42.6 and 11.4 percent, respectively), which could represent a limitation to the placement of BMPs within the watershed due to the soil's high runoff potential.

TABLE 1-4: SUMMARY OF HYDROLOGIC SOIL GROUPS PER WATERSHED

Hydrologic Soil Group	HERRING BAY WATERSHEDS	MIDDLE AND LOWER PATUXENT WATERSHEDS
A	0%	7.3%
B	45.6%	69.9%
C	42.6%	8.1%
D	11.4%	14.5%

TABLE 1-5: HYDROLOGIC SOIL GROUPS PER SUBWATERSHED

Subwatershed	A	B	C	D
HERRING BAY WATERSHED				
HB0	0.0%	8.4%	88.2%	3.4%
HB1	0.0%	65.2%	15.8%	18.8%
HB2	0.0%	84.4%	1.8%	13.8%
HB3	0.0%	0.0%	83.8%	14.1%
HB7	0.0%	0.0%	90.0%	9.2%
HB8	0.0%	0.0%	88.7%	10.5%
HB9	0.0%	0.0%	96.6%	3.3%
HBB	0.0%	0.0%	96.4%	2.7%
HBC	0.0%	0.0%	98.1%	1.3%
HBD	0.0%	0.0%	93.5%	4.4%
HBF	0.0%	0.0%	91.4%	7.6%
HBL	0.0%	83.1%	0.6%	16.3%
HBM	0.0%	17.8%	71.4%	10.3%
HBO	0.0%	77.1%	4.1%	18.8%
HBP	0.0%	35.7%	62.6%	0.0%
HBQ	0.0%	83.0%	0.7%	16.1%
HBR	0.0%	97.8%	0.0%	0.2%
HBS	0.0%	76.8%	0.0%	23.1%
HBT	0.0%	68.1%	17.0%	14.2%
HBU	0.0%	21.5%	70.8%	3.4%
HBV	0.0%	0.0%	89.1%	9.0%
MIDDLE AND LOWER PATUXENT WATERSHEDS				

Subwatershed	A	B	C	D
MP0	5.5%	77.9%	2.6%	14.0%
MP1	31.6%	16.1%	42.6%	9.7%
MP2	25.2%	24.6%	40.1%	10.1%
MP3	0.0%	82.9%	4.4%	12.6%
MP4	20.7%	42.7%	21.9%	14.7%
MP5	15.4%	50.9%	26.6%	7.1%
MP6	5.9%	76.9%	0.6%	16.4%
MP7	7.5%	63.5%	11.9%	17.1%
MP8	4.2%	54.2%	21.4%	19.5%
MP9	38.7%	11.0%	7.6%	42.8%
MPA	38.8%	40.5%	16.6%	4.1%
MPB	4.8%	6.6%	0.0%	77.9%
MPC	0.4%	85.3%	0.0%	14.3%
MPD	0.0%	87.2%	0.0%	12.7%
MPE	0.0%	86.7%	2.5%	10.8%
MPF	0.0%	82.7%	1.2%	16.1%
MPG	0.0%	65.8%	7.9%	26.3%
MPH	0.0%	78.9%	3.3%	17.9%
MPI	0.0%	86.5%	0.0%	13.5%
MPJ	0.0%	89.4%	0.6%	10.0%
MPK	0.0%	86.8%	0.7%	12.5%
MPL	0.0%	86.7%	0.0%	13.3%
MPM	0.0%	88.6%	0.4%	7.9%
MPN	0.0%	86.4%	2.6%	11.0%
MPO	0.0%	84.2%	2.4%	13.4%
MPP	0.0%	88.7%	0.0%	11.3%
MPQ	0.0%	86.2%	1.2%	12.5%
MPR	0.0%	89.6%	0.0%	10.4%
MPS	0.3%	89.9%	0.0%	9.8%
MPT	0.0%	87.3%	0.0%	12.7%
MPU	0.0%	79.8%	5.8%	14.4%
MPV	0.0%	88.6%	0.5%	10.8%
MPW	16.4%	54.3%	17.1%	12.2%
MPX	0.0%	87.3%	0.2%	12.5%
MPY	0.0%	87.6%	0.0%	12.4%
MPZ	26.8%	39.6%	15.2%	18.4%

Soil erodibility varies across the Middle and Lower Patuxent and the Herring Bay watersheds. Soils classified as 'highly erodible' are the most common class present in the Middle and Lower Patuxent (52.1 percent). As shown in the summary Table 1-6, 30.6 percent of the soils in the watershed are classified as 'potentially highly erodible'. Soils classified as not highly erodible are found primarily along the stream systems in zones wetland and floodplain zones. These soils make up 17.1 percent of the watershed area. Regarding Herring Bay, soils classified as 'not highly erodible' are dominant within the watershed (49.9 percent), followed by "highly erodible soils' with 40.8 percent, and 'potentially highly erodible' lands with 8.8 percent. Stream systems with high connectivity to floodplains and stream valleys provide storage for transported sediments; however, these alluvial sediments can be susceptible to erosion, particularly with changes in hydrologic regime and increased channel bed migration. A map of hydrologic soil groups and soil erodibility factors is presented as Map 1.6. Detailed information regarding soil erodibility characteristics within each subwatershed is listed in Table 1-7.

TABLE 1-6: SUMMARY OF SOIL ERODIBILITY PER WATERSHED

Soil Erodibility	HERRING BAY WATERSHED	MIDDLE AND LOWER PATUXENT WATERSHEDS
Highly erodible	40.80%	52.10%
Potentially highly erodible	8.80%	30.60%
Not highly erodible	49.90%	17.10%

TABLE 1-7: SOIL ERODIBILITY PER SUBWATERSHED

Subwatershed	Highly erodible land	Potentially highly erodible land	Not highly erodible land
HERRING BAY WATERSHED			
HB0	10.20%	12.40%	77.30%
HB1	53.70%	15.30%	30.80%
HB2	69.60%	17.50%	12.80%
HB3	0.00%	4.90%	93.00%
HB7	0.00%	0.00%	99.20%
HB8	0.00%	0.40%	98.80%
HB9	0.00%	0.00%	99.80%
HBB	0.00%	0.00%	99.10%
HBC	0.00%	0.00%	99.40%
HBD	0.00%	0.00%	97.80%
HBF	0.00%	6.80%	92.20%
HBL	76.00%	7.50%	16.50%
HBM	21.90%	26.40%	51.10%
HBO	78.20%	1.00%	20.80%
HBP	47.80%	34.50%	16.00%
HBQ	81.40%	2.20%	16.10%
HBR	93.50%	4.30%	0.20%
HBS	76.20%	0.70%	23.10%

Subwatershed	Highly erodible land	Potentially highly erodible land	Not highly erodible land
HBT	54.70%	13.40%	31.20%
HBU	0.00%	21.50%	74.20%
HBV	0.00%	5.20%	92.90%
MIDDLE AND LOWER PATUXENT WATERSHEDS			
MP0	60.40%	25.30%	14.30%
MP1	15.60%	72.20%	12.20%
MP2	20.40%	59.40%	20.10%
MP3	68.90%	17.00%	14.10%
MP4	35.30%	46.60%	18.00%
MP5	44.80%	39.80%	15.40%
MP6	44.20%	34.20%	21.40%
MP7	45.80%	34.10%	20.10%
MP8	38.70%	30.40%	30.30%
MP9	10.40%	40.70%	48.90%
MPA	40.30%	53.10%	6.60%
MPB	11.30%	0.00%	77.90%
MPC	71.10%	14.60%	14.30%
MPD	63.20%	24.10%	12.70%
MPE	76.90%	12.30%	10.80%
MPF	48.30%	35.60%	16.10%
MPG	48.40%	19.70%	32.00%
MPH	48.50%	30.30%	21.20%
MPI	56.80%	26.00%	17.20%
MPJ	53.40%	36.60%	10.00%
MPK	44.50%	43.00%	12.50%
MPL	67.30%	19.40%	13.30%
MPM	75.80%	13.20%	7.90%
MPN	47.10%	39.30%	13.60%
MPO	65.20%	19.00%	15.70%
MPP	56.10%	32.60%	11.30%
MPQ	65.40%	21.60%	12.90%
MPR	67.70%	21.80%	10.40%
MPS	59.60%	28.80%	11.60%
MPT	70.10%	17.20%	12.70%
MPU	63.20%	20.70%	16.00%
MPV	69.60%	19.40%	11.00%
MPW	41.10%	36.10%	22.70%
MPX	65.10%	22.20%	12.70%
MPY	71.90%	15.70%	12.40%
MPZ	32.20%	45.90%	22.00%

1.4.3 SURFACE WATER

The Middle and Lower Patuxent and Herring Bay watersheds contain approximately 356 and 218 total miles of reaches, respectively (Table 1-3). The reaches include:

- Perennial reaches, which are permanent channels that generally flow throughout a normal rainfall year, some perennial channels may go dry in times of drought,
- Intermittent and ephemeral reaches, in which water is present only during wetter portions of the year such as spring time (intermittent) or during and immediately following rainfall events (ephemeral),
- The mainstem of the Patuxent River, which was not assessed due to its size and drainage area,
- Tidal portions of a stream, which for this study include both the tidal portions of the Patuxent mainstem and downstream tidally influenced portions of the Herring Bay watershed,
- Wetlands and floodways, which may not always have a single defined channel, and
- Manmade channels, which include drainage conveyances and stormwater management facilities.

The majority of stream reaches located within the Middle and Lower Patuxent watershed are categorized as perennial (65 percent, 78.1 miles), intermittent and wetland (10 percent each, 12.2 and 11.8 respectively), and ephemeral (8 percent, 10.1 miles). Additionally, the mainstem of the Patuxent River located within the study site is comprised of 12.9 miles (10.6 miles of not assessed, and 2.3 miles of tidal reaches). The streams drain 36 subwatersheds ranging in size from 240 to 1,665 acres (Table 1-3).

The great majority of stream reaches found in the Herring Bay watershed are classified as perennial (44 percent, 19 miles), ephemeral (22 percent, 10 miles), intermittent (13 percent, 6 miles), followed by wetlands (10 percent, 4 miles). The 21 subwatersheds that compose Herring Bay range in size from 112 to 2,374 acres (Table 1-3). A map of the subwatersheds, including the subwatershed three-digit code and name, is presented as Map 1.2. Map 2.1 presents the stream classifications graphically.

1.4.4 ENVIRONMENTAL FEATURES

Environmental features in the Middle and Lower Patuxent and Herring Bay watersheds are presented in Map 1.7. As seen in the map, many sensitive environmental features can be found throughout the watersheds, including wetlands, greenways, forested areas designated by treelines, Chesapeake Bay Critical Area (CA) and Federal Emergency Management Agency (FEMA) floodplains. These high quality habitats are sensitive to anthropogenic stress and are identified as priorities for protection. Wetlands are mainly found in the eastern portion of the Herring Bay watershed, and along the Patuxent River and Jug Bay. Greenways and treeline areas have been identified for preservation as they provide wildlife movement corridors when complete and contiguous, and can be found in various areas throughout the two watersheds. The CA is important because it provides a buffer to reduce pollution to the bay, and it protects shoreline habitat. The CA program is vital to protecting shoreline and near-shoreline areas from development. The floodplains of the Patuxent River within the Middle Patuxent watershed, and the entire eastern border of the Herring Bay watershed fall within the CA. Furthermore, FEMA flood plains can be found along many streams that run through the region, including Jack Creek, Broadwater Creek, Rockhold Creek located in the Herring Bay watershed; and Hardwick Branch and Ferry Branch found in the Middle Patuxent. Two 'Tier II High Quality Waters' stream segments exist in the Middle Patuxent including segments in Cabin Branch 1 (MP8) and Lyons Creek 10 (MP6). Tier II streams are areas of very good biological condition (scoring 'Very Good' Maryland Biological Stream Survey biomonitoring

results for fish and benthic macroinvertebrates), and are afforded special protections under Maryland's anti-degradation policy (COMAR 26.08.02.04-1).

1.4.5 Land Cover and Land Ownership

Table 1-8 summarizes land cover in the Middle and Lower Patuxent and Herring Bay watersheds based on the County's 2014 Land Use/ Land Cover geographic information system (GIS) data based on 6 inch resolution orthophotography incorporating buffering. The classifications were chosen because they were associated with studied Event Mean Concentration (EMC) values for water quality modeling. As shown, woods occupy a majority of the Middle and Lower Patuxent watersheds, representing approximately 38% of the total area. Collectively, residential land cover categories constitute almost 22% of the target territory, and row crops represent the next largest portion of the watershed occupying over 18% of the total area. Commercial, forested wetland, open space, open wetland, pasture/hay and transportation individually occupy 1 – 8 percent of the watershed; while industrial, mining and utilities individually occupy less than 1 percent of the area.

Similarly, the majority of the land cover found within the Herring Bay watershed is classified as mixed woods (41 percent), followed by residential uses with 23 percent, and forested wetlands with 9 percent. Open space, open wetland, pasture/hay, commercial, row crops and transportation individually occupy 2 – 7 percent of the watershed. Industrial activities are less prominent in Herring Bay representing less than 1 percent of the total land use in the watershed. A map showing the land cover makeup in the two watersheds is presented as Map 1.8.

TABLE 1-8: LAND COVER

Land Cover	HERRING BAY WATERSHED		MIDDLE AND LOWER PATUXENT WATERSHEDS	
	Acres	% of Watershed	Acres	% of Watershed
Airport	6.5	0.04%	0	0
Commercial	313.3	2.14%	447.6	1.50%
Forested Wetland	1379.2	9.41%	744.9	2.50%
Industrial	24.9	0.17%	11.8	0.04%
Open Space	521.6	3.56%	1108.6	3.72%
Open Wetland	619.6	4.23%	785.3	2.63%
Pasture/Hay	566.8	3.87%	2208.4	7.41%
Residential 1/2-acre	257.8	1.76%	44.2	0.15%
Residential 1/4-acre	343.4	2.34%	80.3	0.27%
Residential 1/8-acre	628.8	4.29%	289.4	0.97%
Residential 1-acre	292.9	2.00%	516.6	1.73%
Residential 2-acre	1903.4	12.98%	5505.1	18.47%
Row Crops	910.3	6.21%	5430.4	18.22%
Transportation	308.9	2.11%	627.3	2.10%
Utility	321.9	2.20%	36.7	0.12%
Water	136.3	0.93%	230.5	0.77%
Woods-Coniferous	100.4	0.68%	134.8	0.45%
Woods-Mixed	6025.8	41.10%	11153.3	37.42%

The land use and ownership along with their impervious areas are summarized in Table 1-9. The largest ownership types for the Herring Bay watershed are Rural Agriculture, Residential Low Density, Natural Features, and Residential Low-Medium Density, all within County jurisdiction. The largest ownership types for the Middle Patuxent watershed are Rural Agriculture, Natural Features, and Rec and Parks under County jurisdiction. Rural Agriculture, County Roads and Facilities, State Highway Administration (SHA) Roads, and Residential comprise the largest impervious areas. Overall, the Herring Bay watershed has 6.5% impervious coverage, while the Middle Patuxent watershed has 4.8% impervious coverage. Map 1.9 depicted impervious surfaces and land ownership.

TABLE 1-9: IMPERVIOUS, LAND USE, AND WIP SECTOR OWNERSHIP

WIP Sector Ownership	Land Use	Area (acres)	Impervious Cover (acres)	Impervious % of Land Cover	% of Total Impervious Cover
HERRING BAY WATERSHED					
County-Private	Commercial	101.0	27.1	27%	3%
County-Private	Government/ Institution	0.1	0.1	46%	0%
County-Private	Industrial	32.1	13.4	42%	1%
County-Private	Residential Low Density	1,945.4	115.0	6%	12%
County-Private	Residential Low-Medium Density	1,102.0	224.0	20%	23%
County-Private	Maritime	152.3	75.9	50%	8%
County-Private	Natural Features	1,326.7	10.1	1%	1%
County-Private	Rural Agricultural	7,862.3	193.9	2%	20%
County-Private	Utility/Trans-portation	23.8	3.0	12%	0%
County-Public	Board of Education	69.1	7.7	11%	1%
County-Public	Rec and Parks	555.4	8.2	1%	1%
County-Public	Roads and Facilities	787.2	202.9	26%	21%
State-DNR	Department of Natural Resources	457.6	3.6	1%	0%
State-SHA	Roads	200.2	68.7	34%	7%
Herring Bay Total		**14,615.2**	**953.4**	**--**	**--**
MIDDLE AND LOWER PATUXENT WATERSHEDS					
County-Private	Commercial	60.8	32.1	53%	2%
County-Private	Residential Low-Medium Density	36.2	18.2	50%	1%

WIP Sector Ownership	Land Use	Area (acres)	Impervious Cover (acres)	Impervious % of Land Cover	% of Total Impervious Cover
County-Private	Natural Features	2,276.4	34.8	2%	2%
County-Private	Rural Agricultural	23,713.3	915.0	4%	63%
County-Private	Utility/Transportation	108.7	9.5	9%	1%
County-Public	Board of Education	28.0	9.7	35%	1%
County-Public	Rec and Parks	1,900.4	16.3	1%	1%
County-Public	Roads and Facilities	854.4	196.9	23%	14%
State-DNR	Department of Natural Resources	154.0	0.4	0%	0%
State-SHA	Roads	681.0	211.5	31%	15%
Federal	US Postal Service	1.5	0.3	21%	0%
Middle and Lower Patuxent Total		**29,814.7**	**1,444.7**	--	--
Total		**44,429.9**	**2,398.1**	--	--

The Herring Bay, Middle and Lower Patuxent watersheds were initially developed prior to 1700. Since then, the watersheds have developed at varying levels of intensities. Table 1-10 is presented as a "heat map" that displays the rate of new impervious surfaces over each time period using impervious acres developed for the total time period divided by the number of years in the time period. Based on this heat map, it is possible to see that the fastest development in the Herring Bay watershed occurred in the Rockhold Creek (HB0) subwatershed between 1920 and 1999 and the highest rate of development occurred in the Tracys Creek I (HB1) subwatershed between 2000 and 2016. In the Middle and Lower Patuxent watershed the fastest development occurred in the Galloway Creek (MP7) subwatershed between 1920 and 1999, and the highest rate of development occurred in the Hall Creek I (MPC) subwatershed between 1980 and 1999. Age of land development within the watersheds is shown on Map 1.10.

TABLE 1-10: RATE OF NEW DEVELOPMENT

Subshed	<1700-1899	1900-1919	1920-1939	1940-1959	1960-1979	1980-1999	2000-2016
HERRING BAY WATERSHED							
HB0	0.1419	0.0252	0.6535	0.7752	0.7677	0.7646	0.4878
HB1	0.0896	0.0045	0.2906	0.1919	0.4762	0.4657	2.8190
HB2	0.1206	0.0418	0.2641	0.1066	0.5248	0.7032	0.4568
HB3	0.0207	0.0180	0.0240	0.1234	0.0618	0.3051	0.1212
HB7	0.0213	0.0019	0.0710	0.5581	0.2664	0.9170	0.2853
HB8	0.0317	0.0000	0.0524	0.5431	0.1922	0.2510	0.2403
HB9	0.0344	0.0079	0.0481	0.4949	0.2717	0.8747	0.3265

Subshed	<1700-1899	1900-1919	1920-1939	1940-1959	1960-1979	1980-1999	2000-2016
HBB	0.0032	0.0091	0.0032	0.2471	0.2951	0.5771	0.1625
HBC	0.0237	0.0111	0.0977	0.5227	0.2937	0.7973	0.2922
HBD	0.0097	0.0000	0.0189	0.3582	0.0955	0.2187	0.0882
HBF	0.0676	0.0089	0.0496	1.0611	0.2577	0.6394	0.4099
HBL	0.0281	0.0346	0.2348	0.0675	0.3367	0.4786	0.1968
HBM	0.0086	0.0178	0.1218	0.4565	0.0580	0.1769	0.6650
HBO	0.0024	0.0004	0.0533	0.0808	0.0624	0.3297	0.0574
HBP	0.0029	0.0000	0.2331	0.0357	0.0767	0.1126	0.0475
HBQ	0.0259	0.0232	0.1301	0.1177	0.3535	0.2680	0.1411
HBR	0.0017	0.0126	0.1437	0.0226	0.0665	0.0257	0.0140
HBS	0.0023	0.0000	0.0007	0.0000	0.0632	0.0275	0.0068
HBT	0.0101	0.0000	0.0115	0.0139	0.0643	0.1742	0.0686
HBU	0.0374	0.0000	0.0533	0.2094	0.4579	0.1086	0.1687
HBV	0.0079	0.0021	0.3716	0.0206	0.0400	0.0511	0.2051
MIDDLE AND LOWER PATUXENT WATERSHED							
MP0	0.0147	0.0000	0.0702	0.0832	0.1909	0.1583	0.0872
MP1	0.1320	0.0000	0.0000	0.0000	0.0754	0.4197	0.0527
MP2	0.2724	0.0200	0.0108	0.0446	0.5021	0.2626	0.4040
MP3	0.0152	0.0000	0.3584	0.0763	0.0887	0.1554	0.4671
MP4	0.0202	0.0371	0.1210	0.0698	0.4434	0.1591	0.4850
MP5	0.0177	0.0000	0.0629	0.0530	0.2762	0.5239	0.2157
MP6	0.0148	0.2157	0.6750	0.0599	0.3213	0.2135	0.2530
MP7	0.1249	0.0333	0.8068	0.6806	0.8135	0.5634	0.2887
MP8	0.1099	0.0026	0.0680	0.0958	0.4827	0.5487	0.1575
MP9	0.0247	0.0000	0.0319	0.0468	0.0220	0.1127	0.0403
MPA	0.0100	0.0000	0.0083	0.0773	0.0106	0.0090	0.0683
MPB	0.0000	0.0000	0.0000	0.0107	0.0125	0.0039	0.0088
MPC	0.0310	0.0226	0.1226	0.0454	0.2442	1.7203	0.2774
MPD	0.0135	0.0060	0.0693	0.0310	0.1551	0.4336	0.1295
MPE	0.0200	0.0529	0.1965	0.0120	0.0585	0.4194	0.1839
MPF	0.0010	0.0965	0.0209	0.0103	0.1556	0.3157	0.1466
MPG	0.0177	0.0000	0.0311	0.0000	0.0000	0.3218	0.0056
MPH	0.0315	0.0219	0.1412	0.2783	0.4096	0.2995	0.4378
MPI	0.0137	0.0365	0.1438	0.0357	0.3590	0.2488	0.2301
MPJ	0.0428	0.0136	0.2206	0.0713	0.1471	0.5940	0.2228
MPK	0.0072	0.0556	0.1324	0.0233	0.2944	0.2640	0.3853
MPL	0.0036	0.0846	0.0530	0.0046	0.1268	0.2211	0.3213
MPM	0.0021	0.0135	0.0576	0.0000	0.0750	0.6442	0.0177
MPN	0.0036	0.0235	0.0216	0.0440	0.0296	0.1644	0.1530
MPO	0.0134	0.0036	0.1721	0.0751	0.3118	0.9414	0.3144

Subshed	<1700-1899	1900-1919	1920-1939	1940-1959	1960-1979	1980-1999	2000-2016
MPP	0.0392	0.0331	0.2838	0.0412	0.0942	0.0527	0.0824
MPQ	0.0146	0.0000	0.0105	0.0079	0.1154	0.2104	0.3648
MPR	0.0058	0.0000	0.0416	0.0104	0.0512	0.1951	0.0681
MPS	0.0117	0.0152	0.1890	0.0021	0.4489	0.3799	0.2933
MPT	0.0051	0.0014	0.1206	0.1100	0.1298	0.1246	0.0683
MPU	0.0169	0.1649	0.1588	0.0894	0.0752	0.8114	0.3283
MPV	0.0269	0.0940	0.6253	0.2256	0.6697	0.5672	0.3145
MPW	0.0112	0.0000	0.0513	0.0259	0.1203	0.1495	0.2357
MPX	0.0307	0.0135	0.2073	0.1239	0.3996	0.6088	0.3128
MPY	0.0134	0.0350	0.1174	0.0498	0.1207	0.1702	0.1421
MPZ	0.2119	0.0000	0.2892	0.3697	0.8167	0.4277	0.2705

Values represent the number of new impervious acres divided by the number of years in the time period

Development is expected to continue to occur in the Middle and Lower Patuxent and Herring Bay watersheds. The County's official zoning map, shown as Map 1.11, was examined to determine where development may occur and was assumed to reflect build out conditions. This zoning information was last updated on July 25, 2016. Overall, the Middle Patuxent watershed is most likely to experience growth throughout its areas classified as commercial and residential. According to the data, plans classified as redevelopment within the watershed represent a small fraction (0.05 percent) of new development projects. Comparison of the zoning data to the 2014 land cover data indicates that this area has a moderate potential for development in the future due to the limited number of undeveloped or residential parcels. Additional commercial and residential developments may occur in other areas of the watershed currently classified as rural/ agricultural and woods, and may displace current uses like row crops. The majority of the commercial development is expected to place within the subwatersheds HB2 and MPX; while residential development should focus on MPE, MPZ and MP7.

Development activities expected to take place within the Herring Bay watershed include: commercial (divided among local, general, highway, light commercial marina and general commercial marina), open space, residential (R1, R2, R5 and low density), and industrial. The majority of the development is expected to take place in the southern portion of the watershed and near bodies of water. Residential development prevails over the other types of development, and is expected to take place throughout the watershed with hot-spots in HB3, HB7, HBC, HB0, HBF and HBM. Commercial development will take place mostly in areas near the coast, with the greatest concentration of new commercial activities being found in HB0. According to the data, the development forecasted for Herring Bay will take place primarily through the use of vacant parcels (1,518 acres), followed by new development (897 acres) and redevelopment (9 acres). The potential for industrial development is less prevalent than residential and commercial development. The development of open space is only nominal with an expected increase of 0.001 acres.

2 DATA COLLECTION AND COMPILATION

Field data were collected and compiled to support the County's stream reach and subwatershed conditions assessment and rating efforts. Field crews verified and classified the Herring Bay, Middle and Lower Patuxent tributary stream networks, assessed physical habitat conditions, and collected data on infrastructure, environmental features, road crossing flood potential, and channel geomorphology. Field work was performed in the winter of 2017/2018. Additional existing data were also used to support the County's assessment efforts: bioassessment monitoring results, land use cover, impervious areas, BMP characteristics, septic system impacts, soil characteristics, and various other aquatic and landscape indicators. Each of these data components is disused in more detail in this section. The discussion is organized by pertinent ecosystem zone, including the tributary streams and their associated riparian areas (Section 2.1) and upland areas (Section 2.2).

2.1 STREAM DATA COLLECTION AND COMPILATION

The following subsections present and summarize the collected and compiled data within the Herring Bay, Middle and Lower Patuxent tributary streams and the adjacent riparian areas. Stream classifications and verification, physical habitat condition assessment, inventory of infrastructure and environmental features, habitat scores, channel geomorphology, road crossing flood potential, bioassessments, and aquatic resource indicators are all reported in detail. This information is crucial for determining the conditions within the tributary streams and for subsequently identifying, formulating, and prioritizing restoration activities and land management decisions to improve stream conditions.

2.1.1 STREAM CLASSIFICATION AND VERIFICATION

A watershed assessment is predicated on an accurate understanding of stream location and character (e.g., perennial, intermittent, ephemeral, underground, wetland, etc.). The actual position, alignment, and character of all tributary streams in the Herring Bay, Middle and Lower Patuxent watersheds were field-verified. A stream planimetric dataset based on aerial photography, drainage lines derived from a digital elevation model (DEM), and a geodatabase of storm drain outfalls was used as a guide for directing field assessment and verification efforts. Based on field verification activities, a stream reach GIS layer was constructed representing the assessed tributary streams.

Field teams confirmed the location of the stream channel and determined the stream character. Additions to and deletions from the existing stream planimetric dataset were recorded as necessary to match observed field conditions. Modifications to the channel alignment in the dataset were made only when significant inconsistencies were noted. Field teams used best professional judgement to evaluate field indicators of perenniality, including hydrologic indicators (e.g., seeps, leaf litter presence, sediment deposition), geomorphic indicators (e.g., riffle-pool sequence, substrate sorting, sinuosity, bankfull bench presence), soil indicators (e.g., redox-morphic features, chroma), and biological indicators (e.g., vegetation, benthic macroinvertebrates).

Collectively, between the two watersheds, approximately 163 miles of streams were verified and characterized, while 189 miles of stream were not assessed because of limitations relating to private property access restrictions where following County requests, permission was not granted. Characterization in the Herring Hay watershed included 19.0 miles of perennial stream, 9.7 miles of ephemeral stream, 5.8 miles of intermittent stream, 4.2 miles of wetland, and 4.6 miles of other types (ditch, pipe, pond/lake, stormwater management, tidal, and underground). The Middle and Lower Patuxent watershed characterization covered 78.1 miles of perennial stream, 10.1 miles of ephemeral streams, 12.2 miles of intermittent stream, 11.8 miles of wetland, 12.9 miles of the Patuxent mainstem (10.6 miles of not assessed and 2.3 miles of tidal reaches), and 7.9 miles of other types.

During the field verification efforts, streams were segmented into individual stream reaches to facilitate subsequent assessment and analysis efforts. Stream reaches were identified and segmented in the field as distinct habitat or geomorphic conditions were encountered. Physical features, such as stream confluences, were also used to subdivide reaches. A total of 411 individual reaches, with an average length of 556 feet, were identified within the Herring Bay Watershed. The Middle and Lower Patuxent watershed included identification of 993 individual reaches, averaging 639 feet in length.

A summary of stream miles and number of reaches by type is presented for both watersheds in Table 2-1. Stream classifications encountered throughout the watershed are depicted in Map 2.1.

TABLE 2-1: STREAM TYPE RESULTS

Type	HERRING BAY WATERSHED			MIDDLE AND LOWER PATUXENT WATERSHED		
	Number of Reaches	Stream Miles	Percent of Total Stream Miles	Number of Reaches	Stream Miles	Percent of Total Stream Miles
Connector	2	0.1	0.1%	1	0.04	0.0%
Ditch	11	1.4	1.4%	3	0.3	0.1%
Ephemeral	93	9.7	9.7%	139	10.1	4.0%
Intermittent	52	5.8	5.8%	126	12.2	4.9%
Not Assessed	510	56.7	56.7%	1,097	132.2	52.4%
Perennial	179	19.0	19.0%	567	78.1	31.0%
Pipe	1	0.1	0.1%	10	0.4	0.2%
Pond/Lake	6	0.2	0.2%	18	0.9	0.4%
SWM	2	0.2	0.2%	1	0.1	0.0%
Tidal	16	2.7	2.7%	17	5.9	2.3%
Underground	2	0.03	0.0%	2	0.2	0.1%
Wetland	47	4.2	4.2%	109	11.8	4.7%
Total	**921**	**100.0**	**--**	**2,090**	**252.3**	**--**

Stream segments were assigned a stream order according to a modified Strahler stream order hierarchy. In this hierarchy, ephemeral and intermittent channels as well as other non-perennial reaches are assigned as zero-order streams. First order streams then generally begin with the first headwater perennial stream encountered. A summary of the stream ordering per subwatershed, including those reaches not assessed, is presented in in Table 2-2. A Map of the stream ordering is presented in Map 2.2.

TABLE 2-2: STRAHLER STREAM ORDER PER SUBWATERSHED

Stream Order Miles								
Subwatershed	**0**	**1st**	**2nd**	**3rd**	**4th**	**5th**	**6th**	**Total**
HERRING BAY WATERSHED								
HB0	5.1	3.4	0.8	0.0	0.0	0.0	0.0	9.3
HB1	5.9	4.6	2.0	0.9	3.8	0.0	0.0	17.2
HB2	4.6	7.6	5.1	4.1	2.2	0.0	0.0	23.6
HB3	0.6	0.1	0.0	0.0	0.0	0.0	0.0	0.6
HB7	1.0	0.6	0.3	0.0	0.0	0.0	0.0	1.9
HB8	0.4	1.2	0.7	0.0	0.0	0.0	0.0	2.3
HB9	3.7	0.8	0.6	1.5	0.0	0.0	0.0	6.6
HBB	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.1
HBC	0.2	0.4	0.0	0.0	0.0	0.0	0.0	0.6
HBF	0.3	1.3	0.3	0.0	0.0	0.0	0.0	1.9
HBL	2.8	4.0	2.8	2.5	0.0	0.0	0.0	12.1
HBM	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.3
HBO	0.3	0.7	0.5	0.8	0.0	0.0	0.0	2.2
HBP	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
HBQ	4.9	5.2	3.5	1.1	0.9	0.0	0.0	15.5
HBR	0.5	0.1	0.0	0.0	0.0	0.0	0.0	0.6
HBS	1.5	0.6	0.0	1.1	0.0	0.0	0.0	3.3
HBT	0.7	0.4	0.9	0.0	0.0	0.0	0.0	2.0
HB Total	**32.7**	**31.0**	**17.5**	**12.0**	**6.9**	**0.0**	**0.0**	**100.0**
MIDDLE AND LOWER PATUXENT WATERSHEDS								
MP0	4.7	2.7	1.6	2.1	0.7	0.0	0.3	12.1
MP1	0.4	2.0	0.1	1.7	0.0	0.0	1.2	5.5
MP2	0.6	2.1	0.6	0.0	1.6	0.0	1.2	6.2
MP3	0.8	4.1	2.3	0.0	2.1	0.0	0.0	9.3
MP4	0.0	3.8	0.8	0.0	3.4	0.0	1.3	9.3
MP5	0.4	2.4	2.4	1.0	0.0	0.0	0.0	6.2
MP6	0.5	4.2	2.2	1.8	2.4	0.0	0.0	11.0
MP7	2.6	4.1	2.3	1.4	1.9	0.0	1.3	13.5
MP8	0.8	3.5	2.1	0.8	0.0	3.4	0.0	10.6
MP9	4.5	0.9	0.9	0.0	0.0	0.0	3.0	9.2
MPA	2.2	2.5	2.3	0.6	0.0	0.0	0.4	8.0
MPB	3.4	0.0	0.0	0.0	0.0	0.2	1.6	5.2
MPC	2.7	5.5	2.8	1.4	0.0	0.0	0.0	12.4
MPD	0.1	1.8	1.5	0.4	0.0	0.0	0.0	3.8
MPE	0.4	2.0	1.2	1.1	0.8	0.0	0.0	5.4

Stream Order Miles								
Subwatershed	**0**	**1st**	**2nd**	**3rd**	**4th**	**5th**	**6th**	**Total**
MPF	0.2	3.8	1.7	1.2	0.0	0.0	0.0	6.9
MPG	1.9	0.6	0.0	0.0	1.6	0.0	0.0	4.1
MPH	0.7	1.7	0.0	2.1	0.0	0.0	0.0	4.5
MPI	0.0	2.0	1.7	1.2	0.0	0.0	0.0	4.9
MPJ	1.0	3.2	2.0	1.5	0.0	0.0	0.0	7.6
MPK	0.0	1.7	1.2	0.0	0.0	0.0	0.0	2.9
MPL	0.0	1.8	0.9	0.8	0.0	0.0	0.0	3.4
MPM	0.9	1.8	0.7	0.0	0.0	0.0	0.0	3.4
MPN	0.8	1.0	1.6	0.0	0.0	0.0	0.0	3.4
MPO	0.2	2.9	1.9	1.5	0.7	0.0	0.0	7.1
MPP	0.1	4.4	1.2	0.8	0.0	0.0	0.0	6.6
MPQ	1.0	1.3	2.1	0.0	1.5	0.1	0.0	6.0
MPR	2.1	0.9	0.9	0.0	0.0	0.0	0.0	4.0
MPS	0.3	2.5	1.8	0.5	0.6	0.0	0.0	5.6
MPT	0.4	2.1	0.4	0.2	1.1	0.0	0.0	4.3
MPU	0.9	2.7	2.3	1.3	0.0	0.0	0.0	7.2
MPV	1.1	5.7	1.9	2.4	1.1	0.0	0.0	12.2
MPW	1.4	2.0	0.6	3.0	0.0	0.0	0.6	7.6
MPX	1.4	2.8	1.7	0.7	0.0	0.0	0.0	6.7
MPY	0.3	2.7	1.7	0.8	0.0	0.0	0.0	5.6
MPZ	0.5	3.5	2.6	0.0	2.0	0.0	2.0	10.7
MP Total	**39.3**	**92.7**	**51.8**	**30.3**	**21.5**	**3.7**	**12.9**	**252.3**

2.1.2 Physical Habitat Condition Assessment

Physical habitat condition is a good measure of the overall health of a stream and its ability to support aquatic life. Healthy physical habitat for aquatic organisms is typically comprised of stable channels and substrates, diverse flow characteristics, and abundant cover and food sources. Natural streams are typically in a state of dynamic equilibrium. However, this equilibrium can be disrupted and habitat parameters common in healthy streams begin to deteriorate when increased urban and agricultural stressors are introduced. Examples of stream reaches in the Middle Lower Patuxent and Herring Bay Watersheds are shown in Figure 2-1.

FIGURE 2-1: EXAMPLES OF HABITAT CONDITIONS OF ASSESSED STREAM REACHES

Stream Reach in the Wilson Owen's Branch 2 Subwatershed (MPE) with Minimally Degraded Habitat Condition

Stream Reach in the Rock Branch 1 Subwatershed (MP2) with Severely Degraded Habitat Condition

Stream Reach in the Tracy's Creek 2 Subwatershed (HB2) with Minimally Degraded Habitat Condition

Stream Reach in the Unnamed Tributary 2 Subwatershed (HBQ) with Severely Degraded Habitat Condition

A field assessment of in-stream physical habitat conditions was performed for perennial streams by observing and measuring various physical attributes. This work was completed in accordance with the 2003 *Physical Habitat Index for Freshwater Wadeable Streams in Maryland* report developed by Maryland Department of Natural Resources (MDNR) (Paul et al, 2003). Collected habitat assessment parameters included qualitative observations of in-stream and riparian conditions (*i.e.*, fish presence, bacteria or algae presence, aquatic vegetation presence, water clarity and odor, and riparian vegetation character) as well as quantified assessment parameters used to calculate a Maryland Physical Habitat Index (MPHI) score. Data used to support the calculation of the scaled MPHI score for each perennial stream reach included individual scores for remoteness, shading, epifaunal substrate, in-stream habitat, woody debris and rootwads, and bank stability.

Physical habitat condition assessment reaches were created based on observed changes in habitat conditions along a stream. For the Middle and Lower Patuxent Watershed, approximately 75.8 miles of the 78.1 miles of perennial streams were assessed and scored. The remaining perennial stream reaches were not assessed due to access issues or due to individual reach lengths being less than the minimum assessment size requirement (75 meters). The aggregate assessed perennial stream length is comprised of 464 individual reaches with an average assessed stream reach length of approximately 0.16 miles (or 861 feet).

For the Herring Bay Watershed, approximately 17.4 miles of the 19.0 miles of perennial streams were assessed and scored. The remaining perennial reaches were not assessed due to access issues or due to individual reach lengths being less than the minimum assessment size requirement (75 meters). The aggregate assessed perennial stream length is comprised of 125 individual reaches with an average assessed stream reach length of approximately 0.14 miles (or 735 feet).

Based on the calculated MPHI score, each stream reach is assigned a condition category of "Minimally Degraded," "Partially Degraded," "Degraded," or Severely Degraded." Standard MPHI category breakpoints used by MDNR are as follows: 0-50.9 Severely Degraded, 51.0-65.9 Degraded, 66.0-80.9 Partially Degraded, 81.0-100.0 Minimally Degraded. For this study the breakpoint between the Degraded and Severely Degraded category was 59.9 and 60.0. The result is a more conservative approach and identifies additional reaches for restoration. This modified scoring is carried through in the calculation of MPHI scores per watershed and the calculation of Final Habitat Scores (FHS) for reaches and subwatersheds described in section 2.1.4.

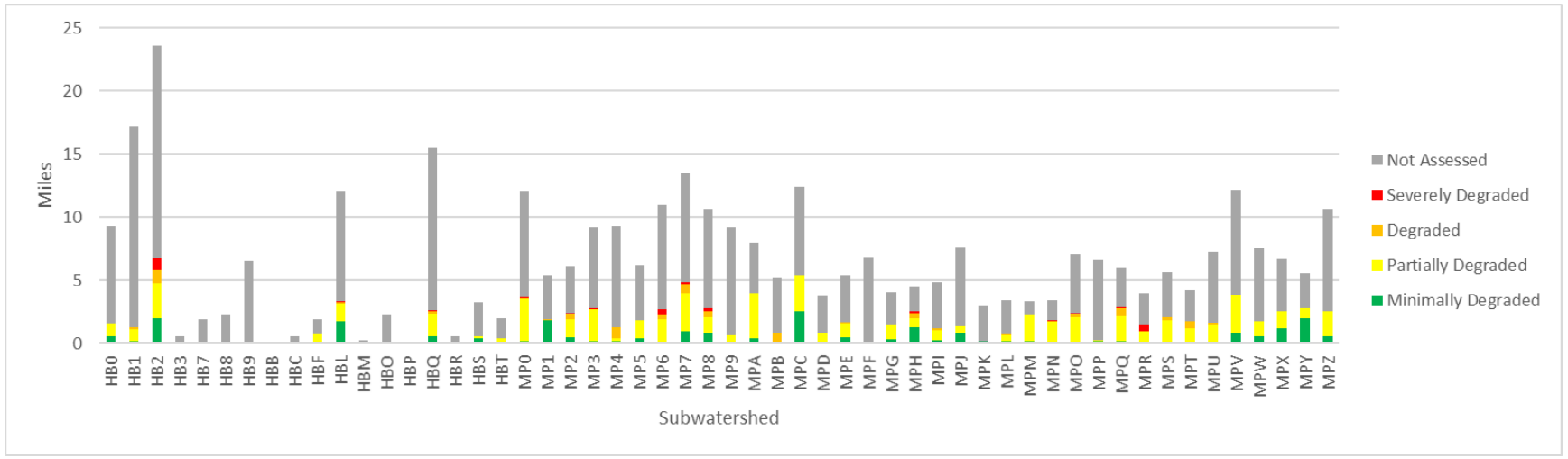
The average length-weighted MPHI score for the Middle and Lower Patuxent watershed is 75.3 ("Partially Degraded"), while for the Herring Bay watershed it is 76.1 ("Partially Degraded"). Approximately 51.6% of perennial stream miles in the Middle and Lower Patuxent watershed were rated as "Partially Degraded". "Minimally Degraded" streams comprised roughly of 33.5% of the perennial streams, followed by "Degraded" and "Severely Degraded" streams at 8.7% and 6.2%, respectively. Herring Bay had very similar proportions of habitat conditions; approximately 65.4% of perennial stream miles in the Herring Bay watershed were rated as "Partially Degraded". "Minimally Degraded" streams comprised roughly 23.6% of the perennial streams, followed by "Degraded" and "Severely Degraded" streams at 8.3% and 2.7%, respectively. A summary of MPHI condition categories by stream mile and number of reaches is provided in Table 2-3. A map of the MPHI conditions throughout the watershed is presented as Map 2.3.

TABLE 2-3: PHYSICAL HABITAT CONDITION RESULTS, MPHI

MPHI Category[1]	HERRING BAY WATERSHED			MIDDLE AND LOWER PATUXENT WATERSHED		
	Number of Reaches	Stream Miles	Percent of Total Stream Miles	Number of Reaches	Stream Miles	Percent of Total Stream Miles
Minimally Degraded	41	5.8	33.5%	115	17.9	23.6%
Partially Degraded	67	9.0	51.6%	306	49.5	65.4%
Degraded	11	1.5	8.7%	31	6.3	8.3%
Severely Degraded	6	1.1	6.2%	12	2.1	2.7%
Total	**125**	**17.4**	**--**	**464**	**75.8**	**--**

[1] Using modified MPHI categories as described above in section 2.1.2.

FIGURE 2-2: MPHI RESULTS PER SUBWATERSHED



2.1.3 Inventory of Infrastructure and Environmental Features

Accurately documenting infrastructure and other environmental features observed along streams is very important for assessment of current conditions. For this reason, fieldwork included an inventory of infrastructure and significant environmental features that compiled within each perennial reach and associated riparian area. These features included riparian buffer deficiencies, channel erosion, stream obstructions, stream crossings, utilities, dump sites, head cuts, and tributary pipes and drainage ditches. Depending on the inventory feature type, the associated impact was scored in the field as "Minor," "Moderate," "Severe," or "Extreme" based on its potential impact on the integrity or health of the stream reach. These impacts were translated to a 0-10 point scale depending on the feature type according to the County's protocol. In addition to the impact scores, other quantitative and qualitative data, such as dimension, relative location, composition, and restoration potential, were collected for each feature. Examples of four types of impacts are shown in Figure 2-3.

FIGURE 2-3: EXAMPLES OF ENVIRONMENTAL AND INFRASTRUCTURE FEATURES

Deficient buffer impacts (residential lawn encroachment), Moderate Impact in the Lyons Creek 8 subwatershed (MPM)

Headcut and bank erosion (7 feet) in Hall Creek 1 subwatershed (MPC)

Dumpsite impacts in the Cabin Branch 5 (MPT) subwatershed with a Moderate Impact

Stream crossing contributing to erosion. Severe Impact in the Tracy's Creek 1 Subwatershed (HB1)

These infrastructure and environmental features are critical to the health of the study watersheds for the various reasons discussed below. Scores range from 0 to 10, increasing with the level of impact. In general 0, 1, or 2 represent a Minor impact; 5 is Moderate; and 10 represents a Severe impact for each impact type except for Buffer, Erosion and Crossing for which a 7 is Severe and a 10 indicates an Extreme condition. Full description of the scores and ratings are found in *Field Data Collection Guide for Watershed Studies, Anne Arundel County Department of Public Works* (Anne Arundel Co. DPW, 2016).

Infrastructure and environmental features documented during the field assessment include:

- Intact wooded/forested **stream buffers** provide important habitat and shading for both terrestrial and aquatic fauna, and also serve to dampen runoff velocities and filter runoff pollutants before they enter a stream. These functions are lost or significantly diminished when stream buffers are removed or compromised by land management decisions.

- Stream **crossings** can vary from a foot bridge with only minor impact on channel stability to a large road crossing that forces a stream into a culvert. Culverted stream crossings tend to be the most problematic, because they can become blocked or clogged by accumulated debris, because they can create backwater conditions (from undersized culverts), and because they can act to accelerate stream flow. Stream crossing impacts can include flooding, local bed and bank erosion upstream and downstream of the culvert, excessive deposition, and fish passage impediments.

- **Dump sites** are typically comprised of trash or debris dumped in the stream channel or in the riparian area. Toxic pollutants from dumpsites can impact water quality and bulk trash and debris can alter stream hydrodynamics.

- 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.

- A **head cut** is an abrupt change or drop in stream channel elevation. Head cuts are often indicators of active channel incision or downcutting. The movement of upstream bed material fills in the low points associated with the head cut, and as a result the head cut migrates upstream until a new grade is established for the entire channel.

- Channel **obstructions** can include natural features like fallen trees as well as man-made features like concrete dams or riprap. These obstructions can partially or completely obscure water flow, which can cause flooding and localized erosion and can impede the passage of fish.

- **Pipes and drainage ditches** are typically associated with stormwater conveyance. Depending on their placement and flow characteristics, pipes and drainage ditches can contribute to water quality impairments and erosion in the receiving streams.

- **Utilities** can include sanitary sewers, storm sewers, water lines, gas lines, and electrical transmission lines (buried or overhead). Impacts from utilities are the most severe when they intersect the stream channel, where they can alter stream hydraulics and cause localized erosion.

A summary of the impacts for each infrastructure feature is presented in Table 2-4 and Table 2-5. Figure 2-4 and Figure 2-5 show the severity and type of inventory points per subwatershed. The distribution of these features throughout the watershed is presented in Map 2.4.

For both watersheds, erosion impacts, riparian buffer impacts, and crossings had some of the highest total cumulative impact scores of all the inventory features identified. Erosion impacts were attributed mostly to agricultural runoff and development in the watersheds. Riparian buffer impacts were most often associated with encroachment from agricultural fields and residential lawns. Both watersheds had a large number of stream crossings, though most were rated as having a minor or moderate impact. Middle Patuxent had more pipe/ditches, obstructions, and dump sites than Herring Bay, but the majority of these points were rated as having minor or moderate impact.

Location and height of headcuts were recorded, however no impact score was assigned at these sites. Ninety-eight headcuts were located in the Herring Bay watershed, averaging 3.5 feet high, but reaching as high as 12 feet high. In Middle and Lower Patuxent, 293 headcuts were located, averaging 3.7 feet high, with several higher than 10 feet tall. Headcuts were most often associated with agricultural or residential runoff and were often found at the headwaters where a stream originated.

TABLE 2-4: INFRASTRUCTURE AND ENVIRONMENTAL FEATURE IMPACT SCORES

Type	Number of Features with Impact Score:				Total Cumulative Impact Scores[1]
	Minor	Moderate	Severe	Extreme	
HERRING BAY WATERSHED					
Buffers	0	56	4	0	308
Crossings	93	11	3	0	482
Dump Sites	3	4	0	0	23
Erosion	0	66	26	0	512
Obstructions	16	9	0	0	77
Pipes/Ditches	56	2	0	0	10
Utilities	0	0	0	0	0
Total	**168**	**148**	**33**	**0**	**1,412**
MIDDLE AND LOWER PATUXENT WATERSHEDS					
Buffers	0	130	28	0	846
Crossings	145	29	14	0	533
Dump Sites	28	44	5	0	298
Erosion	0	366	89	2	2,473
Obstructions	55	31	4	0	305
Pipes/Ditches	99	20	10	0	200
Utilities	0	0	0	0	0
Total	**327**	**620**	**150**	**2**	**4,655**

[1]Score is the sum product of the number of points and the related impact scoring summarized per inventory point type. This score is **not** the Total Impact Score (TIS) calculated per reach for development of the Final Habitat Score (section 2.1.4)

Scores range from 0 to 10, increasing with the level of impact. In general 0, 1, or 2 represent a Minor impact; 5 is Moderate; 10 represents a Severe impact for each impact type except for Buffer, Erosion and Crossing for which 7 is Severe and 10 indicates Extreme. Full description of the scores and ratings are found in *Field Data Collection Guide for Watershed Studies, Anne Arundel County Department of Public Works* (AA DPW, 2016).

TABLE 2-5: INFRASTRUCTURE AND ENVIRONMENTAL FEATURES PER STREAM MILE ASSESSED

Subwatershed	Stream Miles[1]	Number of Inventory Points[2]	Number of Inventory Points per Stream Mile	Total Cumulative Impact Score	Total Cumulative Impact Score Per Stream Mile
HERRING BAY WATERSHED					
HB0	9.31	74	7.9	186	20
HB1	17.20	50	2.9	107	6
HB2	23.61	114	4.8	334	14
HB3	0.60	4	6.6	11	18
HB7	1.90	4	2.1	4	2
HB8	2.27	0	0.0	0	0
HB9	6.56	12	1.8	25	4
HBB	0.09	1	10.8	0	0
HBC	0.61	6	9.8	17	28
HBF	1.92	19	9.9	43	22
HBL	12.08	76	6.3	234	19
HBM	0.26	2	7.6	7	27
HBO	2.23	0	0.0	0	0
HBP	0.05	2	42.3	2	42
HBQ	15.47	58	3.7	175	11
HBR	0.57	4	7.0	10	18
HBS	3.30	8	2.4	12	4
HBT	1.98	13	6.6	25	13
HB Total	**100.01**	**447**	**4.5**	**1,192**	**12**
MIDDLE AND LOWER PATUXENT WATERSHEDS					
MP0	12.07	90	7.5	286	24
MP1	5.45	30	5.5	79	14
MP2	6.15	62	10.1	237	39
MP3	9.26	71	7.7	277	30
MP4	9.28	8	0.9	25	3
MP5	6.18	39	6.3	195	32
MP6	10.99	55	5.0	211	19
MP7	13.50	115	8.5	344	25
MP8	10.63	44	4.1	133	13
MP9	9.23	22	2.4	72	8

Subwatershed	Stream Miles[1]	Number of Inventory Points[2]	Number of Inventory Points per Stream Mile	Total Cumulative Impact Score	Total Cumulative Impact Score Per Stream Mile
MPA	7.95	82	10.3	244	31
MPB	5.22	0	0.0	0	0
MPC	12.44	65	5.2	223	18
MPD	3.78	15	4.0	63	17
MPE	5.41	28	5.2	89	16
MPF	6.89	4	0.6	14	2
MPG	4.09	18	4.4	31	8
MPH	4.47	40	9.0	96	21
MPI	4.88	35	7.2	135	28
MPJ	7.63	22	2.9	56	7
MPK	2.93	1	0.3	2	1
MPL	3.45	31	9.0	106	31
MPM	3.39	54	15.9	120	35
MPN	3.43	25	7.3	95	28
MPO	7.12	38	5.3	122	17
MPP	6.58	12	1.8	29	4
MPQ	5.97	50	8.4	173	29
MPR	4.02	35	8.7	132	33
MPS	5.64	46	8.2	181	32
MPT	4.28	39	9.1	127	30
MPU	7.24	20	2.8	77	11
MPV	12.20	42	3.4	177	15
MPW	7.56	21	2.8	68	9
MPX	6.71	41	6.1	141	21
MPY	5.59	45	8.0	163	29
MPZ	10.68	47	4.4	132	12
MP Total	**252.29**	**208**	**0.8**	**4,655**	**18**

[1]Stream miles include perennial, ephemeral, and intermittent stream miles

[2]Number of inventory points includes headcut features, which are not accounted for in Table 2-4 and did not receive an impact score.

FIGURE 2-4: SEVERITY OF INVENTORY POINTS PER SUBWATERSHED

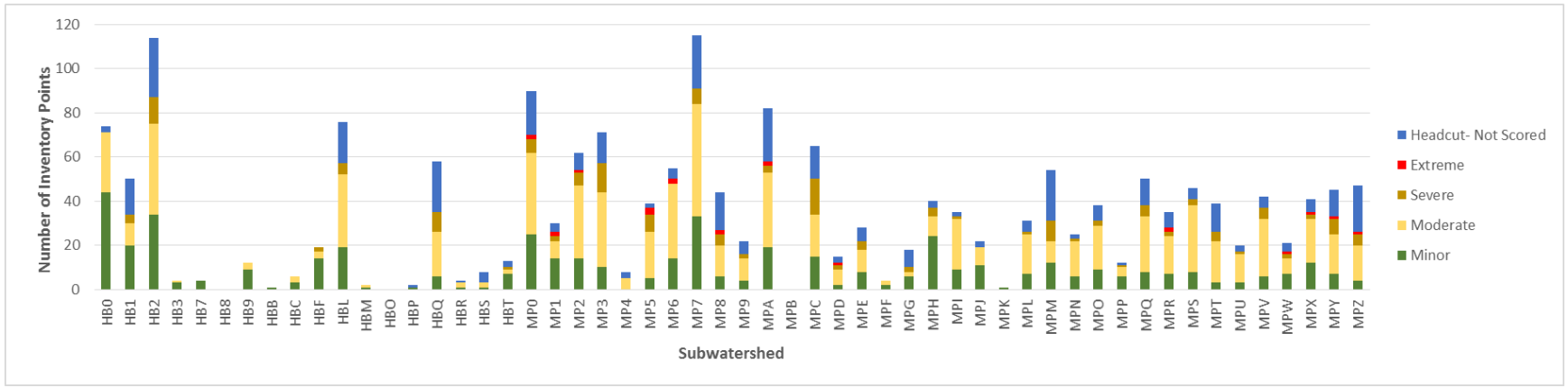
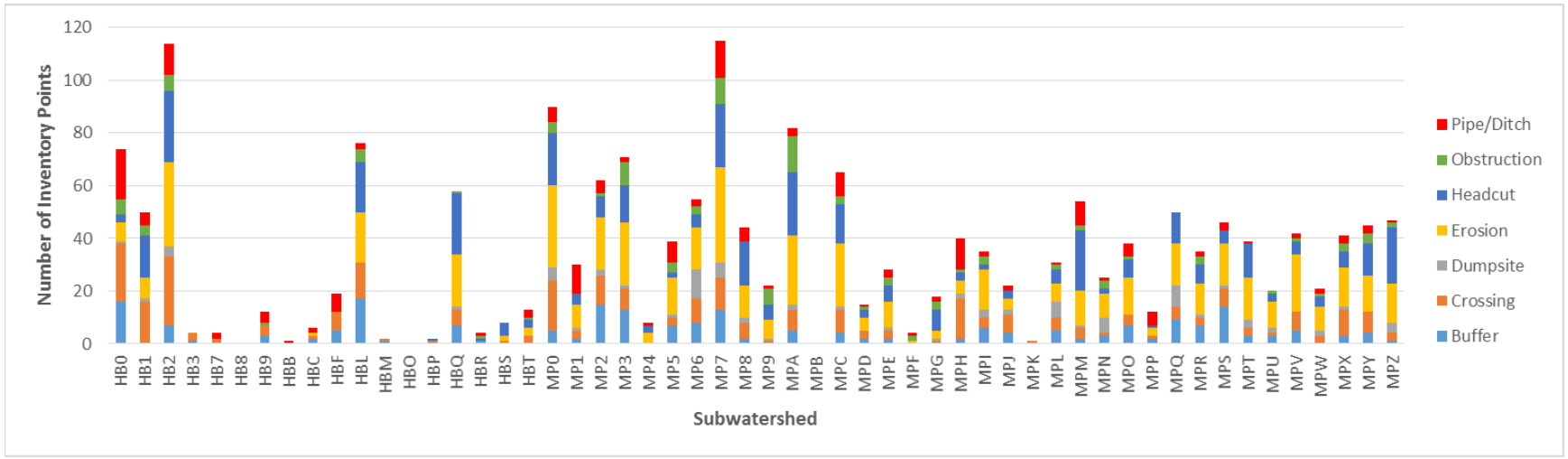


FIGURE 2-5: INVENTORY POINTS PER SUBWATERSHED



2.1.4 FINAL HABITAT SCORE

A Final Habitat Score for each perennial stream reach was calculated using the MPHI scores generated from the physical habitat condition assessment (Section 2.1.2) and the sum of the impact scores generated from the inventory of infrastructure and environmental features (Section 2.1.3). The Final Habitat Score is calculated as follows (Anne Arundel Co., 2003):

$$Final\ Habitat\ Score = MPHI\ Score - 0.5\left(\sum Total\ Impact\ Scores\right)$$

The Final Habitat Score is utilized in the County's subwatershed prioritization assessments, which are discussed in more detail in Section 4. Final Habitat Scores for individual reaches are combined using a reach length-weighted average to assess the physical habitat conditions of perennial streams at the subwatershed level. Similar to the MPHI scoring, each weighted stream reach, and consequently each subwatershed, is assigned a condition category of "Minimally Degraded," "Partially Degraded," "Degraded" or "Severely Degraded." The results of the Final Habitat Scores by reach are presented in Table 2-6. A breakdown of Final Habitat Scores for the subwatersheds that contain assessed perennial streams is presented in Table 2-7 and displayed on Map 2.5. Final habitat scores were not assigned to 12 of the 21 Herring Bay subwatersheds due to the lack of perennial reaches within the subwatersheds. This was either due to permission limitations to access properties which may have contained perennial reaches, or the tidal and wetland nature of these subwatersheds.

No subwatersheds were rated "Severely Degraded" in either watershed. All nine Herring Bay subwatersheds were rated "Partially Degraded". A majority of the Middle and Lower Patuxent subwatersheds (75.0%) were rated "Partially Degraded", followed by "Degraded" (19.4%), and only two subwatersheds were rated "Minimally Degraded" (5.6%).

TABLE 2-6: FINAL HABITAT SCORES BY REACH

Rating[1]	HERRING BAY WATERSHED				MIDDLE AND LOWER PATUXENT WATERSHEDS			
	Number of Reaches	Percent of Reaches	Stream Miles	Percent of Stream Miles	Number of Reaches	Percent of Reaches	Stream Miles	Percent of Stream Miles
Minimally Degraded	11	8.8%	1.5	8.7%	31	6.7%	6.3	8.3%
Partially Degraded	41	32.8%	5.8	33.5%	115	24.8%	17.9	23.6%
Degraded	67	53.6%	9.0	51.6%	306	65.9%	49.5	65.4%
Severely Degraded	6	4.8%	1.1	6.2%	12	2.6%	2.1	2.7%
Total	**125**	**--**	**17.4**	**--**	**464**	**--**	**75.8**	**--**

[1] Using modified MPHI categories as described above in section 2.1.2.

TABLE 2-7: FINAL HABITAT SCORES BY SUBWATERSHED

Rating[1]	HERRING BAY WATERSHED		MIDDLE AND LOWER PATUXENT WATERSHEDS	
	Number of Subwatersheds	Percent of Subwatersheds	Number of Subwatersheds	Percent of Subwatersheds
Minimally Degraded	0	0%	2	5.6%
Partially Degraded	9	100%	27	75.0%
Degraded	0	0%	7	19.4%
Severely Degraded	0	0%	0	0.0%
Total	**9**	**--**	**36**	**--**

[1] Using modified MPHI categories as described above in section 2.1.2.

2.1.5 CHANNEL GEOMORPHOLOGY

Over time, a stable natural stream channel will seek and achieve a state of dynamic equilibrium with its contributing watershed. In such a state, the stream will generally maintain its form and function and will undergo lateral adjustments over long periods of time in response to the range of hydrologic conditions to which it is exposed. During periods of normal flow, the stream can safely and efficiently convey the water and sediment that is directed through it. During periods of high flow, the stream can accommodate large volumes of water effectively by allowing it to overtop the stream banks and flow with dissipated energy through the floodplain. Upstream development patterns, however, can alter the volumes and peak flows conveyed through the stream and upset this dynamic equilibrium.

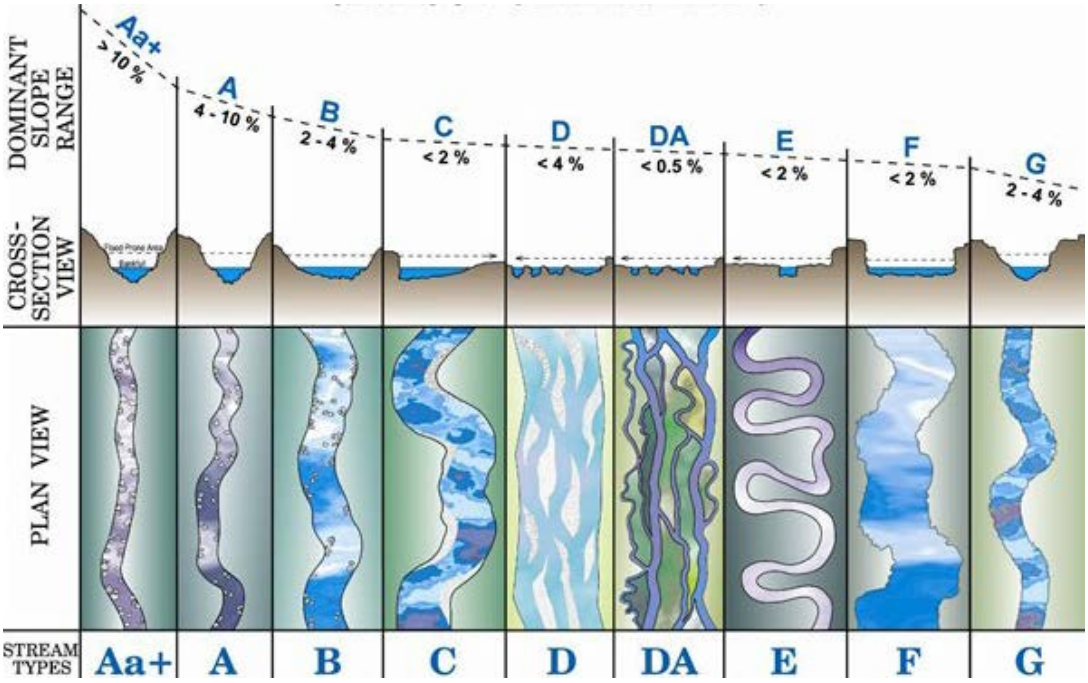
This phenomenon causes the stream to actively erode down its channel bed and banks and eventually lose access to its existing floodplain. This can lead to loss of aquatic and terrestrial habitat, decreased water quality, and greater risk of flood-related damage (including loss of property), as the stream seeks out a new state of equilibrium.

An assessment of channel geomorphology is useful to better understand the stability of a stream and its associated behaviors. The Rosgen classification system is one such assessment method. It provides measurable benchmarks for determining stream stability and for comparing the stream with similar streams in an undisturbed state regardless of their locations. The Rosgen classification system has four levels. The Level I classification is a geomorphic characterization that groups stream as Types A through G based on aspects of channel geometry, including water surface slope, entrenchment, width/depth ratio, and sinuosity. A simplification of the longitudinal, cross-sectional, and plan views of the major stream types under the Rosgen Level I classification scheme (Rosgen, 1994) is presented in Figure 2-6.

The County utilizes Rosgen Level I geomorphic classifications in its watershed modeling and analysis as indicators of stream stability and channel entrenchment. In the study watersheds, field data were collected to support the Rosgen Level I geomorphic classification of each single-threaded reach greater than 75 meters, regardless of perenniality.

These field data were used to support calculation of a Manning's roughness number for each eligible reach using the Cowan method (Cowan, 1956). These calculated Manning's roughness values were used with DEM-derived longitudinal profiles, channel cross-sections, and bankfull discharge calculations to perform the actual Rosgen Level I classification. A County-developed spreadsheet tool was used to facilitate the classifications.

FIGURE 2-6: REPRESENTATION OF ROSGEN LEVEL I CLASSIFICATIONS OF MAJOR STREAM TYPES



Source: Rosgen, 1994

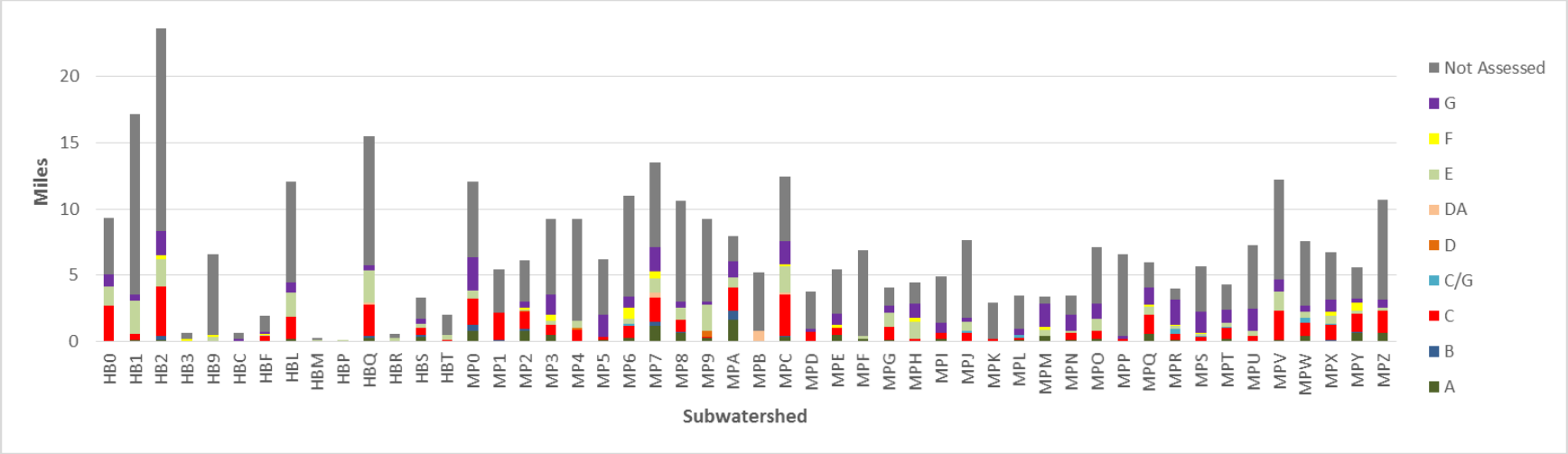
The distribution of Rosgen Level I classifications across the watershed is depicted in Map 2.6 and summarized in Table 2-8 and Figure 2-7. As shown, the majority of stream miles in both watersheds were classified as Type "A", "C", "E", or "G" channels. Type "A" channels have a high slope and were typically found in headwaters in areas with steep slopes. Type "C" channels are typically characterized as moderately stable, having a well-developed floodplain, moderate sinuosity, and a channel slope of 2% or less. Many of the tributary mainstem streams are "C" channels. Type "E" channels are generally stable, low gradient, meandering streams with low width/depth ratios. Type "G" channels are unstable, incised "gully" channels with high erosion rates. It is important to note that not all "C" stream types are stable. Over time, changes in the watershed can transform these relatively stable channels to less stable stream systems such as a "G" type channel. Type "F" channels, while not as predominant are incised and also overwidened. The "F" and "G" channel types are used to define the channels that from a geomorphological standpoint are considered degraded and a high priority for investigation and potential restoration.

A majority of the "G" type channel length was comprised of perennial streams (80%), but a portion was intermittent (14%) and ephemeral (6%). Similarly, majority of the "F" type channels length was comprised of perennial streams (93%), but a portion was intermittent (4%) and ephemeral (3%). This indicates that most of the potentially impaired streams are not located in the headwaters where streams will tend to be classified more routinely as ephemeral or intermittent, but are located further downstream on perennial reaches.

TABLE 2-8: ROSGEN LEVEL I STREAM TYPE CLASSIFICATION

Classification	HERRING BAY WATERSHED			MIDDLE AND LOWER PATUXENT WATERSHEDS		
	Number of Reaches	Stream Miles	Percent of Total Classified Stream Miles	Number of Reaches	Stream Miles	Percent of Total Classified Stream Miles
A	14	1.1	3.5%	169	11.0	10.7%
B	7	0.5	1.6%	20	2.1	2.0%
C	72	12.0	38.2%	180	31.7	31.0%
C/G	0	0.0	0.0%	10	1.5	1.4%
D	0	0.0	0.0%	5	0.7	0.7%
DA	1	0.1	0.4%	4	1.3	1.3%
E	99	11.8	37.6%	155	18.2	17.7%
F	7	0.7	2.3%	24	4.2	4.1%
G	42	5.1	16.3%	228	31.8	31.1%
Total	**242**	**31.3**	--	**795**	**102.4**	--

FIGURE 2-7: MILES OF ROSGEN STREAM TYPE CLASSIFICATION PER SUBWATERSHED



2.1.6 ROAD CROSSING FLOOD POTENTIAL

Flooding where streams and roadways cross can be a safety hazard to residents due to high water levels and has the potential to isolate properties from emergency vehicle access. Roadway stream crossings throughout the Herring Bay and Middle Patuxent watersheds were analyzed to assess the potential for flooding and the need for replacement or modification. An initial subset of stream crossings with the potential for overtopping was identified during fieldwork activities. Potential sites were then evaluated against the County's established selection criteria which include:

1. The crossing must be owned by the County.
2. Roadways at the crossing included all classifications in the County's Master Transportation Plan, including Freeway, Principal Arterial, Minor Arterial, Collector, Local, or TBD.
3. If flooding will completely cut off an area from emergency services where the stream crosses a single or multiple access point(s) to a community or business area.
4. If overtopping is likely, determined by both the height of the road surface above the top of the structure and the channel and floodplain characteristics. In general, the vertical distance between top of roadway and stream water surface should be less than 20 feet to consider it for selection, under the assumption that high stream crossings would not represent the most imminent flooding hazards.

A total of 295 crossings were evaluated against the selection criteria, however, 245 crossings did not meet the County ownership criteria and were thus eliminated. The remaining 50 crossings were identified as being County-owned. Of the 50 retained, 1 site (MP7050.C002) is a bridge and cannot be adequately modeled using HY-8. Ten sites did not isolate communities or businesses, 18 sites were not likely to overtop, and 6 sites would neither isolate nor have a high likelihood of overtopping. Consequently, 35 sites were eliminated, leaving 15 sites selected for field survey. See Appendix A for the complete description of the selection process. During the field visit of one site, HB0014.C001, it was determined that the site was tidally influenced and could not be adequately modeled using HY-8. Therefore, this site was eliminated from consideration. The final 14 crossings modeled are shown in Table 2-9.

Of those surveyed and modeled using HY-8 culvert analysis, none of the sites were determined to overtop at less than the 2 year storm. One site (HBF005.C001), however, was determined to overtop between the 2 and 10 year event. This crossing will be investigated further for remedial actions. See Maps 2.6a, 2.6b, and 2.6c for crossing locations and results.

TABLE 2-9: FLOODING POTENTIAL OF SELECTED ROAD CROSSINGS

Crossing ID	Drainage Area (sq mi)	1 Year (cfs)	2 Year (cfs)	10 Year (cfs)	100 Year (cfs)	Overtopping Discharge (cfs)	Overtopping Frequency
Mallard Dr (HB0022.C001)	0.0762	15	21	45	97	58	Between 10 and 100 years
Swamp Circle Rd (HB0022.C002)	0.0368	7	11	24	56	36	Between 10 and 100 years
Mimosa Cove Rd (HBF001.C001)	0.0480	15	22	45	95	92	Between 10 and 100 years

Crossing ID	Drainage Area (sq mi)	1 Year (cfs)	2 Year (cfs)	10 Year (cfs)	100 Year (cfs)	Overtopping Discharge (cfs)	Overtopping Frequency
Masons Beach Rd (HBF005.C001)	0.0531	15	21	42	86	35	Between 2 and 10 years
Lower Pindell Rd (MP0023.C001)	1.1216	30	53	154	429	249	Between 10 and 100 years
Upper Pindell Rd (MP0030.C001)	0.1776	11	22	74	218	114	Between 10 and 100 years
Sands Rd (MP1001.C001)	0.3386	8	16	54	163	517	Over 100 years
Sands Rd (MP1008.C001)	1.9577	41	69	189	513	651	Over 100 years
Lower Pindell Rd (MP8027.C002)	0.1000	10	18	54	148	87	Between 10 and 100 years
Pindell Rd (MPA001.C001)	0.0395	10	17	40	96	80	Between 10 and 100 years
Cottonwood Dr (MPO020.C001)	0.1177	7	14	44	124	184	Over 100 years
Sigma Dr (MPV001.C001)	0.4104	17	31	96	275	396	Over 100 years
Princes Ln (MPV001.C002)	0.3432	16	31	100	289	267	Between 10 and 100 years
Pindell Rd (MPW016.C001)	0.1737	10	19	58	161	80	Between 10 and 100 years

2.1.7 BIOASSESSMENT

The County has conducted both random and targeted sampling of the Herring Bay and Middle Patuxent watersheds. As part of the full Countywide bioassessment program, random samples were collected in 2005 and 2010 in the Herring Bay watershed and in 2004, 2005, 2006, 2008, 2010, 2012, and 2013 in the Middle Patuxent watershed. To supplement the random sampling program, targeted sampling was also conducted in 2013 and 2016 within the Herring Bay and Middle and Lower Patuxent watersheds, respectively. The full targeted sampling summary reports are included as Appendix B. Links to Round 1 and 2 reports can be found at www.aarivers.org.

Benthic macroinvertebrate collection follows the County's Quality Assurance Project Plan (QAPP) which closely mirrors Maryland Department of Natural Resources (MDNR) Maryland Biological Stream Survey (MBSS) procedures as described in the MBSS manual (Southerland et al., 2005). The monitoring sites include a 75-meter reach and benthic macroinvertebrate sampling is conducted during the spring season (March 1st through April 30th). At each 75- meter sampling site, benthic macroinvertebrates were collected using a D-frame net from a combination of habitats that support the most diverse macroinvertebrate community within a sampling segment, as per MBSS protocols. At each site, 20 "jabs" of the net, totaling 20 square feet of substrate, were distributed amount available habitats, including submerged vegetation, overhanging bank vegetation, leaf packs, organic mats, stream bed substrate, submerged woody debris, and rocks. The 20 jabs were composited into a single macroinvertebrate sampling, which were preserved in the field for laboratory identification.

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. Three sets of metric calculations have been developed for Maryland streams based on broad physiographic regions. These include the coastal plain, piedmont, and combined highlands regions, divided by the Fall Line. This study area is located in the coastal plain region. Metrics included in the BIBI are detailed in Table 2-10.

TABLE 2-10: MBSS COASTAL PLAIN BIBI METRICS AND DESCRIPTION

Metric	Description
Total Number of Taxa	Measures the overall variety of the macroinvertebrate assemblage
Number of EPT Taxa	Number of taxa in the insect orders Ephemeroptera (mayflies), Plecoptera (stoneflies), and Trichoptera (caddisflies)
Number of Ephemeroptera Taxa	Number of mayfly taxa
Percent Intolerant Urban	Percent of sample considered intolerant to urbanization (tolerance values 0-3)
Percent Ephemeroptera	Percent mayfly nymphs
Number Scraper Taxa	Number of taxa that scrape food from substrate
Percent Climbers	Percent of sample that primarily lives on stem type surfaces

MBSS attributes for each identified taxa, including functional feeding group, habitat preference, and tolerance values, were used to compute BIBI metrics. For each BIBI metric at each site, raw values were assigned a score of 1,3, or 5 based on ranges of values developed for each metric (Table 2-11).

TABLE 2-11: SCORING CRITERIA FOR METRICS IN THE MBSS COASTAL PLAIN BIBI

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	1-1	<1
Percent Intolerant to Urban Taxa	≥28	10-27	<10
Percent Ephemeroptera Taxa	≥11	0.8-10.9	<0.8
Number Scraper Taxa	≥2	1-1	<1
Percent Climber Taxa	≥8	0.9-7.9	<0.9

Scores for each metric were averaged to give a scaled BIBI score ranging from 1.0 to 5.0 and a corresponding narrative rating (Table 2-12).

TABLE 2-12: BIBI SCORING AND RATING

BIBI Score	Narrative Rating
4.0 – 5.0	Good
3.0 – 3.9	Fair
2.0 – 2.9	Poor
1.0 – 1.9	Very Poor

The Herring Bay watershed was sampled in 2005 as part of the County's Round 1 random sampling efforts (n=10), in 2010 as part of the County's Round 2 random sampling efforts (n=10), and in 2013 as part of the County's targeted sampling efforts (n=24) (Table 2-13). BIBI scores within the Herring Bay watershed ranged from a low of 1.0 (Very Poor) to a high of 4.7 (Good). Across all sampling years, BIBI scores in the Herring Bay watershed were comprised of four "Good" sites (9%), seven "Fair" sites (16%), 16 "Poor" sites (36%), and 17 "Very Poor" sites (39%) (Figure 2-8).

The Middle Patuxent watershed was sampled from 2004 to 2013 as part of the County's Round 1 and Round 2 random sampling efforts. Targeted Middle Patuxent sites were also sampled by the County in 2016 (Table 2-13). Across all sampling years, BIBI scores in the Middle Patuxent watershed ranged from 1.0 (Very Poor) to 5.0 (Good). Of the 157 sites sampled, BIBI scores were rated as "Good" at 17 sites (11%), "Fair" at 63 sites (40%), "Poor" at 50 sites (32%), and "Very Poor" at 27 sites (17%) (Figure 2-9).

Map 2.8 provides the site locations and ratings for the random and targeted sampling from 2004 to 2016.

TABLE 2-13: BIOLOGICAL STREAM ASSESSMENT SUMMARY

Subwatershed	Sample ID	Study	BIBI Score	Ranking
HERRING BAY WATERSHED				
HB0	15-06	2005 Round 1	2.1	Poor
HB1	15-03	2005 Round 1	2.7	Poor
HB2	15-11A	2005 Round 1	1.6	Very Poor
HB2	15-05	2005 Round 1	1.9	Very Poor
HB2	15-07	2005 Round 1	2.4	Poor
HB2	15-04	2005 Round 1	2.7	Poor
HB2	15-12A	2005 Round 1	3.6	Fair
HB2	15-19A	2005 Round 1	4.4	Good
HB2	15-20A	2005 Round 1	4.4	Good
HBQ	15-01	2005 Round 1	1.9	Very Poor
HB1	R2-15-07	2010 Round 2	3.6	Fair
HB1	R2-15-09	2010 Round 2	4.7	Good
HB2	R2-15-13A	2010 Round 2	1.6	Very Poor
HB2	R2-15-05	2010 Round 2	2.1	Poor
HB2	R2-15-02	2010 Round 2	3.0	Fair
HB2	R2-15-08	2010 Round 2	3.3	Fair
HB2	R2-15-01	2010 Round 2	3.9	Fair
HB2	R2-15-10	2010 Round 2	4.4	Good
HBL	R2-15-03	2010 Round 2	2.4	Poor
HBQ	R2-15-12A	2010 Round 2	2.7	Poor
HB0	HB-01-2013	2013 Targeted	1.0	Very Poor
HB0	HB-02-2013	2013 Targeted	1.9	Very Poor
HB1	HB-03-2013	2013 Targeted	1.6	Very Poor
HB1	HB-04-2013	2013 Targeted	1.9	Very Poor
HB1	HB-36-2013	2013 Targeted	2.7	Poor
HB2	HB-06-2013	2013 Targeted	2.4	Poor
HB2	HB-05-2013	2013 Targeted	3.3	Fair
HB3	HB-07-2013	2013 Targeted	1.3	Very Poor
HB7	HB-31-2013	2013 Targeted	1.0	Very Poor
HB7	HB-10-2013	2013 Targeted	1.3	Very Poor
HB7	HB-09-2013	2013 Targeted	2.4	Poor
HB8	HB-13-2013	2013 Targeted	2.4	Poor
HB9	HB-12-2013	2013 Targeted	1.6	Very Poor
HB9	HB-14-2013	2013 Targeted	1.6	Very Poor
HBC	HB-49-2013	2013 Targeted	2.1	Poor
HBF	HB-19-2013	2013 Targeted	1.6	Very Poor
HBL	HB-20-2013	2013 Targeted	2.4	Poor
HBL	HB-21-2013	2013 Targeted	2.4	Poor

Subwatershed	Sample ID	Study	BIBI Score	Ranking
HBO	HB-47-2013	2013 Targeted	1.0	Very Poor
HBO	HB-23-2013	2013 Targeted	3.0	Fair
HBQ	HB-48-2013	2013 Targeted	1.6	Very Poor
HBQ	HB-25-2013	2013 Targeted	2.4	Poor
HBS	HB-41-2013	2013 Targeted	1.9	Very Poor
HBS	HB-50-2013	2013 Targeted	2.1	Poor
MIDDLE AND LOWER PATUXENT WATERSHEDS				
MP4	21-09	2004 Round 1	3.0	Fair
MP4	21-07	2004 Round 1	3.9	Fair
MP4	21-08	2004 Round 1	4.1	Good
MP4	21-03	2004 Round 1	4.4	Good
MP5	21-05	2004 Round 1	3.0	Fair
MP5	21-02	2004 Round 1	3.6	Fair
MP7	21-10	2004 Round 1	2.1	Poor
MPD	21-01	2004 Round 1	2.4	Poor
MPO	21-06	2004 Round 1	3.3	Fair
MPP	21-04	2004 Round 1	2.1	Poor
MP6	22-05	2005 Round 1	2.4	Poor
MP6	22-04	2005 Round 1	3.0	Fair
MP6	22-17A	2005 Round 1	3.3	Fair
MPH	22-09	2005 Round 1	3.0	Fair
MPI	22-11A	2005 Round 1	3.6	Fair
MPI	22-01	2005 Round 1	4.1	Good
MPJ	22-03	2005 Round 1	1.6	Very Poor
MPJ	22-06	2005 Round 1	1.9	Very Poor
MPJ	22-02	2005 Round 1	2.4	Poor
MPN	22-16A	2005 Round 1	2.4	Poor
MPC	24-04	2006 Round 1	1.9	Very Poor
MPC	24-02	2006 Round 1	2.1	Poor
MPC	24-06	2006 Round 1	2.4	Poor
MPC	24-08	2006 Round 1	2.4	Poor
MPX	24-13A	2006 Round 1	1.9	Very Poor
MPY	24-11A	2006 Round 1	2.7	Poor
MPY	24-10	2006 Round 1	3.3	Fair
MPY	24-05	2006 Round 1	3.6	Fair
MPY	24-09	2006 Round 1	3.6	Fair
MPY	24-07	2006 Round 1	3.9	Fair
MP0	23-02	2008 Round 1	2.1	Poor
MP0	23-06	2008 Round 1	2.4	Poor
MP0	23-01	2008 Round 1	3.0	Fair

Subwatershed	Sample ID	Study	BIBI Score	Ranking
MP1	20-02	2008 Round 1	4.4	Good
MP2	20-04	2008 Round 1	1.9	Very Poor
MP2	20-10	2008 Round 1	3.0	Fair
MP2	20-06	2008 Round 1	3.6	Fair
MP3	20-03	2008 Round 1	1.3	Very Poor
MP3	20-01	2008 Round 1	1.9	Very Poor
MP3	20-08	2008 Round 1	2.4	Poor
MP8	23-10A	2008 Round 1	2.1	Poor
MPA	23-13A	2008 Round 1	3.3	Fair
MPQ	23-09	2008 Round 1	2.4	Poor
MPR	23-03	2008 Round 1	1.6	Very Poor
MPT	23-04	2008 Round 1	2.1	Poor
MPT	23-05	2008 Round 1	2.1	Poor
MPU	20-05	2008 Round 1	2.1	Poor
MPU	20-07	2008 Round 1	2.1	Poor
MPV	20-11A	2008 Round 1	1.6	Very Poor
MPW	23-07	2008 Round 1	1.9	Very Poor
MP4	R2-21-01	2010 Round 2	3.3	Fair
MP5	R2-21-04	2010 Round 2	3.0	Fair
MP5	R2-21-03	2010 Round 2	3.3	Fair
MP5	R2-21-05	2010 Round 2	3.6	Fair
MP7	R2-21-10	2010 Round 2	2.7	Poor
MP7	R2-21-06	2010 Round 2	3.0	Fair
MPD	R2-21-14A	2010 Round 2	2.1	Poor
MPO	R2-21-15A	2010 Round 2	2.1	Poor
MPO	R2-21-07	2010 Round 2	3.0	Fair
MPO	R2-21-13A	2010 Round 2	3.0	Fair
MPC	R2-24-12A	2012 Round 2	1.6	Very Poor
MPC	R2-24-04	2012 Round 2	1.9	Very Poor
MPC	R2-24-03	2012 Round 2	2.7	Poor
MPC	R2-24-05	2012 Round 2	2.7	Poor
MPC	R2-24-10	2012 Round 2	2.7	Poor
MPC	R2-24-09	2012 Round 2	3.6	Fair
MPX	R2-24-11A	2012 Round 2	1.0	Very Poor
MPX	R2-24-13A	2012 Round 2	1.6	Very Poor
MPY	R2-24-06	2012 Round 2	1.6	Very Poor
MPY	R2-24-08	2012 Round 2	3.0	Fair
MP0	R2-23-04	2013 Round 2	2.7	Poor
MP0	R2-23-05	2013 Round 2	3.9	Fair
MP0	R2-23-08	2013 Round 2	3.9	Fair

Subwatershed	Sample ID	Study	BIBI Score	Ranking
MP6	R2-22-12A	2013 Round 2	2.1	Poor
MP6	R2-22-08	2013 Round 2	3.9	Fair
MP6	R2-22-09	2013 Round 2	3.9	Fair
MP6	R2-22-21A	2013 Round 2	4.1	Good
MP8	R2-23-12A	2013 Round 2	3.6	Fair
MPA	R2-23-01	2013 Round 2	4.4	Good
MPF	R2-22-03	2013 Round 2	1.9	Very Poor
MPG	R2-22-01	2013 Round 2	3.0	Fair
MPG	R2-22-10	2013 Round 2	3.9	Fair
MPH	R2-22-27A	2013 Round 2	2.1	Poor
MPN	R2-22-02	2013 Round 2	1.6	Very Poor
MPN	R2-22-19A	2013 Round 2	3.6	Fair
MPQ	R2-23-10	2013 Round 2	3.3	Fair
MPQ	R2-23-03	2013 Round 2	4.1	Good
MPR	R2-23-09	2013 Round 2	1.9	Very Poor
MPR	R2-23-07	2013 Round 2	2.4	Poor
MPT	R2-23-06	2013 Round 2	3.3	Fair
MP0	MP134A	2016 Targeted	1.6	Very Poor
MP0	MP60	2016 Targeted	3.3	Fair
MP1	MP02	2016 Targeted	3.6	Fair
MP1	MP01	2016 Targeted	4.1	Good
MP2	MP03	2016 Targeted	3.0	Fair
MP2	MP04	2016 Targeted	3.9	Fair
MP3	MP08	2016 Targeted	2.1	Poor
MP3	MP07	2016 Targeted	3.9	Fair
MP4	MP79A	2016 Targeted	3.6	Fair
MP4	MP11	2016 Targeted	3.9	Fair
MP5	MP13	2016 Targeted	4.4	Good
MP5	MP80A	2016 Targeted	4.4	Good
MP6	MP126A	2016 Targeted	3.0	Fair
MP6	MP53	2016 Targeted	3.6	Fair
MP7	MP34	2016 Targeted	2.4	Poor
MP7	MP33	2016 Targeted	3.3	Fair
MP8	MP57	2016 Targeted	3.0	Fair
MP8	MP132A	2016 Targeted	4.4	Good
MP9	MP35	2016 Targeted	3.0	Fair
MP9	MP36	2016 Targeted	3.9	Fair
MPA	MP61	2016 Targeted	4.1	Good
MPA	MP62	2016 Targeted	4.1	Good
MPC	LP09A	2016 Targeted	2.4	Poor

Subwatershed	Sample ID	Study	BIBI Score	Ranking
MPC	LP02	2016 Targeted	3.6	Fair
MPD	MP24	2016 Targeted	2.4	Poor
MPD	MP23	2016 Targeted	3.0	Fair
MPE	MP98A	2016 Targeted	2.4	Poor
MPE	MP22	2016 Targeted	3.0	Fair
MPF	MP112A	2016 Targeted	2.1	Poor
MPG	MP51	2016 Targeted	4.7	Good
MPG	MP124A	2016 Targeted	5.0	Good
MPH	MP117A	2016 Targeted	1.9	Very Poor
MPH	MP118A	2016 Targeted	3.9	Fair
MPI	MP42	2016 Targeted	2.7	Poor
MPI	MP113A	2016 Targeted	3.0	Fair
MPJ	MP26	2016 Targeted	2.4	Poor
MPJ	MP25	2016 Targeted	2.7	Poor
MPK	MP92A	2016 Targeted	1.9	Very Poor
MPL	MP119A	2016 Targeted	2.1	Poor
MPL	MP48	2016 Targeted	3.0	Fair
MPM	MP121A	2016 Targeted	1.3	Very Poor
MPM	MP50	2016 Targeted	1.3	Very Poor
MPN	MP44	2016 Targeted	2.7	Poor
MPN	MP43	2016 Targeted	3.6	Fair
MPO	MP16	2016 Targeted	2.1	Poor
MPO	MP15	2016 Targeted	2.4	Poor
MPP	MP88A	2016 Targeted	1.9	Very Poor
MPP	MP86A	2016 Targeted	2.1	Poor
MPQ	MP128A	2016 Targeted	3.6	Fair
MPQ	MP129A	2016 Targeted	3.9	Fair
MPR	MP37	2016 Targeted	1.9	Very Poor
MPR	MP38	2016 Targeted	2.4	Poor
MPS	MP97A	2016 Targeted	2.1	Poor
MPS	MP31	2016 Targeted	3.3	Fair
MPT	MP109A	2016 Targeted	3.0	Fair
MPT	MP39	2016 Targeted	3.9	Fair
MPU	MP06	2016 Targeted	2.7	Poor
MPU	MP05	2016 Targeted	3.3	Fair
MPV	MP71A	2016 Targeted	2.4	Poor
MPV	MP09	2016 Targeted	3.0	Fair
MPW	MP103A	2016 Targeted	2.4	Poor
MPW	MP64	2016 Targeted	4.4	Good
MPX	LP04	2016 Targeted	1.0	Very Poor

Subwatershed	Sample ID	Study	BIBI Score	Ranking
MPY	LP11A	2016 Targeted	1.9	Very Poor
MPY	LP06	2016 Targeted	2.1	Poor
MPZ	MP19	2016 Targeted	2.1	Poor
MPZ	MP139A	2016 Targeted	4.4	Good

Overall, BIBI results indicated substantial impairment within the Herring Bay watershed. In three of the four years sampled, the majority of sites received "Poor" or "Very Poor" ratings. As a whole, BIBI scores within the Middle and Lower Patuxent watershed also indicated impairment, as the majority of the sites were rated as "Poor" or "Fair".

FIGURE 2-8: BIOASSESSMENT RATINGS BY YEAR AND STUDY WITHIN THE HERRING BAY WATERSHED

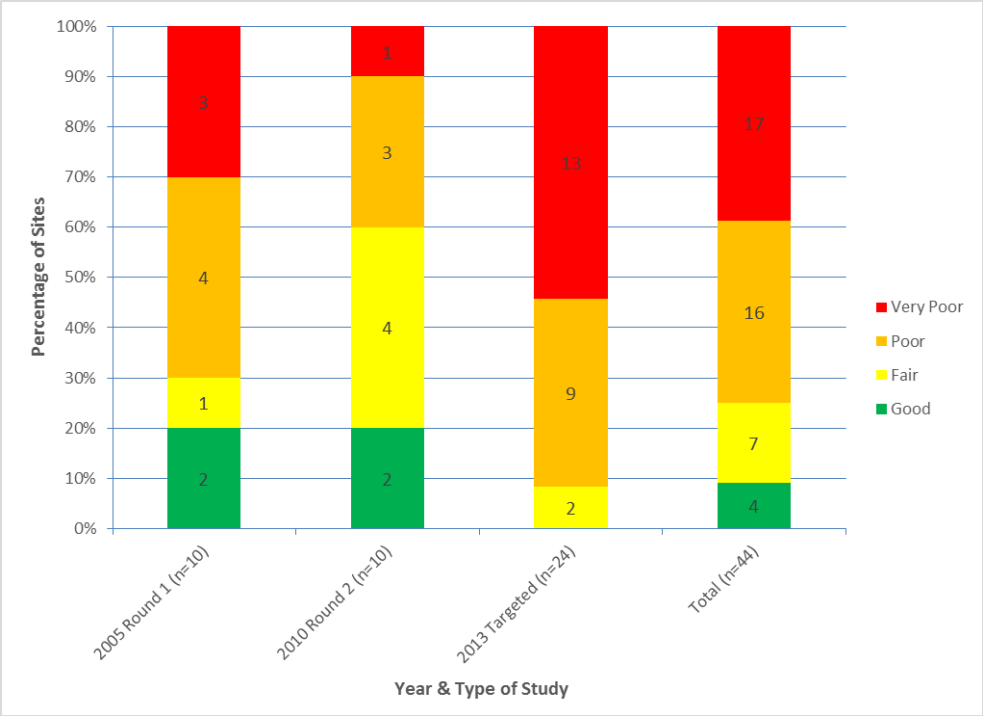
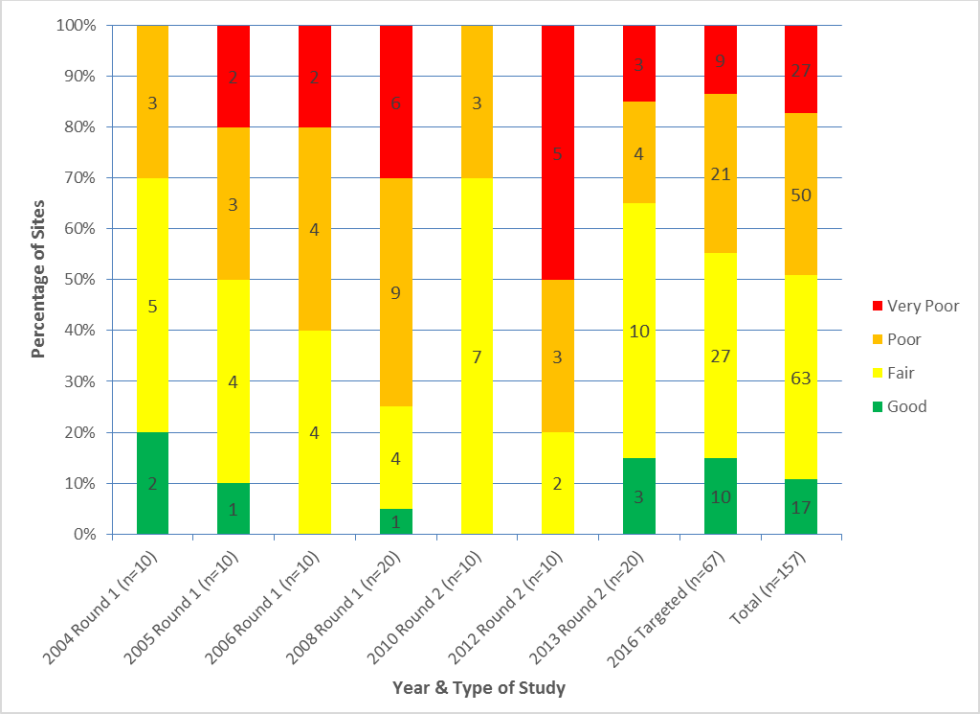


FIGURE 2-9: BIOASSESSMENT RATINGS BY YEAR AND STUDY WITHIN THE MIDDLE AND LOWER PATUXENT WATERSHED



2.1.8 AQUATIC RESOURCE INDICATORS

Areas that support trout spawning, anadromous fish spawning, and threatened and endangered species are all considered high-quality sensitive habitat that should be preserved. The locations of each of these sensitive habitat types in the Herring Bay and Middle and Lower Patuxent watersheds were provided by MDNR and supplemented with additional information from the County. The threatened and endangered species habitat was represented by the Natural Heritage Program's Sensitive Species Project Review Areas (SSPRA). The County overlaid GIS data with locations of these sensitive habitat areas to obtain a single representative GIS layer of all three aquatic resource indicators.

No subwatersheds within the Herring Bay watershed had aquatic resource indicators rated as "High" or "Medium High", however 13 subwatersheds (62%) were rated as "Low" and the remaining eight subwatersheds (38%) were rated as "Medium". In the Middle Patuxent watershed, 12 subwatersheds (33%) were rated as "Low", 18 subwatersheds (50%) were rated as "Medium High" and the remaining 6 subwatersheds (17%) were rated as "High". A summary of aquatic resource ratings is provided in Table 2-14. Subwatershed ratings for aquatic resources are presented in Map 2.9 in which preservation values of "Low" are represented by the green coloration, "Medium" are represented by yellow, "Medium High" is represented by orange, and "High" is represented by red.

TABLE 2-14: AQUATIC RESOURCE INDICATOR RATINGS

Rating	HERRING BAY WATERSHED		MIDDLE AND LOWER PATUXENT WATERSHEDS	
	Number of Subwatersheds	Percent of Subwatersheds	Number of Subwatersheds	Percent of Subwatersheds
High	0	0%	6	17%
Medium High	0	0%	18	50%
Medium	8	38%	0	0%
Low	13	62%	12	33%
Total	**21**	**--**	**36**	**--**

2.2 Upland Data Collection and Compilation

2.2.1 Contributory Impervious Cover to Streams

Links have been well established between the level of impervious cover within a drainage area and the overall health of downgradient water bodies. The Center for Watershed Protection (CWP) suggested that streams with greater than 25% tributary impervious cover are typically considered impaired or non-supporting; streams with 10 to 25% impervious cover are typically considered stressed or impacted, and streams with less than 10% imperviousness can support sensitive habitat and are typically relatively unimpaired (Schueler, 1992). The County utilized its impervious cover GIS layer based on 2014 aerial photography to calculate the impervious percent cover within the drainage area of all assessed perennial reaches. Based on the guidance discussed above from CWP, each perennial reach was assigned a rating of "Sensitive", "Impacted," or "Non-Supporting" related to its percent impervious cover. Approximately 89% of the stream reaches in the Middle Patuxent watershed were rated "Sensitive", 11% were rated "Impacted", and less than 1% were rated "Non-Supporting". In the Herring Bay watershed, 90% of the stream reaches were rated "Sensitive", 5% were rated "Impacted", and 5% were rated "Non-Supporting". A summary of impervious cover ratings is provided in Table 2-15. As described earlier, a map depicting impervious cover throughout the watershed is presented in Map 1.9.

TABLE 2-15: IMPERVIOUS COVER RATINGS, PERENNIAL REACHES PER INDICATOR VALUE

CWP Rating Category (% impervious cover)	HERRING BAY WATERSHED		MIDDLE AND LOWER PATUXENT WATERSHEDS	
	Number of Reaches	Percent of Reaches	Number of Reaches	Percent of Reaches
Sensitive (0-10%)	112	90%	412	89%
Impacted (10-19%)	6	5%	41	9%
Impacted (19-25%)	0	0%	7	2%
Non-Supporting (>25%)	6	5%	2	<1%

2.2.2 Urban Stormwater Best Management Practices

Urban stormwater BMPs are utilized throughout the County to intercept, retain, drain, and/or treat stormwater prior to discharge to receiving water bodies. The installation of structural or nonstructural BMPs is required in all new development areas and in certain individual lot developments. The level of requisite stormwater management (e.g. recharge volume, water quality volume, channel protection volume, etc.) is dependent on development size, proximity to Critical Areas, and downstream conditions, among other considerations. Redevelopment sites also have stormwater management requirements, which can be met by

actual reductions in impervious cover or effective reductions in impervious cover through BMP implementation, BMP upgrades, or other restoration activities (Anne Arundel Co. OPZ, 2017). In addition to stormwater management efforts triggered by development or redevelopment requirements, the County also regularly retrofits publicly-owned property with BMPs as part of its capital improvement program and its watershed management planning activities.

The County maintains a spatially-accurate, GIS inventory dataset of all existing public and private stormwater BMPs. This data was used to help analyze the level of stormwater management within the study watersheds. This analysis is critical for identifying areas within the watersheds that are under-managed and for guiding future retrofit and BMP implementation efforts. The BMP inventory dataset contained accurate and up-to-date information on the location, type, drainage area, and ownership information of stormwater BMPs.

BMPs in the Herring Bay and Middle Patuxent watersheds are grouped by the County into six major categories according to their primary mechanism of action. These categories include “Environmental Site Design”, “Filtering Systems”, “Infiltration”, “Open Channels”, “Ponds”, and “Other Practices”. A list of general BMP types that fall under each of these categories is included in Table 3-4 in Section 3. The County’s GIS inventory dataset includes a total of 517 BMPs within the Herring Bay watershed; these BMPs treat a total drainage area of approximately 100.6 acres. In the Middle Patuxent watershed, a total of 658 BMPs collectively treat a drainage area of approximately 248.4 acres, according to the County’s GIS inventory dataset. A breakdown of BMP types and their drainage areas is presented in Table 2-16. A map of BMPS located throughout the watershed is presented as Map 2.10.

Approximately 349 acres, or 0.8%, of the area of the Herring Bay and Middle Patuxent watersheds receives water quality management (storage and attenuation of runoff) or water quality treatment (pollutant removal) through a BMP. The BMP drainage areas range in size from less than 0.01 acre to 34.64 acres, with an average drainage area of 0.30 acres. This indicates that many of the BMPs are small in size.

TABLE 2-16: SUMMARY OF BMPS BY TYPE

BMP Category	Quantity	Percent by Quantity	Total Managed Drainage Area (Acres)	Percent by Drainage Area	Average Drainage Area (Acres)	Minimum Drainage Area (Acres)	Maximum Drainage Area (Acres)
HERRING BAY WATERSHED							
Environmental Site Design	466	90%	44.7	44%	0.9	<0.0	11.3
Filtering Systems	13	3%	3.3	3%	0.3	<0.0	1.1
Infiltration	25	5%	4.6	5%	0.2	<0.0	0.9
Open Channels	9	2%	4.9	5%	0.5	0.1	1.1
Other Practices	2	<0%	0.5	<0%	0.2	0.2	0.3
Ponds	2	<0%	42.6	42%	21.3	7.9	34.6
Herring Bay Total	**517**	--	**100.6**	--	--	--	--
MIDDLE AND LOWER PATUXENT WATERSHEDS							
Environmental Site Design	467	71%	53.4	21%	0.8	0.0	4.8
Filtering Systems	18	3%	14.7	6%	0.8	0.0	10.5
Infiltration	122	19%	92.6	37%	0.8	0.0	22.7
Open Channels	44	7%	27.9	11%	0.6	0.0	2.7

BMP Category	Quantity	Percent by Quantity	Total Managed Drainage Area (Acres)	Percent by Drainage Area	Average Drainage Area (Acres)	Minimum Drainage Area (Acres)	Maximum Drainage Area (Acres)
Other Practices	2	0%	17.4	7%	8.7	2.0	15.4
Ponds	4	1%	32.4	13%	8.1	0.4	13.0
Wetlands	1	0%	10.0	4%	10.0	10.0	10.0
Middle and Lower Patuxent Total	**658**	**--**	**248.4**	**--**	**--**	**--**	**--**

The stormwater BMPs in the Herring Bay and Middle Patuxent watersheds are typically owned by private land owners, the County, or other State agencies, such as the Maryland State Highway Administration (SHA). A breakdown of BMP types and ownership is presented in Table 2-17. The majority of BMPs in both watersheds are privately owned (93% in Herring Bay, 84% in Middle and Lower Patuxent). Publicly owned (County, SHA, or other State agency) BMPs comprise the remainder of the BMPS. However, when evaluated by the percent of the drainage area that they manage or treat in the watersheds, private BMPS cover 72% of the managed areas within the Herring Bay watershed and 60% of the managed areas within the Middle and Lower Patuxent watersheds. The Maryland State Highway Administration BMPs account for a significant portion managed drainage areas within the Middle and Lower Patuxent watersheds (55%). Many of the privately owned BMPs are small bioretention cells, small environmental site design facilities (e.g. rain gardens and dry wells), and disconnection of rooftop and non-rooftop runoff that serve to manage runoff from single rooftops or other impervious areas associated with residential properties.

TABLE 2-17: SUMMARY OF BMPS BY OWNER

Ownership	Quantity	Percent by Quantity	Total Managed Drainage Area (acres)	Percent by Drainage Area	Average Drainage Area (acres)	Minimum Drainage Area (acres)	Maximum Drainage Area (acres)
HERRING BAY WATERSHED							
County	29	6%	69.8	69%	2.4	0.0	34.6
Private	482	93%	28.1	28%	0.1	0.0	2.4
SHA	6	1%	2.7	3%	0.4	0.1	1.0
Total/Average	**517**	**--**	**100.6**	**--**	**1.0**	**0.0**	**34.6**
MIDDLE AND LOWER PATUXENT WATERSHEDS							
County	15	2%	12.5	5%	0.8	0.0	10.5
Private	551	84%	99.6	40%	0.2	0.0	15.4
SHA	89	14%	135.9	55%	1.5	0.0	22.7
State	3	0%	0.3	0%	0.1	0.1	0.2
Total/Average	**658**	**--**	**248.4**	**--**	**0.7**	**0.0**	**22.7**

2.2.3 ONSITE SEWAGE DISPOSAL SYSTEMS

OSDSs (i.e. septic systems) can contribute high levels of nutrients, particularly nitrogen and bacteria, to downstream water bodies via subsurface migration. This is especially true for older or poorly maintained OSDSs. In 2008, the County conducted a study to evaluate service options for properties with OSDSs and to develop a cost-effective approach to reducing pollutant loads from OSDSs (Anne Arundel Co., 2008). As part of this study, the locations and basic characteristics of OSDSs throughout the County were identified. This information was used with data on per capita loading to quantify aggregate pollutant loads from OSDSs across the Herring Bay and Middle Patuxent watersheds.

The 2008 OSDS study noted that the Herring Bay watershed has 1,041 OSDSs and the Middle and Lower Patuxent has 2,206 OSDSs, which represents approximately 2.6% and 5.4% of the OSDS County-wide, respectively. These systems contribute 33,406 lbs of total nitrogen annually to streams within the Herring Bay watershed, and 63,439 lbs of nitrogen annual within the Middle and Lower Patuxent watershed.

The 2008 OSDS study also identifies the most cost-effective approaches to reducing nitrogen loads from OSDSs. Treatment alternatives examined included sewer extension to an existing water reclamation facility (WRF) (both in areas of no public service and areas with an existing sewer system), clustering of community sewer service, OSDS upgrades with enhanced nitrogen removal, and no action. In the Herring Bay watershed, approximately 16% of OSDSs are recommended for connection to a sewer extension and 84% are recommended for enhanced nitrogen removal upgrades at individual OSDS. In the Middle and Lower Patuxent watershed, 100% of OSDSs are recommended for enhanced nitrogen removal upgrades at individual OSDS. In the Herring Bay watershed, the implementation of all treatment options would be expected to reduce total nitrogen from OSDSs by approximately 58% or 19,280 pounds per year. In the Middle and Lower Patuxent watershed, the implementation of all treatment options would be expected to reduce total nitrogen from OSDSs by approximately 50% or 31,609 pounds per year. A map of OSDS locations and the areas associated with treatment recommendations is presented in Map 2.11.

Since nitrogen is generally the most mobile of the typical pollutants associated with OSDSs, it is used in the County's prioritization assessments as an indicator of septic system impacts to streams within the watershed. Subwatersheds are prioritized as "Very Poor," "Poor," "Fair," or "Good" based on the natural breaks (a systematic method for classification) in the cumulative annual total nitrogen loading (in pounds) within the subwatersheds. A breakdown of ratings for total nitrogen loading from OSDSs for Herring Bay and Middle and Lower Patuxent subwatersheds is presented in Table 2-18 and in Map 2.11.

Milestones for the reduction of total nitrogen from OSDSs in Anne Arundel County have been published in a Watershed Implementation Plan to comply with the Chesapeake Bay TMDL (Anne Arundel Co., 2012).

TABLE 2-18: TOTAL ANNUAL NITROGEN LOAD RATING FROM OSDS

Rating	HERRING BAY WATERSHED		MIDDLE AND LOWER PATUXENT WATERSHEDS	
	Number of Subwatersheds	Percent of Subwatersheds	Number of Subwatersheds	Percent of Subwatersheds
Very Poor	3	14%	4	11%
Poor	4	19%	9	25%
Fair	5	24%	15	42%
Good	9	43%	8	22%
Total	**21**	**--**	**36**	--

2.2.4 SOIL INDICATORS

Native soils vary in their susceptibility to erosive forces. Clay soils, for instance, are less susceptible to erosion than are coarse sandy soils. The soil erodibility factor, K, is a measure of the susceptibility of soil to detachment and transport by precipitation and runoff. Soil erodibility factors for Anne Arundel County were obtained from Natural Resources Conservation Service (NRCS) datasets. The County uses these soil erodibility factors to identify areas susceptible to soil erosion as part of its subwatershed preservation assessment.

Subwatersheds are prioritized as having "Low," "Medium," or "Medium High", or "High" preservation value based on natural breaks in soil erodibility factor across subwatersheds. A summary of subwatershed ratings for soil erodibility is presented in Table 2-19 and depicted in Map 2.12. Approximately 24 percent and 22 percent of subwatersheds are prioritized "High" for susceptibility to soil erosion in the Herring Bay and Middle and Lower Patuxent watersheds, respectively.

TABLE 2-19: SUBWATERSHED RATINGS FOR SOIL ERODIBILITY

Rating	HERRING BAY WATERSHED		MIDDLE AND LOWER PATUXENT WATERSHEDS	
	Number of Subwatersheds	Percent of Subwatersheds	Number of Subwatersheds	Percent of Subwatersheds
Low	5	24%	5	14%
Medium	4	19%	9	25%
Medium High	7	33%	15	42%
High	5	24%	7	19%
Total	**21**	**--**	**36**	**--**

2.2.5 LANDSCAPE INDICATORS

The County employs a variety of landscape-based indicators for restoration and preservation assessments. Percent impervious cover, percent forest within the 100-foot stream buffer, ratio of existing wetlands to potential wetlands, and acres of developable land within the Critical Area are used as indicators of the potential need for restoration activities. Percent forest cover, percent wetland cover, density of headwater streams, percent of land within the Greenway Master Plan, the presence of bog wetlands, acres of Resource Conservation Area (RCA) lands within Critical Area, percent of protected lands, and presence of Wellhead Protection Area are used as indicators of the potential need for preservation.

GIS datasets were used by the County to quantify the extent of the landscape indicators within each subwatershed. The GIS analyses related to impervious area, forest cover, bog wetland locations, Critical Areas, protected lands, land associated with the Greenway Master Plan, and density of headwater streams were performed using the County's existing geodatabase of land use and land features. GIS analyses associated with wetland cover were performed using MDNR datasets.

Subwatersheds are prioritized as having "Very Poor", "Poor", "Fair", or "Good" restoration priority based on natural breaks in the data. Summaries of these ratings for all subwatersheds are presented in Table 2-20 and on Map 2.13. The percent forest within the 100-foot stream buffer and the ratio of existing to potential wetlands were the most evenly distributed of the landscape indicator ratings for subwatershed restoration in both the Herring Bay and Middle and Lower Patuxent watersheds. Most subwatersheds were rated as "Good" or "Fair" for the percent impervious cover indicator. Restoration priority ratings for the acres of developable land within the Critical Area indicator were evenly distributed in the Herring Bay watershed and were predominantly rated as "Good" in the Middle and Lower Patuxent River watershed.

TABLE 2-20: LANDSCAPE INDICATOR RATINGS (SUBWATERSHED RESTORATION)

Rating	HERRING BAY WATERSHED		MIDDLE AND LOWER PATUXENT WATERSHEDS	
	Number of Subwatersheds	Percent of Subwatersheds	Number of Subwatersheds	Percent of Subwatersheds
Percent Impervious Cover				
Good	14	67%	34	94%
Fair	4	19%	2	6%
Poor	2	10%	0	0%
Very Poor	1	5%	0	0%
Percent Forest within the 100-foot Stream Buffer				
Good	3	14%	12	33%
Fair	8	38%	16	44%
Poor	5	24%	6	17%
Very Poor	5	24%	2	6%
Ratio of Existing to Potential Wetlands				
Good	3	14%	3	8%

Rating	HERRING BAY WATERSHED		MIDDLE AND LOWER PATUXENT WATERSHEDS	
	Number of Subwatersheds	Percent of Subwatersheds	Number of Subwatersheds	Percent of Subwatersheds
Fair	8	38%	14	39%
Poor	5	24%	11	31%
Very Poor	5	24%	8	22%
Acres of Developable Critical Area				
Good	7	33%	32	89%
Fair	3	14%	1	3%
Poor	5	24%	2	5%
Very Poor	6	29%	1	3%

Subwatersheds are prioritized as having “Low”, “Medium”, “Medium High” or “High” preservation potential based on natural breaks in the data. Summaries of these ratings are presented in Table 2-21 and on Maps 2.14 and 2.15. Preservation priority ratings of most indicators ranged from “Low” to “Medium”, or were evenly distributed across preservation priority ratings. The percent forest cover indicator rated the majority of subwatersheds as “Medium” or “Medium High” for preservation. Furthermore, bog wetlands and Wellhead Protection Areas were predominantly absent or indicated “Low” preservation priority across the study subwatersheds.

TABLE 2-21: LANDSCAPE INDICATOR RATINGS (SUBWATERSHED PRESERVATION)

Rating	HERRING BAY WATERSHED		MIDDLE AND LOWER PATUXENT WATERSHEDS	
	Number of Subwatersheds	Percent of Subwatersheds	Number of Subwatersheds	Percent of Subwatersheds
Percent Forest Cover				
High	2	9%	3	8%
Medium High	10	48%	13	36%
Medium	6	29%	14	39%
Low	3	14%	6	17%
Percent Wetland Cover				
High	2	10%	1	3%
Medium High	3	14%	1	2%
Medium	7	33%	10	28%
Low	9	43%	24	67%
Density of Headwater Streams				
High	4	19%	6	17%
Medium High	3	14%	10	28%
Medium	5	24%	13	36%

Rating	HERRING BAY WATERSHED		MIDDLE AND LOWER PATUXENT WATERSHEDS	
	Number of Subwatersheds	Percent of Subwatersheds	Number of Subwatersheds	Percent of Subwatersheds
Low	9	43%	7	19%
Percent of Land within the Greenway Master Plan				
High	3	14%	9	25%
Medium High	4	19%	7	19%
Medium	5	24%	10	28%
Low	9	43%	10	28%
Presence of Bog Wetlands				
High	0	0%	0	0%
Low	21	100%	36	100%
Acres of RCA lands with the Critical Area				
High	4	19%	1	3%
Medium High	5	24%	2	6%
Medium	9	43%	7	19%
Low	3	14%	26	72%
Percent of Protected Lands				
High	3	14%	3	8%
Medium High	1	5%	9	25%
Medium	5	24%	9	25%
Low	12	57%	15	42%
Presence of Wellhead Protection Areas				
High	2	10%	4	11%
Low	19	90%	32	89%

3 HYDROLOGIC AND POLLUTANT LOAD MODELING

The data collection efforts described in Section 2 provide a solid basis for assessing the current status of the Middle and Lower Patuxent, and Herring Bay watersheds and identifying potential stressors that may contribute to observed impairments. Modeling, the computer simulation of natural processes, serves to extend the utility of the collected data by allowing extrapolation from existing conditions to alternative future conditions scenarios that reflect differing assumptions about the course of land development and the implementation of pollutant controls.

Land development is typically associated with increased imperviousness and decreased capacity for managing precipitation. As watersheds become more developed, runoff volumes and peak flow rates increase and stream base flows decrease. This often results in destabilized streams, increased pollutant loading, and adverse impacts to physical habitat. Nutrients and suspended solids are two of the leading causes of water quality impairment in sensitive water bodies, including the Chesapeake Bay and its tributaries. Nutrients, such as nitrogen and phosphorus, can cause excessive algae growth and eutrophication. Suspended solids can limit growth of aquatic vegetation and destroy physical habitat.

The County's hydrologic and pollutant load modeling provides quantification of watershed processes and allows for the comparison of different scenarios used to prioritize restoration and mitigation projects. The County performed hydrologic and pollutant load modeling to help assess existing conditions as well as future development and pollutant control scenarios within the study watersheds. The results were used to understand the extent of potential water quality improvements necessary for satisfying MS4 permit and TMDL requirements.

This section presents and discusses the methods and inputs used in the hydrologic and water quality modeling of current and future build-out conditions (Section 3.1) and the results of that modeling (Section 3.2). Discussions of future scenario modeling to support development of the implementation plan for the study watershed are presented in Section 5.

3.1 METHODS

This subsection describes two types of modeling performed in the watershed characterization to help evaluate and prioritize areas and projects for action. Hydrologic modeling, which involves simulation of the runoff and conveyance stormwater runoff, was done to improve understanding of reach and subwatershed sensitivity to erosion and to development. Pollutant load modeling of current conditions, which entails the simulation of the generation, transport, and delivery of solids, nutrients, and pathogens, provides the basis for assessment of current and future condition pollutant loading. Model results enable comparison and prioritization of restoration strategies and projects as discussed in Section 5. The methods and inputs for each model are discussed below.

3.1.1 HYDROLOGIC MODELING

Hydrologic modeling is used to represent rainfall-induced runoff conditions and the conveyance of streamflow in the watershed. The County applies the NRCS TR-20 for hydrologic modeling. This NRCS model is a single event watershed scale runoff and routing model that was used to evaluate runoff volumes and peak flow for various return period storm events. Model inputs include rainfall, curve numbers, and time of concentration. Table 3-1 presents the 24-hour rainfall depths and recurrence intervals for Anne Arundel County. Area-weighted curve numbers, which represent the runoff response to a rain event, are derived from soil types and land cover. Table 3-2 presents the base curve numbers that the County uses to develop the weighted curve numbers.

Time of concentration is the time required for runoff to travel from the hydraulically most distant point in the watershed to the most downstream point or outlet. The County uses a modified version of the NRCS lag equation as a means of calculating the travel time for each subwatershed. The NRCS lag equation relates time of concentration to flow length, average slope, and curve number (NRCS, 2010). Since this equation was developed for rural watersheds, the County also applies an urban correction factor (Impervious Area Factor), to account for the more urban nature of the study watersheds (US DOT, 1984). The Impervious Area Factor accounts for higher amounts of impervious area that accelerate the rate of overland flow in the watershed.

The TR-20 model results, presented as peak flow rate normalized to area (cfs/acre) and surface runoff yield (inches), are used to evaluate the likely sensitivity of the study watersheds to gullying and stream erosion. Areas with higher normalized peak flow rates and/or surface runoff yields are more likely to suffer from erosion in-stream or on the land surface, and therefore could be prioritized higher for restoration versus areas with lower normalized peak flow rates or surface runoff yields. Higher rates and yields are often expected in urbanized areas with more extensive impervious surface area.

TABLE 3-1. RAIN FREQUENCY

Event Frequency	Rain (in)
1 year	2.7
2 year	3.3
10 year	5.2
100 year	7.4

TABLE 3-2: RUNOFF CURVE NUMBERS FOR URBAN AREAS

Land Cover Type and Condition	Hydrologic Soil Group			
	A	B	C	D
Open space (lawns, parks, golf courses, cemeteries, etc.)				
Poor condition (grass cover < 50%)	Not Used			
Fair condition (grass cover 50% to 75%)	Not Used			
Good condition (grass cover > 75%)	39	61	74	80
Paved parking lots, roofs, driveways, etc.(excluding right-of-way)	98	98	98	98
Streets and roads				
Paved; curbs and storm drains (excluding right-of-way)	98	98	98	98
Paved; open ditches (including right-of-way)	Not Used			
Gravel (including right-of-way)	Not Used			
Dirt (including right-of-way)	Not Used			
Urban districts				
Commercial and business	89	92	94	95
Industrial	81	88	91	93
Residential districts by average lot size				
1/8 acre or less (town houses)	77	85	90	92
1/4 acre	61	75	83	87
1/3 acre	57	72	81	86
1/2 acre	54	70	80	85
1 acre	51	68	79	84
2 acres	46	65	77	82
Newly graded areas (pervious areas only, no vegetation)	77	86	91	94

3.1.2 WATER QUALITY MODELING

Water quality modeling is used to represent the generation of pollutant loads and their potential control by BMPs. The County's water quality model for the Middle Patuxent, Lower Patuxent, and Herring Bay watersheds is based on EPA's Simple Method (Schueler, 1987) and PLOAD models (EPA, 2001). The water quality model calculates annual loadings for total nitrogen, total phosphorus, total suspended solids, fecal coliforms, and metals from stormwater under pristine, current, and ultimate build-out or future conditions. Given the focus of the Chesapeake Bay TMDL, only total nitrogen, total phosphorus, and total suspended solids are discussed in this report. The water quality model is also used to tabulate annual load reductions or credits that are achieved with existing BMPs in the ground within the watershed.

The model's basic elements are polygons determined in GIS by the geometric intersection of the County's 2007 land use dataset, land ownership, impervious cover, and subwatershed boundaries. The polygon GIS attribute information is imported into the County's spreadsheet model to perform the loading calculations. The Simple Method calculates annual runoff as a product of annual rainfall (42.9 inches in Anne Arundel County), the fraction of annual rainfall events that produce runoff (assumed to be 90%), and a runoff coefficient based on the impervious fraction in the drainage area. In one modification to the Simple Method, the County's model uses an actual impervious cover delineation to explicitly represent impervious surface runoff instead of the standard impervious rating approach. The pollutant loads are the product of the annual runoff, the drainage area, and the event mean concentrations (EMCs) for each land use category. A delivery ratio is further applied to the loading estimates depending on its proximity to non-tidal and tidal waters. For the study watershed, the delivery ratio is assumed to be equal to one.

A summary of EMC values and associated land use types are presented in Table 3-3 below. These EMC values have been compiled from a number of literature sources or calculated directly from export coefficients used by the Chesapeake Bay Program (CBP). Individually, the County's EMC values are conservatively set to be equal to or greater than the values used by the CBP.

TABLE 3-3: WATER QUALITY MODELING EVENT MEAN CONCENTRATIONS

TMDL Source Sector	Land Use Code	Land Use Name	Average Impervious Percent	TN (mg/L)	TP (mg/L)	TSS (mg/L)
Urban	AIR	Airport	85	2.24	0.3	99
	COM	Commercial	85	2.24	0.3	43
	IND	Industrial	72	2.22	0.19	77
	OPS	Open Space	1	1.15	0.15	34
	R11	Residential - 1 acre lot	13	2.74	0.32	43
	R12	Residential - 1/2 acre lot	18	2.74	0.32	43
	R14	Residential - 1/4 acre lot	20	2.74	0.32	43
	R18	Residential - 1/8 acre lot	34	2.74	0.32	43
	R21	Residential - 2 acre lot	13	2.74	0.32	43
	R20	Residential - 20 acre lot	2	2.2	0.15	51
	RWD	Residential Woods	6	2	0.19	51
	TRN	Transportation	75	2.59	0.43	99
	UTL	Utility	75	1.15	0.15	34
Agriculture	PAS	Pasture and Hay	0	7.83	2.09	341
	SRC	Single Row Crop	1	16.06	2.63	1,046
Other	FRW	Forested Wetland	0	1	0.11	34
	OPW	Open Wetland	0	1	0.11	34
	WAT	Water	0	1.2	0.03	43
	WDS	Woods	0	1	0.11	34

To account for pollutant removal associated with existing BMPs or those implemented in the future, the County utilizes pollutant removal efficiencies or approved pollutant removal methods by MDE[1]. A summary of the BMP pollutant removal efficiencies used for modeling in these watersheds by the County are provided in Table 3-4. To facilitate assignment of a pollutant removal efficiency to each BMP type, the County has organized its BMP types into nine BMP category "groups".

TABLE 3-4: WATER QUALITY MODELING BMP POLLUTANT REMOVAL EFFICIENCIES (MDE, 2014B)

BMP Category Group	County BMP Code	MDE Code	BMP Name	Percent Removal		
				TN	TP	TSS
Filtration	O-1	ODSW	Dry Swale	33%	52%	66%
	O-2	OWSW	Wet Swale	33%	52%	66%
	ASCD		Attenuation Swale/Check Dam	33%	52%	66%
	F-1	FSND	Surface sand filter	33%	52%	66%
	F-2	FUND	Underground sand filter	33%	52%	66%
	F-3	FPER	Perimeter sand filter	33%	52%	66%
	F-4	FORG	Organic filter	33%	52%	66%
	F-5		Pocket Sand Filter	33%	52%	66%
	F-6	FBIO	Bioretention Facility	33%	52%	66%
	SF	FSND	Sand Filter	33%	52%	66%
	ATTENSWA		Attenuation Swale	33%	52%	66%
	AS		Attenuation Swale	33%	52%	66%
	POSAND		Pocket Sand Filter	33%	52%	66%
	VB		Vegetated Buffer	33%	52%	66%
	BIO	FBIO	Bioretention Facility	33%	52%	66%
	SPSC	SPSC	Regenerative Step Pool Storm Conveyance	33%	52%	66%
	GBMP	FBIO	Bioretention Facility	33%	52%	66%
Infiltration	ATTTRENCH		Attenuation Trench	57%	66%	70%
	DW	MIDW	Dry Well	57%	66%	70%
	DWIT		Dry Well - Infiltration Trench	57%	66%	70%
	DWITCE		Dry Well - Infiltration Trench with Complete Exfiltration	57%	66%	70%
	DWITCE-2		Dry Well - Infiltration Trench with Complete Exfiltration	57%	66%	70%
	C-2/drywells	MIDW	Dry Well	57%	66%	70%
	DWITCW		Dry Well - Infiltration Trench with Complete Exfiltration	57%	66%	70%
	DWITPE		Dry Well - Infiltration Trench with Partial Exfiltration	57%	66%	70%

[1] MDE's guidance document *Accounting for Stormwater Wasteload Allocations and Impervious Acres Treated* (MDE, 2014b)

BMP Category Group	County BMP Code	MDE Code	BMP Name	Percent Removal		
				TN	TP	TSS
	DWITWQE		Dry Well - Infiltration Trench with Water Quality Exfiltration	57%	66%	70%
	EDSDITCE		Extended Detention Structure Dry, Infiltration Trench with Complete Exfiltration	57%	66%	70%
	IB	IBAS	Infiltration Basin	57%	66%	70%
	IITCE		Infiltration Trench with Complete Exfiltration	57%	66%	70%
	INPOND		Infiltration Basin No Outfall	57%	66%	70%
	IT	ITRN	Infiltration Trench	57%	66%	70%
	ITVSW		Infiltration Trench, Extended Detention	57%	66%	70%
	ITCE		Infiltration Trench with Complete Exfiltration	57%	66%	70%
	ITCEMB		Infiltration Trench with Complete Exfiltration, Microbasin	57%	66%	70%
	ITPE		Infiltration Trench with Partial Exfiltration	57%	66%	70%
	ITWQE		Infiltration Trench with Water Quality Exfiltration	57%	66%	70%
	OGSITCE		Oil Grit Separator Infiltration Trench with Complete Exfiltration	57%	66%	70%
	PNDTR		Same as infiltration basin	57%	66%	70%
	PP	APRP	Porous Pavement	57%	66%	70%
	SB	IBAS	Infiltration Basin	57%	66%	70%
	WQITPE		Water Quality Infiltration Trench with Partial Exfiltration	57%	66%	70%
	WQP		Water Quality Trench	57%	66%	70%
Wet Ponds	EDSW	PWED	Extended Detention Structure Wet	33%	52%	66%
	MP	PMED	Micro Pool	33%	52%	66%
	P-3	PWED	Extended Detention Structure Wet	33%	52%	66%
	EXPOND	PWET	Wet Pond	33%	52%	66%
	P-2	PWET	Wet Pond	33%	52%	66%
	SW		Wet Structure	33%	52%	66%
	P-1	PMED	Micro Pool	33%	52%	66%
	WP	PWET	Retention Structure (Wet Pond)	33%	52%	66%
	P-4	PMPS	Multiple pond system	33%	52%	66%
	P-5	PPKT	Pocket pond	33%	52%	66%
Wetlands	SM	WSHW	Shallow Marsh	33%	52%	66%
	W-1		Shallow Wetland	33%	52%	66%
	RSC		Regenerative Wetland Seepage	33%	52%	66%
	W-2		ED shallow wetland	33%	52%	66%

BMP Category Group	County BMP Code	MDE Code	BMP Name	Percent Removal		
				TN	TP	TSS
	W-3		pond/wetland system	33%	52%	66%
	W-4	WPKT	pocket wetland	33%	52%	66%
Stream Restoration	Stream Conventional	STRE	In-stream Riffles/Stabilization	NA	NA	NA
ESD or Stormwater to the MEP	A1	AGRE	Green Roofs	57%	66%	70%
	A2	APRP	Permeable Pavement	57%	66%	70%
	A3	ARTF	Reinforced Turf	57%	66%	70%
	C2	NDRR	ESD rooftop disconnect	57%	66%	70%
	C2/ Raingardens	MRNG	ESD rain gardens	57%	66%	70%
	C3	NDNR	ESD non roof top disconnect	57%	66%	70%
	C4	NSCA	Sheetflow to Conservation Areas	57%	66%	70%
	N1	NDRR	Disconnection of Roof-top	57%	66%	70%
	N2	NDNR	Disconnection of Non Roof-top	57%	66%	70%
	N3	NSCA	Sheetflow to Conservation Areas	57%	66%	70%
	M1	MRWH	Rainwater Harvesting	57%	66%	70%
	M2	MSGW	Submerged Gravel Wetlands	57%	66%	70%
	M3	MILS	Landscape Infiltration	57%	66%	70%
	M4	MIBR	Infiltration Berms	57%	66%	70%
	M5	MIDW	Dry Wells	57%	66%	70%
	M6	MMBR	Micro-Bioretention	57%	66%	70%
	M7	MRNG	Rain Gardens	57%	66%	70%
	M8	MSWB	Swales	57%	66%	70%
	M9	MENF	Enhanced Filters	57%	66%	70%
Alternative Credits	Street Sweeping		Regenerative Vacuum Street Sweeping	5%	6%	25%
	Planting pervious		Forestation on pervious urban	66%	77%	57%
	Impervious to Pervious		Impervious Area Elimination and conversion to pervious	13%	72%	84%
	Impervious to Forest		Impervious Area Elimination and conversion to forest	71%	94%	93%

With the exception of alternative BMPs (e.g. stream restoration, shoreline restoration, etc.), pollutant removal efficiencies are reported in Table 3-4 for BMPs as percent of a constituent removed. For stream restoration, removal is determined using the "interim revised rates" as presented in MDE's guidance (MDE, 2014b). The efficiencies are based on linear feet restored and apply a reduction for nitrogen, phosphorus and sediment.

- Total nitrogen – 0.075 lbs per linear foot restored
- Total phosphorus – 0.068 lbs per linear foot restored
- Total suspended solids – 15 lbs per linear foot restored

These rates can be used for stream restoration projects completed up to 2015 and are also used for planning purposes for future projects. Currently there are no completed stream restoration projects in the study watersheds. Any future project will develop its final pollutant load reduction crediting using the methods developed by the Chesapeake Bay Program's Urban Stormwater Workgroup. The workgroup convened an expert panel to produce updated guidance (Schueler and Stack, 2014), which developed four protocols for determining pollutant reduction credits for individual projects:

- Protocol 1: Credit for Prevented Sediment during Storm Flow. This protocol provides an annual mass nutrient and sediment reduction credit for qualifying stream restoration practices that prevent channel or bank erosion that would otherwise be delivered downstream from an actively enlarging or incising urban stream.
- Protocol 2: Credit for Instream and Riparian Nutrient Processing during Base Flow. This protocol provides an annual mass nitrogen reduction credit for qualifying projects that include design features to promote denitrification during base flow within the stream channel through hyporheic exchange within the riparian corridor.
- Protocol 3: Credit for Floodplain Reconnection Volume. This protocol provides an annual mass sediment and nutrient reduction credit for qualifying projects that reconnect stream channels to their floodplain over a wide range of storm events.
- Protocol 4: Credit for Dry Channel Regenerative Stormwater Conveyance (RSC) as an Upland Stormwater Retrofit. This protocol provides an annual nutrient and sediment reduction rate for the contributing drainage area to a qualifying dry channel RSC project. The rate is determined by the degree of stormwater treatment provided in the upland area using the retrofit rate adjustor curves developed by the Stormwater Retrofit Expert Panel.

As previously discussed, the County's water quality model is applied to various scenarios that represent real and hypothetical watershed conditions. A summary of the modeled scenarios is presented in Table 3-5.

TABLE 3-5: MODELED WATER QUALITY SCENARIOS

Modeled Scenario	Purpose
A. Pristine Conditions	Baseline, all-forested condition representing pre-development state
B. Existing Conditions with no SWM	Current land use without accounting for any existing BMPs or disconnected impervious surfaces
C. Credits from existing SWM	Credits based on performance of public and private BMPs and disconnected impervious surfaces
D. Existing Conditions with SWM	Current land use accounting for existing BMPs and disconnected impervious surfaces
E. Future Conditions with Stormwater to the MEP	Expected future land use with development informed by future stormwater regulations and stormwater management retrofits to the MEP

Pristine or pre-development conditions (Scenario A) were modeled for contextual purposes only and assumed that the watershed was entirely forested prior to development. Existing conditions (Scenario B) were based on high resolution 2014 land cover and impervious surface data collected by the County. Existing condition pollutant loads do not account for existing stormwater management (SWM) (i.e., BMPs in the ground or disconnected impervious surfaces).

Existing stormwater management credit modeling (Scenario C) calculates pollutant load reductions for existing stormwater BMPs and disconnection credits. This scenario incorporates into the model all existing publicly and privately owned BMPs, all restoration projects performed as part of the County's Capital Improvement Program (CIP), and all disconnected impervious surfaces (including a subset of rooftops and open section roads with swales). This calculation relies on delineated drainage areas for each BMP or credit and the pollutant removal efficiency. As described in Section 2.2.2, the drainage areas for each BMP were delineated from the County's DEM. Drainage areas for disconnection credits were obtained from the appropriate land cover polygon (i.e., rooftops or road segment). For each polygon representing a BMP or disconnection credit, the resulting baseline pollutant load reduction was calculated using pollutant removal efficiencies summarized in Table 3-4.

In a number of cases, drainage areas from individual BMPs were found to partially or wholly overlap. In reality, it is not unusual for BMPs to treat stormwater pollutants in series (e.g., as part of a treatment train). Nonetheless, in these cases, the County used a conservative accounting approach to avoid double counting of credits. In those areas with overlapping drainage areas, best professional judgment was used to determine which BMP was predominantly managing a particular intersected drainage area. Overlapping drainage area segments were assigned to the closest BMP with the assumption that the closer a segment was to a particular BMP, the more likely the area was to be treated by that facility. The drainage area polygon was then assigned to the predominant BMP. This was performed to ensure that only a single BMP managed a particular area and that the appropriate BMP was receiving the management credit.

Existing conditions with BMP credit accounting (Scenario D) represents actual existing watershed conditions. It combines the results of Scenario B existing conditions modeling and the Scenario C BMP credits for existing BMPs and disconnected impervious surfaces.

The future conditions modeling (Scenario E) relies on realistic estimates of future development. Future watershed conditions were determined in two steps. First, areas in the watershed were identified where future development is legally constrained or not physically possible. These areas, which are shown on Map 3.2, include:

- Steep slopes (greater than 25%) derived from the DEM,
- Federal Emergency Management Agency (FEMA) 100-year floodplains,
- Jurisdictional wetlands,
- 100-foot regulatory stream buffers,
- Schools and parks,
- Cemetery lots,
- DNR protected lands, including Maryland Environmental Trust Lands, and

- Utility and storm water management easements.

Second, outside of these areas where development is not possible, existing land use was examined to determine where future development or re-development could occur and what form it would likely take. This analysis was informed by a holding capacity or development capacity study conducted by the County's Office of Planning and Zoning. For those areas where future land use is anticipated to change from the existing condition land use, the County estimated a future impervious cover percentage based on the average impervious values presented in Table 3-3. Future development is subject to the Maryland stormwater regulations discussed in Section 1.2.2, where Environmental Site Design (ESD) is to be implemented to the maximum extent practicable. As such, for both future development and redevelopment, the calculated pollutant loads were reduced by the pollutant removal efficiency associated with ESD practices (see Table 3-4). MDE refers to stormwater management retrofits using ESD practices as Stormwater to the MEP. For areas where new development is expected to occur, 100% of the new impervious area was assumed to be managed by Stormwater to the MEP. For those areas where redevelopment is expected to occur, 50% of the existing impervious area and 100% of new impervious area is managed with Stormwater to the MEP.

3.2 Modeling Results

This subsection presents and discusses results from application of the hydrological and water quality models to the Middle Patuxent, Lower Patuxent, and Herring Bay watersheds.

3.2.1 Hydrologic Modeling

The hydrologic model results are primarily utilized in the subwatershed assessments discussed in Section 4. In these assessments, four hydrologic indicators are evaluated for each subwatershed:

- Area-normalized peak flow (cfs/acre) for a 2.7" (one-year storm)
- Area-normalized peak flow (cfs/acre) for a 3.3" (two-year storm)
- Surface runoff yield (inches) for a 2.7" (one-year storm)
- Surface runoff yield (inches) for a 3.3" (two-year storm)

The one-year and two-year events were selected because bankfull conditions for streamflow, which are generally considered to be the most critical condition for delivery of sediment and associated pollutants, typically occur about once every one to two years in the Chesapeake Bay region. The results of the hydrologic model run for the 1, 2, 10, and 100-year storm events are presented below in Table 3-6.

TABLE 3-6: HYDROLOGIC MODEL RESULTS

Subwatershed		1 year	2 year	10 year	100 year
HERRING BAY WATERSHED					
HB0	Runoff Yield (in)	0.74	1.1	2.41	5.44
	Peak Discharge (cfs)	269	419	974	2288
HB1	Runoff Yield (in)	0.47	0.74	1.71	3.8
	Peak Discharge (cfs)	72	116	288	726
HB2	Runoff Yield (in)	0.17	0.29	0.75	1.59
	Peak Discharge (cfs)	40	68	184	494
HB3	Runoff Yield (in)	0.93	1.34	2.74	5.85

Subwatershed		1 year	2 year	10 year	100 year
	Peak Discharge (cfs)	44	64	138	303
HB7	Runoff Yield (in)	0.92	1.32	2.68	5.66
	Peak Discharge (cfs)	68	100	214	474
HB8	Runoff Yield (in)	0.73	1.08	2.31	5.04
	Peak Discharge (cfs)	68	104	239	559
HB9	Runoff Yield (in)	0.68	1.01	2.16	4.65
	Peak Discharge (cfs)	66	102	235	556
HBB	Runoff Yield (in)	1.26	1.72	3.25	6.47
	Peak Discharge (cfs)	56	78	150	303
HBC	Runoff Yield (in)	0.81	1.18	2.49	5.36
	Peak Discharge (cfs)	48	72	160	366
HBD	Runoff Yield (in)	0.83	1.22	2.58	5.7
	Peak Discharge (cfs)	48	72	160	336
HBF	Runoff Yield (in)	0.93	1.33	2.74	5.9
	Peak Discharge (cfs)	106	158	339	747
HBL	Runoff Yield (in)	0.36	0.61	1.63	4.26
	Peak Discharge (cfs)	55	99	292	827
HBM	Runoff Yield (in)	1.01	1.43	2.88	6.18
	Peak Discharge (cfs)	144	207	428	913
HBO	Runoff Yield (in)	0.38	0.64	1.69	4.46
	Peak Discharge (cfs)	25	46	140	398
HBP	Runoff Yield (in)	0.78	1.15	2.49	5.66
	Peak Discharge (cfs)	79	121	272	624
HBQ	Runoff Yield (in)	0.28	0.5	1.44	4.01
	Peak Discharge (cfs)	50	99	325	989
HBR	Runoff Yield (in)	0.43	0.71	1.8	4.64
	Peak Discharge (cfs)	37	69	200	536
HBS	Runoff Yield (in)	0.27	0.49	1.42	4.01
	Peak Discharge (cfs)	37	69	200	536
HBT	Runoff Yield (in)	0.42	0.69	1.77	4.58
	Peak Discharge (cfs)	19	34	100	276
HBU	Runoff Yield (in)	1.25	1.71	3.26	6.56
	Peak Discharge (cfs)	87	120	231	466
HBV	Runoff Yield (in)	0.86	1.24	2.56	5.44
	Peak Discharge (cfs)	27	41	89	200
MIDDLE AND LOWER PATUXENT RIVER WATERSHEDS					
MP0	Runoff Yield (in)	0.34	0.57	1.52	3.87
	Peak Discharge (cfs)	29	51	144	404
MP1	Runoff Yield (in)	0.1	0.17	0.42	0.81
	Peak Discharge (cfs)	10	17	43	104

Subwatershed		1 year	2 year	10 year	100 year
MP2	Runoff Yield (in)	0.04	0.06	0.13	0.23
	Peak Discharge (cfs)	8	13	29	55
MP3	Runoff Yield (in)	0.02	0.03	0.05	0.13
	Peak Discharge (cfs)	4	7	16	31
MP4	Runoff Yield (in)	0.02	0.03	0.05	0.13
	Peak Discharge (cfs)	4	7	16	31
MP5	Runoff Yield (in)	0.02	0.03	0.08	0.16
	Peak Discharge (cfs)	2	3	9	19
MP6	Runoff Yield (in)	0.23	0.39	0.95	1.97
	Peak Discharge (cfs)	22	37	97	255
MP7	Runoff Yield (in)	0.47	0.75	1.88	4.76
	Peak Discharge (cfs)	247	453	1299	3457
MP8	Runoff Yield (in)	0.45	0.72	1.7	3.84
	Peak Discharge (cfs)	34	55	140	361
MP9	Runoff Yield (in)	0.01	0.03	0.1	0.24
	Peak Discharge (cfs)	1	3	11	30
MPA	Runoff Yield (in)	0.11	0.26	0.97	3.17
	Peak Discharge (cfs)	7	17	77	287
MPB	Runoff Yield (in)	0.65	0.94	1.86	3.58
	Peak Discharge (cfs)	10	15	33	76
MPC	Runoff Yield (in)	0.35	0.6	1.6	4.17
	Peak Discharge (cfs)	53	95	278	788
MPD	Runoff Yield (in)	0	0.01	0.02	0.03
	Peak Discharge (cfs)	0	1	1	3
MPE	Runoff Yield (in)	0.44	0.72	1.82	4.67
	Peak Discharge (cfs)	112	209	619	1677
MPF	Runoff Yield (in)	0.03	0.05	0.1	0.16
	Peak Discharge (cfs)	7	12	32	82
MPG	Runoff Yield (in)	0.19	0.31	0.75	1.5
	Peak Discharge (cfs)	7	12	32	82
MPH	Runoff Yield (in)	0.01	0.01	0.02	0.04
	Peak Discharge (cfs)	1	1	2	5
MPI	Runoff Yield (in)	0.18	0.29	0.63	1.11
	Peak Discharge (cfs)	13	21	51	119
MPJ	Runoff Yield (in)	0.03	0.04	0.09	0.15
	Peak Discharge (cfs)	5	7	15	28
MPK	Runoff Yield (in)	0.08	0.12	0.24	0.39
	Peak Discharge (cfs)	5	8	18	35
MPL	Runoff Yield (in)	0.37	0.6	1.38	2.95
	Peak Discharge (cfs)	13	21	52	134

Subwatershed		1 year	2 year	10 year	100 year
MPM	Runoff Yield (in)	0.38	0.62	1.49	3.35
	Peak Discharge (cfs)	10	16	40	105
MPN	Runoff Yield (in)	0.15	0.27	0.7	1.48
	Peak Discharge (cfs)	6	10	26	70
MPO	Runoff Yield (in)	0	0.01	0.01	0.03
	Peak Discharge (cfs)	1	1	2	5
MPP	Runoff Yield (in)	0.01	0.01	0.02	0.04
	Peak Discharge (cfs)	1	1	3	5
MPQ	Runoff Yield (in)	0.22	0.38	0.97	2.15
	Peak Discharge (cfs)	12	21	57	153
MPR	Runoff Yield (in)	0.1	0.18	0.46	0.92
	Peak Discharge (cfs)	6	11	29	71
MPS	Runoff Yield (in)	0.16	0.26	0.56	1
	Peak Discharge (cfs)	16	25	60	138
MPT	Runoff Yield (in)	0.22	0.35	0.75	1.38
	Peak Discharge (cfs)	12	19	48	114
MPU	Runoff Yield (in)	0.02	0.03	0.06	0.11
	Peak Discharge (cfs)	2	4	10	20
MPV	Runoff Yield (in)	0.35	0.6	1.62	4.35
	Peak Discharge (cfs)	207	421	1388	4017
MPW	Runoff Yield (in)	0.27	0.49	1.42	3.92
	Peak Discharge (cfs)	20	39	126	380
MPX	Runoff Yield (in)	0.5	0.8	1.95	4.85
	Peak Discharge (cfs)	89	154	418	1097
MPY	Runoff Yield (in)	0.43	0.7	1.78	4.49
	Peak Discharge (cfs)	41	71	198	539
MPZ	Runoff Yield (in)	0.05	0.08	0.18	0.32
	Peak Discharge (cfs)	9	14	34	68

Subwatersheds were prioritized and rated "High," "Medium High," "Medium," or "Low" based on the natural breaks for each of the four hydrologic indicators. A summary of these ratings is presented in Table 3-7. For the majority of the subwatersheds in the Herring Bay watershed, the one-year peak flow scores were similar to the two-year peak flow scores and the one-year yield scores were identical to the two-year yield scores. The scores for the Middle and Lower Patuxent subwatersheds were similar for the peak flows but more varied for the yield scores. A visual representation of the hydrologic results within the study subwatersheds is depicted in Map 3.1. Approximately 71% of the subwatersheds within the Herring Bay watershed and 89% of the subwatersheds within the Middle and Lower Patuxent watersheds are rated "Low" or "Medium" for the two year peak flow indicators. In the Herring Bay Watershed, approximately 38% of the subwatersheds were rated "Low" or "Medium" for the runoff indicator for both evaluated storm events. In contrast, 69% of the subwatersheds in Middle and Lower Patuxent are rated "Low" or "Medium" for the one year surface runoff yield indicator and 58% for the two year surface runoff yield indicator.

TABLE 3-7: HYDROLOGIC INDICATOR RATINGS

Rating	HERRING BAY WATERSHED		MIDDLE AND LOWER PATUXENT WATERSHEDS	
	Number of Subwatersheds	Percent of Subwatersheds	Number of Subwatersheds	Percent of Subwatersheds
Peak Flow (one-year storm)				
High	3	14.3%	3	8.3%
Medium High	5	23.8%	2	5.6%
Medium	7	33.3%	8	50.0%
Low	6	28.6%	13	36.1%
Peak Flow (two-year storm)				
High	3	14.3%	3	8.3%
Medium High	3	14.3%	1	2.8%
Medium	4	19.0%	14	38.9%
Low	11	52.4%	18	50.0%
Surface Runoff Yield (one-year storm)				
High	2	9.5%	6	16.7%
Medium High	11	52.4%	5	13.9%
Medium	5	23.8%	8	22.2%
Low	3	14.3%	17	47.2%
Surface Runoff Yield (two-year storm)				
High	2	9.5%	11	30.6%
Medium High	11	52.4%	4	11.1%
Medium	5	23.8%	7	19.4%
Low	3	14.3%	14	38.9%

3.2.2 WATER QUALITY MODELING RESULTS

Existing condition water quality modeling results are summarized at the watershed scale in Table 3-8. Additional water quality modeling results are summarized at the subwatershed scale in Table 3-9. These tables show the model-predicted annual loadings of total phosphorus, total nitrogen, and total suspended solids for pristine, current, and future scenarios and for the existing conditions credits. Except where noted, these results are presented for all County jurisdictional lands that fall under the urban stormwater (or urban nonpoint source [NPS]) sector. Pollutant loading results for existing conditions and future conditions are also depicted in Maps 3.3 and Map 3.4, respectively.

TABLE 3-8: ANNUAL LOADS FOR VARIOUS SCENARIOS

Scenario	Total Nitrogen (lb/yr)	Total Phosphorus (lb/yr)	Total Suspended Solids (tons/yr)
HERRING BAY WATERSHED			
A. Pristine Conditions	13,363	1,470	227
B. Existing with no SWM Credits	37,352	5,200	603
C. Credits from Existing SWM	4,559	892	89
D. Existing with SWM Credits	30,207	3,896	456
E. Future with Stormwater to the MEP	29,475	3,692	399
MIDDLE AND LOWER PATUXENT WATERSHEDS			
A. Pristine Conditions	39,959	4,395	679
B. Existing with no SWM Credits	91,114	14,088	2,013
C. Credits from Existing SWM	3,138	626	92
D. Existing with SWM Credits	82,697	12,606	1,820
E. Future with Stormwater to the MEP	72,115	10,434	1,361

TABLE 3-9: ANNUAL LOADS AT SUBWATERSHED LEVEL FOR MODELED SCENARIOS

Shed Code	SCENARIO A			SCENARIO B						SCENARIO C			SCENARIO D			SCENARIO E		
	Pristine Condition Loads			Existing Condition Load without existing SWM credit (All lands)			Existing Condition Load without existing SWM credit (County Urban NPS)			SWM Credits (County Urban NPS)			Existing Condition Load with existing SWM credit (County Urban NPS)			Future Condition Load with Existing SWM Credits (County Urban NPS)		
	TN (lbs/yr)	TP (lbs/yr)	TSS (tons/ yr)	TN (lbs/yr)	TP (lbs/yr)	TSS (tons/ yr)	TN (lbs/yr)	TP (lbs/yr)	TSS (tons yr)	TN (lbs/yr)	TP (lbs/yr)	TSS (tons/ yr)	TN (lbs/yr)	TP (lbs/yr)	TSS (tons/ yr)	TN (lbs/yr)	TP (lbs/yr)	TSS (tons/ yr)
HERRING BAY WATERSHED																		
HB0	1,783	196	30	6,417	1,010	127	6,097	957	120	160	31	4	6,257	979	123	6,050	929	112
HB1	1,588	175	27	5,530	821	116	5,228	772	110	108	21	4	5,422	800	112	5,206	754	102
HB2	1,682	185	29	4,584	653	88	4,343	615	84	137	25	5	4,447	628	83	4,109	551	63
HB3	272	30	5	739	116	10	739	116	10	18	3	0.2	721	113	9	727	114	9
HB7	690	76	12	1,698	206	16	1,698	206	16	28	4	0.3	1,669	202	15	1,677	203	15
HB8	674	74	11	2,262	319	45	1,276	166	17	18	3	0.2	2,244	316	44	2,235	315	44
HB9	908	100	15	2,278	290	32	2,102	261	28	64	9	0.7	2,214	281	31	2,227	282	31
HBB	361	40	6	957	112	8	957	112	8	22	0.3	0	955	112	8	957	112	8
HBC	650	72	11	1,669	203	16	1,566	186	14	403	73	6	1,265	129	9	1,282	131	9
HBD	306	34	5	704	87	8	704	87	8	13	2	0.1	691	85	8	700	86	8
HBF	770	85	13	1,859	228	17	1,829	223	17	3424	697	66	-1,565	-469	-49	-1,538	-466	-49
HBL	894	98	15	2,344	337	44	2,265	324	43	26	4	0.3	2,317	334	44	2,138	293	34
HBM	364	40	6	988	129	11	988	129	11	60	8	0.6	928	121	10	908	115	9
HBO	261	29	4	675	108	9	658	105	9	8	1	0.1	667	107	9	672	105	9
HBP	170	19	3	512	66	7	510	66	7	8	1	0.1	504	65	7	448	55	5
HBQ	894	98	15	1,644	205	22	1,429	170	18	37	5	0.4	1,607	200	22	1,751	215	21
HBR	112	12	2	265	32	3	245	29	2	0	0	0	265	32	3	266	32	3
HBS	161	18	3	272	33	4	241	29	4	0	0	0	272	33	4	272	33	4
HBT	190	21	3	458	61	6	397	51	5	0	0	0	458	61	6	469	60	6
HBU	352	39	6	868	107	8	863	106	8	2	0.3	0	866	106	8	867	107	8
HBV	281	31	5	629	77	7	629	77	7	42	6	0.4	587	71	6	638	78	6
Total	**13,363**	**1,470**	**227**	**37,352**	**5,200**	**603**	**34,765**	**4,788**	**545**	**4,559**	**892**	**89**	**30,207**	**3,896**	**456**	**29,475**	**3,692**	**399**

Shed Code	SCENARIO A			SCENARIO B						SCENARIO C			SCENARIO D			SCENARIO E		
	Pristine Condition Loads			Existing Condition Load without existing SWM credit (All lands)			Existing Condition Load without existing SWM credit (County Urban NPS)			SWM Credits (County Urban NPS)			Existing Condition Load with existing SWM credit (County Urban NPS)			Future Condition Load with Existing SWM Credits (County Urban NPS)		
	TN (lbs/yr)	TP (lbs/yr)	TSS (tons/ yr)	TN (lbs/yr)	TP (lbs/yr)	TSS (tons/ yr)	TN (lbs/yr)	TP (lbs/yr)	TSS (tons yr)	TN (lbs/yr)	TP (lbs/yr)	TSS (tons/ yr)	TN (lbs/yr)	TP (lbs/yr)	TSS (tons/ yr)	TN (lbs/yr)	TP (lbs/yr)	TSS (tons/ yr)
MIDDLE AND LOWER PATUXENT WATERSHEDS																		
MP0	616	68	10	2,745	446	64	2346	381	56	0.8	0.1	0	2,744	446	64	2,378	369	46
MP1	697	77	12	1,837	255	39	1837	255	39	3	0.3	0	1,834	255	39	1,585	205	25
MP2	1,246	137	21	3,786	504	82	3786	504	82	56	14	3	3,730	490	78	3,579	458	66
MP3	833	92	14	3,920	604	101	3853	593	100	213	48	7	3,708	556	95	3,391	494	81
MP4	755	83	13	2,141	335	41	2122	332	41	40	6	0.5	2,101	329	41	2,045	315	37
MP5	600	66	10	2,010	291	39	2005	291	38	56	13	1	1,954	278	37	1,704	225	26
MP6	845	93	14	3,644	640	79	3472	610	75	41	7	1	3,603	633	78	3,210	540	62
MP7	1,394	153	24	4,881	678	79	3799	505	59	105	16	1	4,777	663	77	4,573	621	66
MP8	816	90	14	2,476	353	39	2162	302	34	38	8	2	2,438	344	38	2,373	325	34
MP9	420	46	7	809	126	14	809	126	14	12	2	0.1	797	124	14	805	125	13
MPA	347	38	6	1,330	203	36	1330	203	36	0	0	0	1,330	203	36	1,324	202	36
MPB	79	9	1	99	12	1	33	4	0	0	0	0	99	12	1	99	12	1
MPC	1,199	132	20	3,405	488	54	3245	462	51	48	8	1	3,357	479	53	3,341	459	48
MPD	380	42	6	1,979	320	49	1879	303	48	49	9	2	1,930	310	48	1,603	242	35
MPE	464	51	8	2,118	322	51	2059	312	50	85	15	1	2,033	307	50	1,685	238	36
MPF	458	50	8	2,752	448	76	2752	448	76	31	7	1	2,721	442	75	2,235	354	55
MPG	283	31	5	1,202	176	30	1202	176	30	0.3	0.1	0	1,202	176	30	1,063	148	22
MPH	618	68	11	2,528	400	48	2017	320	39	606	115	11	1,922	285	37	1,809	257	32
MPI	490	54	8	2,608	408	66	2513	393	64	34	5	0.4	2,574	403	66	1,844	271	36
MPJ	754	83	13	4,855	774	131	4644	740	126	118	21	3	4,738	753	127	3,511	529	80
MPK	413	45	7	2,203	336	52	1972	299	47	50	10	2	2,153	326	50	1,756	254	34
MPL	339	37	6	1,727	258	40	1527	225	36	124	22	4	1,603	235	36	1,367	193	26
MPM	349	38	6	1,152	161	20	1152	161	20	4	0.6	0	1,148	160	20	1,139	157	20
MPN	251	28	4	880	129	18	793	115	17	15	2	0.2	865	127	18	679	91	9

Shed Code	SCENARIO A			SCENARIO B						SCENARIO C			SCENARIO D			SCENARIO E		
	Pristine Condition Loads			Existing Condition Load without existing SWM credit (All lands)			Existing Condition Load without existing SWM credit (County Urban NPS)			SWM Credits (County Urban NPS)			Existing Condition Load with existing SWM credit (County Urban NPS)			Future Condition Load with Existing SWM Credits (County Urban NPS)		
	TN (lbs/yr)	TP (lbs/yr)	TSS (tons/ yr)	TN (lbs/yr)	TP (lbs/yr)	TSS (tons/ yr)	TN (lbs/yr)	TP (lbs/yr)	TSS (tons yr)	TN (lbs/yr)	TP (lbs/yr)	TSS (tons/ yr)	TN (lbs/yr)	TP (lbs/yr)	TSS (tons/ yr)	TN (lbs/yr)	TP (lbs/yr)	TSS (tons/ yr)
MPO	831	91	14	3,293	507	70	3166	486	67	58	8	0.6	3,235	499	69	2,702	394	47
MPP	548	60	9	3,584	651	94	3429	625	91	23	5	0.5	3,561	645	93	3,038	543	73
MPQ	1,051	116	18	1,869	289	46	1809	279	45	75	11	1	1,795	278	45	1,522	221	33
MPR	806	89	14	1,388	222	36	1269	202	34	6	1	0.2	1,382	221	36	1,205	182	28
MPS	1,750	192	30	3,238	503	79	3198	496	78	205	43	8	3,033	460	71	2,528	358	51
MPT	976	107	17	1,855	337	44	1744	319	42	4	0.56	0	1,851	337	44	1,755	317	41
MPU	3,516	387	60	3,238	507	72	3197	500	71	228	49	6	3,010	459	66	2,559	363	47
MPV	7,041	775	120	5,142	838	116	4900	798	111	116	22	2	5,026	815	114	4,424	678	90
MPW	1,915	211	33	1,658	253	37	1658	253	37	435	107	26	1,223	145	11	1,009	101	1
MPX	1,640	180	28	3,342	513	75	3095	472	70	31	5	0.5	3,311	508	75	2,856	415	57
MPY	1,524	168	26	2,592	442	63	2327	398	58	86	15	3	2,506	427	60	2,053	317	41
MPZ	3,718	409	63	2,827	359	34	2736	344	32	144	32	3	2,683	328	31	2,643	316	27
Total	**39,959**	**4,395**	**679**	**91,114**	**14,088**	**2,013**	**85835**	**13,232**	**1,912**	**3,138**	**626**	**92**	**82,697**	**12,606**	**1,820**	**72,115**	**10,434**	**1,361**

Pollutant loading was considered in the assessments of both subwatershed restoration and subwatershed preservation that are discussed in more detail in Section 4. For the subwatershed restoration assessment, the County evaluated two water quality indicators based on existing conditions: total nitrogen load from runoff (lbs/acre/yr) and total phosphorus load from runoff (lbs/acre/yr). For the subwatershed preservation assessment, the County evaluated water quality indicators based on the percent future departure of loading conditions for total nitrogen and total phosphorus in terms of pounds per acre per year.

Subwatersheds were prioritized and rated "High," "Medium High," "Medium," or "Low" for each of the water quality indicators related to the subwatershed restoration analysis. A summary of these ratings is presented in Table 3-10. A visual representation of the existing condition pollutant loads within the study subwatersheds is depicted in Map 3.3. In the Herring Bay watershed, over half (52.4%) of the subwatersheds were in the "Mediums" to "Low" range when evaluating total nitrogen and total phosphorus. In the Middle and Lower Patuxent watersheds, 58.3% of the watersheds were rated "High" and "Medium High" for total nitrogen and 69.5% were rated "High" and "Medium High" for total phosphorus loading.

TABLE 3-10: WATER QUALITY INDICATOR RATINGS (SUBWATERSHED RESTORATION)

Rating	HERRING BAY WATERSHED		MIDDLE AND LOWER PATUXENT WATERSHEDS	
	Number of Subwatersheds	Percent of Subwatersheds	Number of Subwatersheds	Percent of Subwatersheds
Total Nitrogen Load from Runoff				
High	4	19.0%	8	22.2%
Medium High	6	28.6%	13	36.1%
Medium	10	47.6%	13	36.1%
Low	1	4.8%	2	5.6%
Total Phosphorus Load from Runoff				
High	4	19.0%	10	27.8%
Medium High	6	28.6%	15	41.7%
Medium	10	47.6%	10	27.8%
Low	1	4.8%	1	2.8%

For the subwatershed preservation assessment, subwatersheds are rated and prioritized "High," "Medium High," "Medium," or "Low" based on their relative need for preservation. A summary of these ratings for the watersheds is presented in Table 3-11, and is shown visually on Map 3.5. In the Herring Bay watershed, the vast majority of subwatersheds (71% and 76%, respectively) were rated as "Low" or "Medium" in both the total nitrogen and total phosphorous indicator categories. The Middle and Lower Patuxent River subwatersheds had very low changes in nitrogen and phosphorus which skewed the natural breaks toward the "High" and "Medium High" ratings.

TABLE 3-11: WATER QUALITY INDICATOR RATINGS (SUBWATERSHED PRESERVATION)

Rating	HERRING BAY WATERSHED		MIDDLE AND LOWER PATUXENT WATERSHEDS	
	Number of Subwatersheds	Percent of Subwatersheds	Number of Subwatersheds	Percent of Subwatersheds
Percent Future Departure of Total Nitrogen Load				
High	3	14.30%	1	2.80%
Medium High	3	14.30%	35	97.20%
Medium	4	19%	0	0%
Low	11	52.40%	0	0%
Percent Future Departure of Total Phosphorus Load				
High	3	14.30%	1	2.80%
Medium High	2	9.50%	35	97.20%
Medium	4	19.00%	0	0%
Low	12	57.10%	0	0%

4 PRIORITIZATION AND RATING

The County typically performs three detailed prioritization assessments in order to characterize current conditions within each watershed, guide decisions that impact waterways, and assist with land use management planning. Three assessments (stream restoration, subwatershed restoration, and subwatershed preservation) are presented in more detail in the following subsections. Each prioritization assessment relies on indicators derived from the data collected and compiled in Section 2 and the model results generated in Section 3. For this watershed study, the County also incorporated a preservation prioritization at the individual parcel level. This is a new approach that can ultimately be used Countywide to identify parcels that have high quality conditions and should be prioritized for preservations efforts such as land purchase or easements.

4.1 STREAM RESTORATION ASSESSMENT AND RATING

The County's stream restoration assessment is intended to identify and rate the impaired stream reaches in the Herring Bay and Middle Patuxent watersheds to prioritize future stream restoration and capital improvement projects and to guide future land use management and development decisions. Methods and findings for the stream restoration assessment and rating are presented in this subsection.

4.1.1 METHODS

The methods determine the relative ranking of stream reaches. That is, they are not compared against an absolute threshold of good or poor conditions, but are ranked to determine which are better or worse within each subwatershed when compared to one another. Results are also provided for a Countywide ranking which is a relative ranking of all of the County's streams.

The stream restoration assessment uses a suite of indicator scores or ratings that are weighted and then combined to obtain a single stream restoration rating for each perennial reach. The indicators are grouped into one of five categories: stream habitat; stream morphology; land cover; infrastructure; and hydrology and

hydraulics. As shown in Table 4-1, each category is comprised of one to six different indicators, and each indicator has a relative weight assigned by the County.

TABLE 4-1: STREAM PRIORITY RATING INDICATORS FOR RESTORATION

Category	Indicator	Weight
Stream Habitat	MPHI score	31.6%
Stream Morphology	Rosgen Level I Classification	5.3%
Land Cover	Imperviousness (%)	5.3%
Infrastructure	Stream buffer impacts	5.3%
	Channel erosion impacts	10.5%
	Head cut impacts	5.3%
	Dumpsite impacts	5.3%
	Other infrastructure impacts (pipes, ditches, stream crossings, and obstructions)	15.8%
Hydrology and Hydraulics	Crossing flooding likelihood	15.8%

Among the indicators for stream restoration, the MPHI score is utilized to represent the quality of physical stream habitat characteristics. Rosgen Level I classifications are used as an indicator of the degree of stability and entrenchment of each stream reach. The percentage of imperviousness contributes to increased stormwater volumes and thermal and chemical pollutant loading. The presence and impacts associated with stream buffers, channel erosion, head cuts, dumpsites, and other indicators (i.e., pipes, ditches, stream crossings, and obstructions) are a sign of potential channel degradation, excessive pollution and sedimentation, and habitat impairment. Flooding and overtopping of road stream crossings pose an inconvenience and safety hazard to nearby residents.

Although all stream channel types (e.g., perennial, intermittent, ephemeral etc.) were assessed as part of the physical habitat condition assessment described in Section 2.1.2, several of the metrics used to calculate the MPHI are only applicable for perennial channels. Since the MPHI score is a critical indicator and weighed so heavily in the County's stream restoration prioritization, only perennial streams are considered.

4.1.2 FINDINGS

The results rank the stream reaches Of the 124 assessed perennial stream reaches in the Herring Bay watershed, 13 reaches were rated as "High" priorities for restoration. 37 reaches were rated as "Medium High". The remaining 74 reaches were rated as "Medium" or "Low" (44 and 30, respectively). In the Middle Patuxent watershed, 462 perennial reaches were assessed. Of these, a total of 28 reaches were rated as "High" priorities for restoration. 140 reaches were rated as "Medium High". The remaining 294 reaches were rated as "Medium" or "Low" (208 and 86, respectively). A breakdown of the results by subwatershed is presented in Table 4-2. See Map 4.1 for a map of the stream restoration assessment results.

TABLE 4-2: STREAM PRIORITY RATINGS FOR RESTORATION

Subwatershed Code	Subwatershed Name	Number of Reaches with Rating				
		High	Medium High	Medium	Low	Total
HERRING BAY WATERSHED						
HB0	Rockhold Creek	2	1	1	1	5
HB1	Tracys Creek I	0	2	8	3	13
HB2	Tracys Creek II	6	9	12	16	43
HBF	Parker Creek	2	0	1	3	6
HBL	Trotts Branch	1	9	8	8	26
HBQ	Unnamed Tributary II	2	5	10	6	23
HBR	Herring Bay III	0	0	1	0	1
HBS	Unnamed Tributary III	0	3	1	0	4
HBT	Red Lyon Creek	0	1	2	0	3
MIDDLE AND LOWER PATUXENT WATERSHEDS						
MP0	Deep Creek	3	0	14	7	24
MP1	Unnamed Tributary	1	3	1	0	5
MP2	Rock Branch 1	2	3	8	7	20
MP3	Rock Branch 2	3	0	7	8	18
MP4	Ferry Branch 1	0	2	6	1	9
MP5	Wilson Owens Branch 3	1	1	3	5	10
MP6	Lyons Creek 10	4	0	10	4	18
MP7	Galloway Creek	1	4	18	13	36
MP8	Cabin Branch 1	0	7	8	8	23
MP9	Two Run Branch 2	1	0	4	1	6
MPA	Pindell Branch	0	1	14	8	23
MPC	Hall Creek 1	1	10	10	4	25
MPD	Wilson Owens Branch 1	0	0	0	3	3
MPE	Wilson Owens Branch 2	1	2	2	4	9
MPF	Lyons Creek 1	0	0	1	0	1
MPG	Lyons Creek 2	0	2	7	1	10
MPH	Lyons Creek 3	1	4	3	4	12
MPI	Lyons Creek 4	1	1	6	1	9
MPJ	Lyons Creek 5	0	3	6	0	9
MPK	Lyons Creek 6	0	1	0	0	1
MPL	Lyons Creek 7	0	1	4	2	7
MPM	Lyons Creek 8	1	0	2	7	10
MPN	Lyons Creek 9	1	0	3	4	8
MPO	Ferry Branch 2	1	1	12	5	19

Subwatershed Code	Subwatershed Name	Number of Reaches with Rating				
		High	Medium High	Medium	Low	Total
MPP	Ferry Branch 3	0	1	1	1	3
MPQ	Cabin Branch 2	1	1	9	4	15
MPR	Cabin Branch 3	2	0	1	4	7
MPS	Cabin Branch 4	1	0	5	9	15
MPT	Cabin Branch 5	0	0	4	9	13
MPU	Unnamed Tributary	0	1	4	4	9
MPV	Rock Branch 3	0	7	13	3	23
MPW	Two Run Branch 1	0	3	4	1	8
MPX	Hall Creek 2	0	11	5	4	20
MPY	Hall Creek 3	0	8	5	2	15
MPZ	Wilson Owens Branch 4	1	8	8	2	19
	Total	**41**	**116**	**252**	**177**	**586**
	Percent of Total	**7%**	**20%**	**43%**	**30%**	**--**

Table 4-3 presents the stream reach restoration priority ratings for all reaches assessed throughout the County's watershed assessments. Herring Bay and Middle Patuxent watersheds have relatively few reaches rated "High" for restoration, with majority of the reaches in these watersheds falling in the "Medium" and "Low" category. Watersheds with the most subwatersheds in the "High" restoration category include Patapsco Tidal, South River, Severn River, and Patapsco Non-Tidal.

TABLE 4-3: COUNTYWIDE STREAM PRIORITY RATINGS FOR RESTORATION

Watershed	Number of Reaches with Rating			
	High	Medium High	Medium	Low
Bodkin Creek	0	2	18	34
Herring Bay	3	24	38	59
Little Patuxent River	17	64	100	124
Magothy River	4	36	149	83
Middle Patuxent River	13	102	207	140
Patapsco Non-Tidal	30	33	63	16
Patapsco Tidal	61	75	138	68
Rhode River	9	32	83	73
Severn River	34	121	139	58
South River	42	89	255	310
Upper Patuxent River	9	59	148	156
West River	8	20	34	7
Total	**230**	**657**	**1,372**	**1,128**

4.2 SUBWATERSHED RESTORATION ASSESSMENT AND RATING

The County's subwatershed restoration assessment is intended to identify and rate those subwatersheds where conditions warrant priority consideration for restoration activities. Methods and findings for the subwatershed restoration assessment and rating are presented in this subsection.

4.2.1 METHODS

The methods determine the relative ranking of subwatersheds. That is, they are not compared against an absolute threshold of good or poor conditions, but are ranked to determine which are better or worse within each subwatershed when compared to one another. Results are also provided for a Countywide ranking which is a relative ranking of all of the County's subwatersheds.

Like the stream restoration assessment, the subwatershed restoration assessment uses a suite of indicator ratings that are weighed and combined to obtain a single restoration rating for each subwatershed. The indicators are grouped into one of seven categories: stream ecology, 303(d) list, septics, BMPs, hydrologic and hydraulic (H&H), water quality, and landscape. Each category is comprised of one to four different indicators. Table 4-4 provides a summary of the categories, indicators, and relative weighting assigned by the County.

TABLE 4-4: SUBWATERSHED PRIORITY RATING INDICATORS FOR RESTORATION

Category	Indicator	Weight
Stream Ecology	Final habitat score	8.1%
	Bioassessment score	8.1%
303(d) List	Number of TMDL impairments	8.1%
Septics	Total nitrogen load 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 (cfs/acre)	4.4%
	Peak flow from 2-year storm (cfs/acre)	4.4%
	Runoff volume from 1-year storm (inches/acre)	5.6%
	Runoff volume from 2-year storm (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%
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%

Among the indicators for the subwatershed restoration assessment, the final habitat and bioassessment scores are used as indicators of the quality of the physical and biological characteristics of stream reaches in the subwatershed. The relative magnitude of total nitrogen loading from septics and total nitrogen and total phosphorus loading from runoff are indicative of potential water quality degradation in each subwatershed. Peak flow and runoff volume are indicators of hydrology changes due to increased development and urbanization. BMP and landscape indicators, including percent imperviousness, percent BMP treatment, and percent forested buffer, influence stormwater volumes, peak flows, and pollutant loading. The presence of potential wetland areas and acres of developable Critical Area serve as indicators of restoration potential.

4.2.2 RESULTS

The subwatersheds in the Herring Bay and Middle Patuxent watershed were assessed to identify restoration needs. As seen in Table 4-5, of the 21 Herring Bay subwatersheds assessed, 7 were rated "High", which makes them priorities for restoration. These 7 subwatersheds represent 33% of the subwatersheds in the Herring Bay watershed. The remaining watershed area was split between "Medium High" (14%), "Medium" (29%), and "Low" (24%) priority. The breakdown of rating results by subwatershed is presented in Table 4-5. See Map 4.2 for a map of the subwatershed restoration assessment results.

In the Middle Patuxent watershed, only 6 of the 36 subwatersheds (17%) were rated as a "High" priority for restoration. Eleven subwatersheds (31%) were assessed to be "Medium High" on the prioritization scale for restoration needs, while 12 subwatersheds (33%) were assessed to be "Medium" priority. Finally, 7 subwatersheds (19%) were assessed to be "Low" priorities. Summaries of rankings by subwatershed are presented in Table 4-5 and Table 4-6. Map 4.2 for a map of the subwatershed restoration assessment results.

TABLE 4-5: SUBWATERSHED PRIORITY RATING FOR RESTORATION

Subwatershed Code	Subwatershed Name	Priority for Restoration
HERRING BAY WATERSHED		
HB0	Rockhold Creek	High
HB7	Cedarhurst	High
HBB	Chesapeake Bay	High
HBC	Broadwater Creek	High
HBF	Parker Creek	High
HBM	Herring Bay	High
HBU	Herrington Harbor	High
HB3	Jack Creek	Medium High
HB8	Deep Creek	Medium High
HBP	Herring Bay II	Medium High
HB1	Tracys Creek I	Medium
HB9	Deep Cove Creek	Medium
HBD	Carrs Creek	Medium
HBO	Unnamed Tributary	Medium
HBT	Red Lyon Creek	Medium
HBV	Chesapeake Bay II	Medium
HB2	Tracys Creek II	Low
HBL	Trotts Branch	Low
HBQ	Unnamed Tributary II	Low
HBR	Herring Bay III	Low
HBS	Unnamed Tributary III	Low
MIDDLE AND LOWER PATUXENT WATERSHEDS		
MP7	Galloway Creek	High
MPE	Wilson Owens Branch 2	High
MPL	Lyons Creek 7	High

Subwatershed Code	Subwatershed Name	Priority for Restoration
MPM	Lyons Creek 8	High
MPX	Hall Creek 2	High
MPY	Hall Creek 3	High
MP0	Deep Creek	Medium High
MP6	Lyons Creek 10	Medium High
MP8	Cabin Branch 1	Medium High
MPC	Hall Creek 1	Medium High
MPD	Wilson Owens Branch 1	Medium High
MPI	Lyons Creek 4	Medium High
MPK	Lyons Creek 6	Medium High
MPP	Ferry Branch 3	Medium High
MPS	Cabin Branch 4	Medium High
MPT	Cabin Branch 5	Medium High
MPV	Rock Branch 3	Medium High
MP3	Rock Branch 2	Medium
MP5	Wilson Owens Branch 3	Medium
MPB	House Creek	Medium
MPF	Lyons Creek 1	Medium
MPG	Lyons Creek 2	Medium
MPH	Lyons Creek 3	Medium
MPJ	Lyons Creek 5	Medium
MPN	Lyons Creek 9	Medium
MPO	Ferry Branch 2	Medium
MPQ	Cabin Branch 2	Medium
MPR	Cabin Branch 3	Medium
MPU	Unnamed Tributary	Medium
MP1	Unnamed Tributary	Low
MP2	Rock Branch 1	Low
MP4	Ferry Branch 1	Low
MP9	Two Run Branch 2	Low
MPA	Pindell Branch	Low
MPW	Two Run Branch 1	Low
MPZ	Wilson Owens Branch 4	Low

To demonstrate the relative importance of each indicator on each of the subwatersheds final ranking a graphic is presented in Figure 4-1. A larger red bar represents a greater importance and influence on the ranking, while a smaller bar represent less importance. For example Rockhold Creek's restoration ranking was most influenced by the bioassessment score, nitrogen load from septics, and acres of developable land. Whereas Herrington Harbor was most impacted by the impervious cover, peak flows and pollutant loading, and % of wetlands. The number of TMDLs and percent impervious area treated by BMPs indicators were not factor for any of the subwatersheds and did not help in distinguishing the higher and lower priority areas.

FIGURE 4-1: RESTORATION INDICATOR RESULTS SUMMARY

Subshed Code	Subshed Name	Priority Rank	Final Habitat Score	Bioassessment Score	# of TMDL Impairments	Nitrogen Load from Septics (lbs)	% Impervious Area Treated by BMPs	Peak Flow from 1-year Storm Event (cfs/acre)	Peak Flow from 2-year Storm Event (cfs/acre)	Runoff Volume from 1-year Storm Event (inches/acre)	Runoff Volume from 2-year Storm Event (inches/acre)	Nitrogen Load from Runoff (lbs/acre/yr)	Phosphorous Load from Runoff (lbs/acre/yr)	% Impervious Cover	% Forest within the 100 ft Stream Buffer	% of Existing Wetlands to Potential Wetlands	Acres of Developable Critical Area
HBF	Parker Creek	1															
HBB	Chesapeake Bay	2															
HBU	Herrington Harbor	3															
HBM	Herring Bay	4															
HB0	Rockhold Creek	5															
HBC	Broadwater Creek	6															
HB7	Cedarhurst	7															
HBP	Herring Bay II	8															
HB3	Jack Creek	9															
HB8	Deep Creek	10															
HB9	Deep Cove Creek	11															
HB1	Tracys Creek I	12															
HBD	Carrs Creek	13															
HBO	Unnamed Tributary	14															
HBV	Chesapeake Bay II	15															
HBT	Red Lyon Creek	16															
HBL	Trotts Branch	17															
HBR	Herring Bay III	18															
HB2	Tracys Creek II	19															
HBQ	Unnamed Tributary II	20															
HBS	Unnamed Tributary III	21															
MP7	Galloway Creek	1															
MPX	Hall Creek 2	2															
MPE	Wilson Owens Br. 2	3															
MPL	Lyons Creek 7	4															
MPY	Hall Creek 3	5															
MPM	Lyons Creek 8	6															
MPI	Lyons Creek 4	7															
MPS	Cabin Branch 4	8															
MPT	Cabin Branch 5	9															
MPV	Rock Branch 3	10															
MPC	Hall Creek 1	11															
MP6	Lyons Creek 10	12															
MPD	Wilson Owens Br. 1	13															
MP0	Deep Creek	14															
MP8	Cabin Branch 1	15															
MPK	Lyons Creek 6	16															
MPP	Ferry Branch 3	17															
MPF	Lyons Creek 1	18															
MPB	House Creek	19															
MPJ	Lyons Creek 5	20															
MPU	Unnamed Tributary	21															
MPR	Cabin Branch 3	22															
MPG	Lyons Creek 2	23															
MP3	Rock Branch 2	24															
MPO	Ferry Branch 2	24															
MPQ	Cabin Branch 2	26															
MPN	Lyons Creek 9	27															
MPH	Lyons Creek 3	28															
MP5	Wilson Owens Br. 3	29															
MPW	Two Run Branch 1	30															
MP9	Two Run Branch 2	31															
MPZ	Wilson Owens Br. 4	32															
MP4	Ferry Branch 1	33															
MP1	Unnamed Tributary	34															
MP2	Rock Branch 1	35															
MPA	Pindell Branch	36															

TABLE 4-6: SUBWATERSHED RESTORATION ASSESSMENT RESULTS

Rating	HERRING BAY WATERSHED		MIDDLE AND LOWER PATUXENT WATERSHEDS	
	Number of Subwatersheds	Percent of Subwatersheds	Number of Subwatersheds	Percent of Subwatersheds
High	7	33%	6	17%
Medium High	3	14%	11	31%
Medium	6	29%	12	33%
Low	5	24%	7	19%
Total	**21**	**--**	**36**	**--**

Table 4-7 presents the subwatershed restoration priority ratings for all subwatersheds assessed throughout the County's watershed assessments. Three Herring Bay subwatersheds were rated "High" for restoration, but no subwatersheds in the Middle Patuxent watershed were rated "High". The majority of the subwatersheds in the study watersheds fell within in the "Medium" and "Low" categories for restoration priority. Watersheds with the most subwatersheds in the "High" restoration category include Magothy River, Patapsco Tidal, and South River.

TABLE 4-7: COUNTYWIDE SUBWATERSHED PRIORITY RATINGS FOR RESTORATION

Watershed	Number of Subwatersheds with Rating			
	High	Medium High	Medium	Low
Bodkin Creek	0	1	5	1
Herring Bay	3	7	9	2
Little Patuxent River	2	6	6	5
Magothy River	14	29	17	8
Middle Patuxent River	0	1	21	14
Patapsco Non-Tidal	6	5	1	0
Patapsco Tidal	13	9	5	0
Rhode River	1	2	5	7
Severn River	7	36	20	7
South River	12	16	24	4
Upper Patuxent River	0	1	1	17
West River	2	6	4	1
Total	**60**	**119**	**118**	**66**

4.3 SUBWATERSHED PRESERVATION ASSESSMENT AND RATING

The County's subwatershed preservation assessment is intended to identify and rate those subwatersheds where conditions warrant consideration for preservation activities. This section presents the methods and findings for the subwatershed preservation assessment and rating.

4.3.1 METHODS

The methods determine the relative ranking of subwatersheds. That is, they are not compared against an absolute threshold of good or poor conditions, but are ranked to determine which are better or worse within each subwatershed when compared to one another. Results are also provided for a Countywide ranking which is a relative ranking of all of the County's streams.

The subwatershed preservation assessment uses a suite of indicator ratings that are weighed and combined to obtain a single preservation rating for each subwatershed. The indicators are grouped into one of five categories: stream ecology, future departure of water quality conditions, soils, landscape, and aquatic living resources. Each category is comprised of one to eight different indicators. Table 4-8 provides a summary of the categories, indicators, and relative weighting assigned by the County.

TABLE 4-8: SUBWATERSHED PRIORITY RATING INDICATORS FOR PRESERVATION

Category	Indicator	Weight
Stream Ecology	Final Habitat Score	7.4%
	Bioassessment Score	7.4%
Future Departure of Water Quality Conditions	Percent Future Departure of Total Nitrogen	11.1%
	Percent Future Departure of Total Phosphorous	11.1%
Soils	NRCS Erodibility Factor	7.4%
Landscape	Percent Forest Cover	11.1%
	Percent Wetland Cover	11.1%
	Density of Headwater Streams (feet/acre)	7.4%
	Percent of Land within the Greenway Master Plan	3.7%
	Presence of Bog Wetlands	3.7%
	Acres of RCA Lands within the Critical Area	3.7%
	Percent of Protected Lands	3.7%
	Presence of Wellhead Protection Areas	3.7%
Aquatic Living Resources	Presence of Trout Spawning, Anadromous Spawning, and SSPRA	7.4%

4.3.2 RESULTS

In the Herring Bay watershed, three subwatersheds (HB9, HBQ, and HBV) were rated to be "High" priority for preservation, making up 14% of the 21 subwatersheds. The remaining 18 subwatersheds were split equally between "Medium High", "Medium", and "Low" priorities, making up the remaining 79% of the subwatersheds. The full breakdown by ranking per watershed is presented in Table 4-9. Map 4.3 depicts the subwatershed preservation assessment results.

In the Middle Patuxent watershed, 10 subwatersheds were rated to be "High" priority for preservation, making up 28% of the 36 subwatersheds. Eight subwatersheds (22%) were rated "Medium High", 11 subwatersheds (31%) were rated "Medium" and 7 (19%) were rated "Low" priority for preservation. The full breakdown by ranking per watershed is presented in Table 4-10. Map 4.3 depicts the subwatershed preservation assessment results.

TABLE 4-9: SUBWATERSHED PRIORITY RATINGS FOR PRESERVATION

Subwatershed Code	Subwatershed Name	Priority for Preservation
HERRING BAY WATERSHED		
HB9	Deep Cove Creek	High
HBQ	Unnamed Tributary II	High
HBV	Chesapeake Bay II	High
HB3	Jack Creek	Medium High
HB7	Cedarhurst	Medium High
HB8	Deep Creek	Medium High
HBC	Broadwater Creek	Medium High
HBD	Carrs Creek	Medium High
HBT	Red Lyon Creek	Medium High
HB0	Rockhold Creek	Medium
HB1	Tracys Creek I	Medium
HB2	Tracys Creek II	Medium
HBF	Parker Creek	Medium
HBL	Trotts Branch	Medium
HBS	Unnamed Tributary III	Medium
HBB	Chesapeake Bay	Low
HBM	Herring Bay	Low
HBO	Unnamed Tributary	Low
HBP	Herring Bay II	Low
HBR	Herring Bay III	Low
HBU	Herrington Harbor	Low
MIDDLE AND LOWER PATUXENT WATERSHEDS		
MP4	Ferry Branch 1	High
MP7	Galloway Creek	High
MP8	Cabin Branch 1	High
MP9	Two Run Branch 2	High
MPA	Pindell Branch	High
MPG	Lyons Creek 2	High
MPN	Lyons Creek 9	High
MPQ	Cabin Branch 2	High
MPW	Two Run Branch 1	High
MPZ	Wilson Owens Branch 4	High

Subwatershed Code	Subwatershed Name	Priority for Preservation
MP0	Deep Creek	Medium High
MP1	Unnamed Tributary	Medium High
MP2	Rock Branch 1	Medium High
MP3	Rock Branch 2	Medium High
MP5	Wilson Owens Branch 3	Medium High
MP6	Lyons Creek 10	Medium High
MPF	Lyons Creek 1	Medium High
MPR	Cabin Branch 3	Medium High
MPB	House Creek	Medium
MPC	Hall Creek 1	Medium
MPE	Wilson Owens Branch 2	Medium
MPH	Lyons Creek 3	Medium
MPI	Lyons Creek 4	Medium
MPL	Lyons Creek 7	Medium
MPM	Lyons Creek 8	Medium
MPP	Ferry Branch 3	Medium
MPT	Cabin Branch 5	Medium
MPU	Unnamed Tributary	Medium
MPV	Rock Branch 3	Medium
MPD	Wilson Owens Branch 1	Low
MPJ	Lyons Creek 5	Low
MPK	Lyons Creek 6	Low
MPO	Ferry Branch 2	Low
MPS	Cabin Branch 4	Low
MPX	Hall Creek 2	Low
MPY	Hall Creek 3	Low

To demonstrate the relative importance of each indicator on each of the subwatersheds final ranking a graphic is presented in Figure 4-2. A larger green bar represents a greater importance and influence on the ranking, while a smaller bar represent less importance. For example Deep Creek's preservation ranking was most influenced by the erodibility factor, greenway master plan, critical area, and area of protected lands indicators. The percent of bog wetlands was not factor for any of the subwatersheds and did not help in distinguishing the higher and lower priority areas.

FIGURE 4-2: PRESERVATION INDICATOR RESULTS SUMMARY

Subshed Code	Subshed Name	Priority Rank	Final Habitat Score	Bioassessment Score	Percent Future Departure of Total Nitrogen	Percent Future Departure of Total Phosphorous	NRCS erodibility Factor	Percent Forest Cover	Percent Wetland Cover	Density of Headwater Streams in feet/Acre	Percent of Land within the Greenway Master Plan	Presence of Bog Wetlands	Acres of RCA Lands within the Critical Area	Percent of Protected Lands	Presence of Wellhead Protection Areas	Presence of Trout & Anadromous Spawning, and SSPRA
HBQ	Unnamed Tributary II	1			111											
HBV	Chesapeake Bay II	2														
HB9	Deep Cove Creek	3														
HBC	Broadwater Creek	4														
HB8	Deep Creek	5														
HBD	Carrs Creek	6														
HBT	Red Lyon Creek	7														
HB3	Jack Creek	8														
HB7	Cedarhurst	9														
HB1	Tracys Creek I	10														
HBS	Unnamed Tributary III	11														
HB0	Rockhold Creek	12														
HBL	Trotts Branch	13														
HBF	Parker Creek	14														
HB2	Tracys Creek II	15														
HBR	Herring Bay III	16														
HBO	Unnamed Tributary	17														
HBB	Chesapeake Bay	18														
HBU	Herrington Harbor	19														
HBM	Herring Bay	20														
HBP	Herring Bay II	20														
MP9	Two Run Branch 2	1														
MPA	Pindell Branch	2														
MPZ	Wilson Owens Br. 4	3														
MPG	Lyons Creek 2	4														
MPW	Two Run Branch 1	4														
MP8	Cabin Branch 1	6														
MPN	Lyons Creek 9	7														
MPQ	Cabin Branch 2	7														
MP4	Ferry Branch 1	9														
MP7	Galloway Creek	10														
MPF	Lyons Creek 1	11														
MP5	Wilson Owens Br 3	12														
MP2	Rock Branch 1	13														
MP0	Deep Creek	14														
MP3	Rock Branch 2	15														
MP6	Lyons Creek 10	15														
MP1	Unnamed Tributary	17														
MPR	Cabin Branch 3	17														
MPV	Rock Branch 3	19														
MPT	Cabin Branch 5	20														
MPP	Ferry Branch 3	21														
MPL	Lyons Creek 7	22														
MPB	House Creek	23														
MPE	Wilson Owens Br. 2	23														
MPI	Lyons Creek 4	25														
MPM	Lyons Creek 8	25														
MPU	Unnamed Tributary	25														
MPC	Hall Creek	28														
MPH	Lyons Creek 3	28														
MPD	Wilson Owens Br. 1	30														
MPO	Ferry Branch 2	31														
MPX	Hall Creek 2	31														
MPY	Hall Creek 3	31														
MPS	Cabin Branch 4	34														
MPK	Lyons Creek 6	35														
MPJ	Lyons Creek 5	36														

TABLE 4-10: SUBWATERSHED PRESERVATION ASSESSMENT RESULTS

Rating	HERRING BAY WATERSHED		MIDDLE AND LOWER PATUXENT WATERSHEDS	
	Number of Subwatersheds	Percent of Subwatersheds	Number of Subwatersheds	Percent of Subwatersheds
High	3	14%	10	28%
Medium High	6	29%	8	22%
Medium	6	29%	11	31%
Low	6	29%	7	19%
Total	**21**	**--**	**36**	**--**

Table 4-11 presents the subwatershed preservation priority ratings for all subwatersheds assessed throughout the County's watershed assessments. Majority of the Herring Bay subwatersheds were rated "Medium High" (12 subwatersheds) priority for preservation while the Middle Patuxent subwatersheds were rated mostly "Medium High" (15 subwatersheds) and "Medium (15 subwatersheds"). Watersheds with the most subwatersheds in the "High" priority for preservation category include South River and Upper Patuxent River.

TABLE 4-11: COUNTYWIDE SUBWATERSHED PRIORITY RATINGS FOR PRESERVATION

Watershed	Number of Subwatersheds with Rating			
	High	Medium High	Medium	Low
Bodkin Creek	0	4	2	1
Herring Bay	2	12	4	3
Little Patuxent River	5	6	8	0
Magothy River	1	9	29	29
Middle Patuxent River	6	15	15	0
Patapsco Non-Tidal	7	4	1	0
Patapsco Tidal	2	5	11	9
Rhode River	2	8	3	2
Severn River	7	26	24	13
South River	10	19	13	14
Upper Patuxent River	11	8	0	0
West River	0	6	7	0
Total	**53**	**122**	**117**	**71**

As described in section 1.4.4, two 'Tier II High Quality Waters' stream segments exist in the Middle Patuxent including segments in Cabin Branch 1 (MP8) and Lyons Creek 10 (MP6). MP8 had a reservation ranking of 'High', while MP6 had a ranking of 'Medium High'. Several adjacent subwatersheds draining to these reaches were also rate 'High' including MPQ, MPN, and MPG making this an important area for implementing preservation measures.

4.4 PARCEL SCALE ASSESSMENT AND RATING

Beginning with the Severn River Watershed Study, Anne Arundel County has included watershed protection and preservation as a key item into each of the completed watershed studies and management plans. The County understands that while watershed restoration, treatment of impervious surfaces, and reducing pollutant loads are extremely important objectives, just as important is managing land use effectively and preserving the County's natural resources including wetlands, high quality streams, forests, and estuaries. Each watershed study has utilized a quantitative method to prioritize areas for preservation using a series of indicators of watershed health incorporated into a scoring system such that each County subwatershed is prioritized and ranked relative to all of the other subwatersheds.

General land use conditions in the southern portions of Anne Arundel County differ from the northern and central portions of the County in that southern areas are less developed and overall there is more agricultural use and more forest present (see section 1.4.5 for details). As a result, the amount of impervious surface in the southern areas is considerably less than in other parts of the County. Herring Bay's overall impervious surface coverage is 6.5% and the Middle Patuxent is 4.8% of the total watershed area. Because of these factors, the County recognizes that preservation is a critical factor in the Herring Bay, Middle and Lower Patuxent watersheds and has therefore emphasized those elements.

To supplement the subwatershed based preservation ranking used in all of the previous studies and the current study, KCI worked with the County to develop three separate but related prioritization models that identify areas at the parcel level. The prioritization models are being piloted in the current assessment for the study watersheds, with a future goal of potentially applying the methods across other watersheds across the County.

Three related prioritization models were identified for development:

1. Parcel Preservation: The goal of this model is to identify parcels with high ecological value that should be, but are not already preserved or protected.
2. Pervious to Forest: The goal of this model is to identify parcels that are good candidates for tree planting, including stream buffers and areas of general reforestation.
3. Impervious to Pervious: The goal of this model is to identify impervious areas that are good candidates for impervious surface treatment either by removal or through stormwater management practices.

Because the models are applied at the parcel scale there are thousands of results. It is impractical to include a list ranking all or even a meaningful portion of the outcome; therefore the results are summarized by watershed and by ranking category (High, Medium High, Medium, Low) and are presented in several maps. GIS results files are delivered to the County for their use.

4.4.1 METHODS

Appendix C describes in more detail the methods used to develop the models, and describes each indicator, including how the data were processed and used, and provides a summary of the results.

In general, the prioritization models were developed with a procedure consisting of the following steps:

- Indicators: Choose three sets of indicators (one for each model), that characterize conditions for the specific model with a minimum of duplication within each set,

- Scoring: Quantify or score each indicator, preferably in a normalized fashion so that one parcel's score is directly compared with that of another, A 0-10 scale was used for each indicator where 0 indicates low priority for selection and 10 indicates high priority for selection.
- Weights: Weight the indicators against each other so that the ones that are most important in establishing the model outcome would have the highest consideration.

Table 4-12 presents the selected indicators and corresponding weights for each of the models. It is noted that two 'Tier II High Quality Waters' stream segments exist in the Middle Patuxent including segments in Cabin Branch 1 (MP8) and Lyons Creek 10 (MP6). The Targeted Ecological Areas indicator includes Tier II streams, ensuring that these areas will be captured by the model.

TABLE 4-12: MODEL INDICATORS AND WEIGHTS

Indicator	Weight
Parcel Preservation	
Bioassessment Score	8%
Instream and Epifaunal Habitat Scores	11%
Targeted Ecological Areas	10%
Within Natural Heritage Area	5%
Within Green Infrastructure Network	8%
Forest within the 100 ft stream buffer (%)	17%
Presence of Forest	9%
Presence of Wetland	15%
Proximity to Wetland	3%
Presence of Headwater Streams	13%
Pervious to Forest	
Unforested Areas within 100ft Stream Buffer	35%
Buffer Impacts and Restoration Potential	28%
Unforested Areas on Slopes 15 to 24%	8%
Unforested Areas on Slopes >25%	10%
Unforested 'Open Space' Land Cover	20%
Impervious to Pervious	
Total Impervious Area	13%
Percent Impervious Area	9%
Presence of Gravel Parking Lot	16%
Presence of Paved Parking Lot	27%
Presence of BMP Treatment	13%
Within Critical Area	22%

4.4.2 PARCEL PRESERVATION

The parcel preservation model uses a series of indicators that describe various conditions of a parcel to identify those with high ecological value that should be, but are not already preserved or protected. The indicators are grouped into one of three categories: stream ecology, landscape, and aquatic living resources.

A total of 12,402 parcels within the Herring Bay, Middle Patuxent and Lower Patuxent watersheds were evaluated against the selection criteria. A total of 409 road and utility parcels were eliminated under the assumption that parcel preservation would not be feasible on the property. These include State and County roadways, County utility, and Baltimore Gas and Electric Company utility properties. A total of 778 parcels are already fully or partially (greater than 50% of the parcel) preserved and were removed from the analysis.

Table 4-13 and Map 4.4 present the preservation prioritization rating of the 9,165 parcels not already preserved. The high priority parcels are evenly distributed throughout the watersheds. Larger parcels tended to be rated higher priority than smaller parcels, which are generally clustered around the coast of Herring Bay.

TABLE 4-13: PARCEL PRESERVATION PRIORITIZATION RESULTS

	Preservation Prioritization Rating				Already Protected	Excluded Roads/Utility Parcels	Total
	High	Medium High	Medium	Low			
Herring Bay							
Number of Parcels	166	718	2,458	5,087	375	178	8,982
Parcel Acres	3,786	2,642	2,409	1,404	4,625	1,532	16,398
Middle and Lower Patuxent							
Number of Parcels	626	1,015	834	311	403	231	3,420
Parcel Acres	10,085	4,407	2,117	525	11,529	1,260	29,923

4.4.3 PERVIOUS TO FOREST

The pervious to forest conversion prioritization uses a series of indicators that aided in the identification of areas that could be reforested with a particular focus on stream buffers, open space, and steep slopes.

A total of 12,402 parcels are within the Herring Bay, Middle Patuxent and Lower Patuxent watersheds. A total of 409 road and utility parcels were eliminated under the assumption that tree planting would not be feasible on the property. These include State and County roadways, County utility, and Baltimore Gas and Electric Company utility properties. In an effort to eliminate parcels consisting primarily of wetland habitat, parcels with greater than 50% of the parcel area consisting of wetland were eliminated from the selection. This was done to avoid disturbance of the wetlands and because establishment of forest would likely be unsuccessful in these wetland areas with high soil saturations. A total of 463 parcels were eliminated. While the majority of these parcels were initially rated Low priority for reforestation before they were excluded, a total of 15 parcels had overall priority ratings of High, Medium High, or Medium. To ensure the removal of these properties did not eliminate good potential planting sites, the aerial photography of all 15 parcels were reviewed visually. None of these sites were determined to be good potential planting sites.

Table 4-14 and Map 4.5 present the number of parcels receiving each preservation rating by watershed. Similar to the parcel preservation, the high priority parcels are evenly distributed throughout the watersheds and larger parcels tended to be rated higher priority than smaller parcels.

TABLE 4-14: PERVIOUS TO FOREST CONVERSION PRIORITIZATION RESULTS

Watershed	Number of Parcels with Priority Rating				Excluded Roads/Utility Parcels	Excluded Wetland Parcels	Total
	High	Medium High	Medium	Low			
Herring Bay	9	34	111	8,233	178	417	8,982
Middle and Lower Patuxent	17	74	158	2,893	231	47	3,420

4.4.4 IMPERVIOUS TO PERVIOUS

The impervious to pervious conversion prioritization uses a series of indicators to identify areas of impervious that could be good candidates for impervious treatment, either by removal or through application of stormwater management practices such as pervious pavers, pervious concrete, or stormwater treatment BMPs.

A total of 409 road and utility parcels were eliminated under the assumption that impervious removal would not be feasible on the property. These include State and County roadways, County utility, and Baltimore Gas and Electric Company utility properties.

Table 4-15 and Map 4.6 present the number of parcels receiving each preservation rating by watershed. The high priority parcels are generally clustered around the coasts of the Herring Bay and Patuxent River. This is partially due to the fact that these areas have a higher density of impervious surfaces than the central areas of the watersheds, but also because these parcels are within the Critical Area, which are rated higher priority in the model.

TABLE 4-15: IMPERVIOUS TO PERVIOUS CONVERSION PRIORITIZATION RESULTS

Watershed	Number of Parcels with Priority Rating				Excluded Roads/Utility Parcels	Total
	High	Medium High	Medium	Low		
Herring Bay	37	146	7,146	1,475	178	8,982
Middle and Lower Patuxent	4	50	207	2,928	231	3,420

4.4.1 FEASIBILITY ANALYSES

Identification of the parcels shown in the results mapping is just the first phase of implementation. All parcels identified in the three models for preservation, planting, and impervious area conversion and treatment will need to undergo additional feasibility analyses to determine their specific suitability for the management measures proposed and to determine the willingness of the property owner.

County staff from both the Watershed Protection and Restoration Program and the County's Planning and Zoning department will work collaboratively on implementation. The County may look to engage with partners such as the Maryland Environmental Trust or the Advocates for Herring Bay for land conservation projects, or with local watershed groups such as the Alliance for the Chesapeake Bay or the Patuxent Riverkeeper for tree planting projects.

Parcels will require additional desktop assessment and records research to confirm items such as ownership, existing easement location and type, zoning, and property value. Field visits will be necessary to document suitable conditions on the ground and to meet with private property owners. County staff and their representatives will obtain permission from property owners before field assessments on private property are conducted. Desktop and field assessments should include the following items:

For preservation areas the following items will be useful for determining the current conditions and the type of preservation mechanism that will be appropriate:

- Acreage,
- Property improvements,
- Current land use – forest, agriculture, open space,
- Presence of historic resources,
- Presence of natural resources including forest, wetland, shoreline, streams
- Presence of natural habitats,
- Lands contiguous to other open space or conservation areas,
- Adjacent to or including unique designation including Chesapeake Bay Critical Area, Scenic Roads, Natural Heritage, or Endangered Species,
- Protection of the area from development, and
- Potential public benefit including outdoor recreation and education.

For tree planting areas the following should be reviewed when selecting a site and identifying the types of vegetation to plant:

- Acres of available planting area,
- Access to the site for planting and maintenance,
- Soil conditions,
- Susceptibility to animal browse,
- Surrounding vegetation including invasive species and noxious weeds, and
- Maintenance requirements.

For impervious removal or treatment a field assessment should be conducted by a water resources engineer. The site assessment will determine the best method of treatment, which could include impervious surface removal or impervious treatment through application of stormwater management practices such as pervious pavers, pervious concrete, or stormwater treatment BMPs. Site visits will document:

- Current use and pavement type,
- Future use,
- Acres of pervious and impervious surface,
- Access considerations for construction and maintenance,
- Existing utilities,
- Analysis of runoff volume and available treatment/storage areas,
- Maintenance considerations, and
- BMP siting and site Hydraulic and Hydrologic conditions.

5 LITTER AND FLOATABLES

Part IV.D.4 of the County's NPDES MS4 permit requires the County to "address problems associated with litter and floatables in waterways that adversely affect water quality". The permit requires the County to evaluate current litter control problems and develop programs to address them. Further the permit requires that as part of Anne Arundel County's watershed assessments under PART IV.E.1 of the permit that the County will document litter control programs and identify potential sources, ways of elimination, and opportunities for overall improvement. This section includes a current review of the County's Litter and Floatables Comprehensive Plan and summarizes the litter documented in the current study.

5.1 PLAN REVIEW

In November 2017, Anne Arundel County completed a Litter and Floatables Comprehensive Plan, which was submitted as an appendix to the NPDES MS4 Annual Report. The plan describes litter as any materials improperly discarded by the public, along with materials spilt during business and/or waste management operations. The US EPA defines floatables as "any foreign matter which may float or remain suspended in the water column" including plastics (bottles, food packaging, and other items), polystyrene (Styrofoam) items, plastic bags, aluminum cans, foil bags, and paper products (US EPA, 2018).

The Plan was reviewed and is summarized in the following sections, along with suggestions for additions and modifications.

5.2 CURRENT PROGRAMS

The County currently undertakes 18 programs to reduce or remove litter and trash from roadways, open space, streams, and other areas. Similar programs are in use in many other jurisdictions. They use three approaches from the EPA's Waste Management Hierarchy (US EPA, 2018):

<u>Source Reduction and Reuse</u>

- Education & Outreach
- Storm Drain Stenciling

<u>Recycling / Composting</u>

- Recycling
  - Residential Curbside Collection
  - Parks
  - Schools
  - County Office Recycling Program (CORP)
  - Recycling Centers
- Household Hazardous Waste (HHW) Disposal
- Scrap Tire Program

<u>Treatment and Disposal</u>

- Law Enforcement and Reporting
- Roadside Litter Cleanup
- Alley Clean-ups
- Community Cleanups

FIGURE 5-1: WASTE MANAGEMENT HIERARCHY (USA EPA, 2018).

- Stream Cleanups
- Street Sweeping
- Inlet Cleaning and Storm Drain Vacuuming
- Maryland Clean Marina Initiative
- Adopt-a-Highway and Sponsor-a-Highway

5.2.1 Source Reduction and Reuse

Source reduction programs have the potential to reduce the amount of litter by eliminating materials from the waste stream entirely. Some examples are minimizing packaging by buying in bulk or replacing single-use items such as water bottles with reusable containers. Outreach programs can reduce the amount of waste that is littered even if the amount of materials aren't reduced at the source.

5.2.2 Recycling / Composting

Recycling programs are an adjunct to solid waste collection. Residential curbside collection removes trash from the landfill and provides raw materials for reuse. Recycling in parks and commercial areas such as convenience stores may increase the use of proper disposal procedures and thus reduce litter.

HHW disposal at recycling centers provides an environmentally acceptable method to dispose of materials which otherwise might be dumped or littered. Used oil and paint, for example, can be collected for recycling into other products.

5.2.3 Treatment and Disposal

Treatment and disposal is the last, and least preferable, step in both waste management and litter control. For litter, these activities focus on enforcing laws against littering and removing materials after they have been discarded into the environment. Cleanup activities are more difficult and less cost-effective than source controls because they are collecting materials that have been dispersed over a wide area. These programs rely on volunteer labor to reduce costs.

Street sweeping, inlet cleaning, and storm drain vacuuming are mechanical methods to intercept litter in the conveyance system before it is washed into streams and rivers or on to beaches. They require less labor than cleanups and can be an effective method to remove trash and litter.

5.3 Future Programs

Two TMDLs were reviewed for additional ideas on programs for litter and floatable control. Both were from the California Regional Water Quality Board, one of which (Los Angeles River; California Regional Water Quality Control Board, 2007) was in the references of the County's plan while the other was written for Santa Monica Bay (California Regional Water Quality Control Board, 2010). They categorized programs as either structural or non-structural. Some of the suggested programs could potentially be implemented in Anne Arundel County; others may require statewide legislation.

5.3.1 Source Reduction and Reuse

Plastic Bag Bans

Two states have passed ordinances banning disposable plastic bags: California and Hawaii. A number of others and a number of local jurisdictions, including Montgomery County, have enacted fees which require the customer to pay for each bag used.

Polystyrene Foam Bans

Polystyrene (Styrofoam) packaging, especially for food service carryout, is a significant contributor to litter. Polystyrene breaks apart into smaller and smaller pieces, is non-biodegradable, and resists photolysis. Polystyrene also absorbs more toxic pollutants than other plastics, and mobilizes them into the environment.

It has already been phased out in Montgomery and Prince George's counties and Washington DC, and a ban was recently passed by a City Council committee in Baltimore.

Smoking Ban

Santa Monica has banned smoking at its beaches to reduce cigarette butt litter. In Maryland, Howard County banned smoking in County parks in 2011, other Maryland counties have partial bans. Anne Arundel County has a partial ban at County parks, as follows:

- In a restroom, at a spectator or concession area, dog park, aquatic facility, or playground in any County park
- Within 100 yards of an organized activity at a County park

County parks with beaches are not regulated differently than other parks, so smoking is allowed except as described above.

5.3.2 Treatment and Disposal

Trash Receptacles

For both public and private outdoor space, the location of trash receptacles can reduce littering behavior (NACS/KAB 2017). Studies have shown that making disposal convenient increases its use. Receptacles should be placed no more than 25 to 30 steps apart, at high traffic areas, and near the source of trash. Containers with push flaps on the front or side are more effective than open top receptacles to keep litter from blowing out of the container during windy conditions.

Street Sweeping, Catch Basin Cleaning, and Storm Drain Vacuuming

The County is currently sweeping priority areas twice per month, and parking lots once per month. Increasing the frequency to weekly or even daily in a subset of priority areas could be an effective method of removing litter and trash. Similarly, a study to identify geographic areas where litter is a more frequent problem would be useful to direct catch basin cleaning operations where they could be most effective.

Catch Basin Inserts

These devices trap sediment and gross solids before they enter storm drains. They require frequent cleaning; however most have a bypass to maintain flow when full. They would be useful in areas where monitoring shows high levels of litter. One potential drawback is that they will probably require more frequent maintenance and catch basin cleaning.

Trash Nets

These devices trap gross solids at the outfall. Baltimore City has been testing them. In Anne Arundel County, a trash trap has been installed on Crab Creek by the South River Federation, The purpose is to study how much trash is flowing downstream and help with the City of Annapolis to reduce litter. In two storms, 150-200 pounds of trash were captured.

Booms and Skimmers

These devices remove litter from tidal waters. Skimmers can be either stationary, such as Baltimore's trash wheel, or mounted on a vessel. They would be best suited for areas with heavy loads of trash getting to the waterway.

5.3.3 MONITORING

Determination of success for litter reduction will ultimately depend on monitoring. A monitoring program can provide information for the following goals:

- Establish a baseline level of litter by watershed, receiving water, land use, or geographic area. Baseline data are needed to track effectiveness of reduction programs.
- Determine the type of litter that is most prevalent
- Identification of specific hotspots
- Assess the effectiveness of litter reduction programs

A targeted study could be useful to assess the effectiveness of litter/floatable reduction programs by coordinating monitoring with clean-ups, education campaigns, etc. The location could be an area that has been identified as a major source, such as Brooklyn Park.

5.4 WATERSHED LITTER SUMMARY

Part IV.E.1 of the County's NPDES MS4 permit requires the County to identify potential sources and means for elimination. Field teams conducting the Physical Habitat Condition Assessment as described earlier in sections 2.1.2 and 2.1.3 identified 'dump sites' or areas of high trash concentration that could be potential sites for source control or for targeted clean-up efforts.

Results below in Table 5-1 indicate that overall there were 84 sites identified with 77 located in the Middle and Lower Patuxent, and only 7 identified in Herring Bay. Most of the sites fell in the Minor (37%) and Moderate (57%) while only 5 sites, or 6% of the total were considered Severe and none were Extreme.

TABLE 5-1: DUMP SITE SUMMARY

Watershed	Number of Dump Sites with Impact Score:				
	Minor	Moderate	Severe	Extreme	Total
Herring Bay	3	4	0	0	7
Middle and Lower Patuxent	28	44	5	0	77

Locations of the observed dump sites are presented in Figure 5-2 with the sites labeled according to the severity ranking. Note that many areas were not assessed due to property permissions or a lack of perennial stream channels, therefore a lack of dump or trash sites present on the map does not always indicate that the stream reach was free of trash. In addition the field crews were focused on the stream valleys during the field assessments so upland source areas are not captured well with this method.

Table 5-2 below includes field collected data for all of the dump sites and areas of concentrated trash in the areas assessed. The 'Material' field indicates the dominant type of trash identified and the 'Comments' further describes the types of trash observed. The 'Cleanup Comments' indicate the type of cleanup that should occur, noting if the site can be cleaned by volunteers or whether heavy machinery is necessary and if there are site constraints.

The most common materials found at dump sites throughout both watersheds include tires, appliances, and metal items such as cars, 55-gal drums, and old farm equipment. For the most part the trash observed appears to be older material and trash that has been dumped purposefully. The sites observed do not appear to result from stormwater discharges. Several sites were noted as good opportunities for participation of volunteers in clean-up efforts, however many sites would require equipment to move heavy or large pieces.

Specific high concentrations of new trash related to commercial areas, schools, or roadways were not observed. However, several subwatersheds including MPQ, MP6 in Lyons Creek and MP7 along the MD Ret 4 corridor had higher than average numbers of sites identified.

FIGURE 5-2: DUMP SITE LOCATIONS

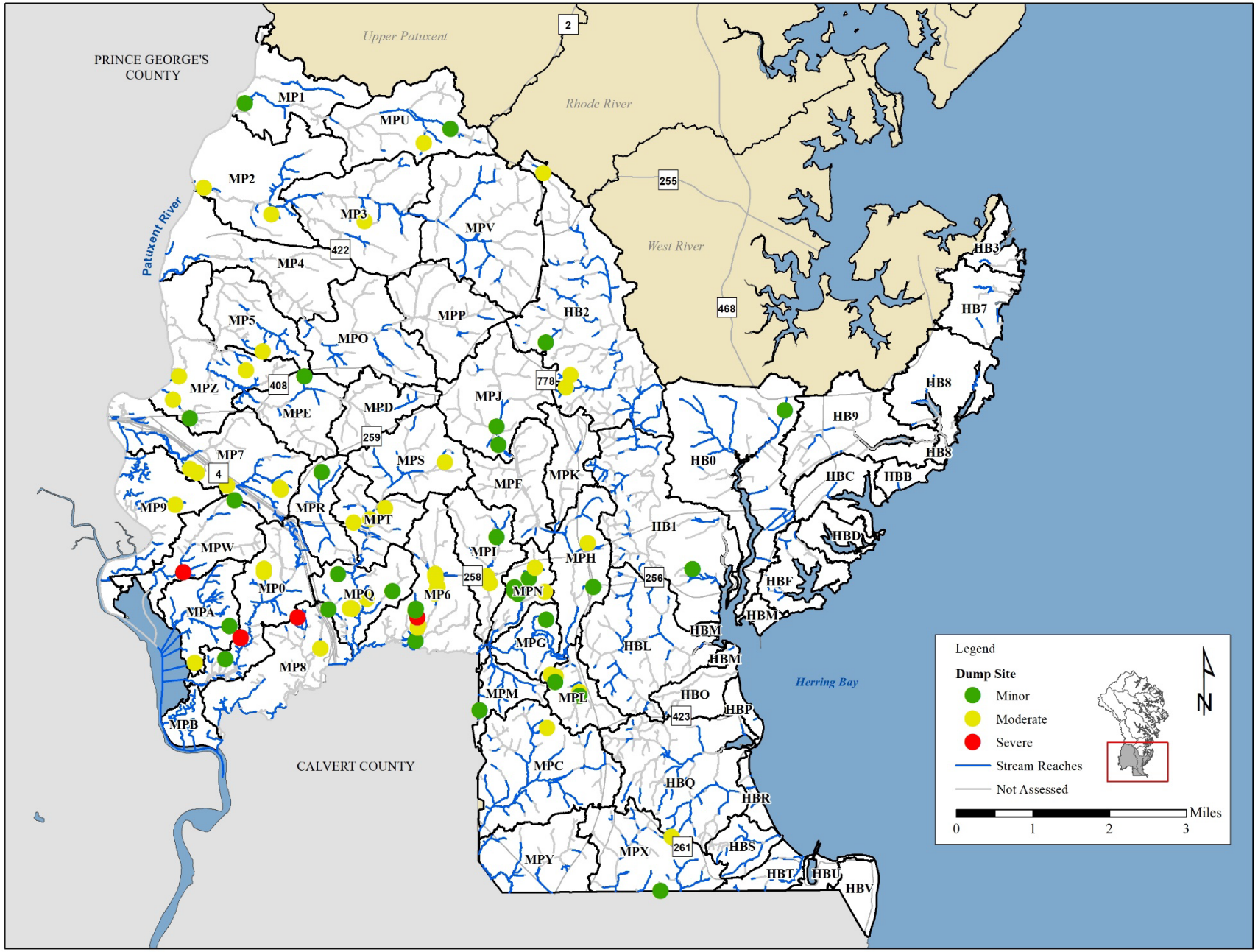


TABLE 5-2: DUMP SITE MATERIAL AND CLEAN UP NOTES

Site ID	Impact Score	Location	Materials	Comments	Cleanup Comments
MP0021.M001	10	Instream	55-gal Drums (Empty)	plastic bags, toilet	can be cleaned up by volunteers with permission from property owner
MP0021.M002	10	Instream	55-gal Drums (Empty)	bottles, bags, etc	can be cleaned up by volunteers with permission from property owner
MP6009.M003	10	Bank	Appliances	gallon drums, car parts appliances	professional cleanup required
MP8021.M001	10	Instream	Tires	other trash material present	mixed batch from tires to empty oil bottles. Could be cleaned up by volunteers with permission from property owner
MPW007.M001	10	Bank	Appliances	tires, appliances	
HB2011.M001	5	Bank	Appliances	TRASH, TIRES, BOTTLES	VOLUNTEERS
HB2016.M001	5	Instream	Tires	OTHER METAL FRAMES AND TRASH	VOLUNTEERS, EASY ACCESS, FIELD/PATH NEARBY
HB2102.M001	5	Bank	Appliances	SEVERAL DRAINAGE DEPRESSIONS ON EITHER BANK FILLED WITH APPLIANCES, TRASH, CAR PARTS, ETC.	MOST MATERIALS COULD BE CARRIED OUT BY VOLUNTEERS, EXCEPT FOR VEHICLE ENGINE
HBQ053.M001	5	Instream	VEHICLE COMPONENTS, VARIOUS TRASH, OLD CAR BATTERI	SPARCELY SPREAD OVER ~500 SQ FT	VERY STEEP SLOPES SURROUNDING REACH OF STREAM, HEAVY PIECES OF TRASH
MP0033.M001	5	Instream	55-gal Drums (Empty)	20 tires	can be cleaned up by volunteers with permission from the homeowner
MP0033.M002	5	Instream	55-gal Drums (Empty)	tires are prevalent, old appliances	can be cleaned up, but not by volunteers. Too much of a health risk
MP2002.M001	5	Floodplain	Trash	BOTTLES AND CANS, 500 SQ FT	SCATTERED CANS AND BOTTLES, ACCESS NOT VERY EASY BUT GOOD OPPORTUNITY FOR VOLUNTEERS
MP2024.M001	5	Instream	Appliances	OLD FARM AND KITCHEN, 2,400 SQ FT	

Site ID	Impact Score	Location	Materials	Comments	Cleanup Comments
MP3017.M001	5	Instream	Trash	located in stream channel, glass bottles, tires, appliances , 1000 sq feet	
MP5018.M001	5	Floodplain	OLD CAR, METAL	OLD CAR, RUSTY METAL	IN WETLAND SEEP CHANNEL, STEEP SLOPES
MP6009.M001	5	Bank	Motorcycles	Two motorcycles side of bank	
MP6009.M002	5	Bank	Appliances	gas home heating tank	bottles throughout
MP6012.M001	5	Instream	Trash		Volunteers
MP6013.M001	5	Bank	School Bus		professional cleanup required
MP6017.M001	5	Floodplain	Trash	appliances, trash	
MP6017.M002	5	Floodplain	Trash	trash	
MP6017.M003	5	Floodplain	Trash	bottles, cans	
MP7005.M001	5	Instream	Trash	includes but not limited to: wood debris, toilets, general trash, and old box frame	could be cleaned up by volunteers with permission from property owner
MP7033.M001	5	Bank	Trash	includes tires, metal chair, and various other metal materials. Approximately 500 sq. ft	can be cleaned up by volunteers with permission from the homeowner
MP7033.M002	5	Bank	Tires	majority tires with old vaccuum cleaner and other rusted metal. Approximately 150 sq ft	can be cleaned up by volunteers with permission from the homeowner
MP7033.M003	5	Bank	55-gal Drums (Empty)	tires and empty drum. Approximately 150 sq ft	can be cleaned up by volunteers with permission from the homeowner
MP7075.M001	5	Bank	Appliances	old vehicles	1000sq feet
MP7077.M001	5	Bank	Appliances		750sqft
MP8026.M001	5	Instream	Tires	with various other pieces of trash	can be cleaned up by volunteers with permission from property owner
MP9012.M001	5	Bank	Trash	aproximately 300sqft, bottles, cans, trash	
MPA006.M001	5	Floodplain	Appliances	some 55gal drums, 300 sqft	clean up by volunteers

Site ID	Impact Score	Location	Materials	Comments	Cleanup Comments
MPC051.M001	5	Bank	farm equipment		Volunteers, COULD BE CLEANED UP BUT BENEFIT WOULD NOT BE GREAT
MPH012.M001	5	Bank	2 CARS, NUMEROUS LARGE METAL OBJECTS		CLEANUP MAY NOT HELP STREAM MUCH
MPI017.M001	5	Bank	metal/cars		will need heavy equipment to remove trash
MPI017.M002	5	Bank	Trash	Mainly plastic bottles and aluminum cans	mainly plastic bottles and aluminum cans
MPL008.M002	5	Instream	Trash	MULTITUDE OF TRASH	Volunteers
MPL009.M001	5	Floodplain	Tires	IN ADDITION TO APPLIANCES AND OLD FARMING EQUIPMENT	Volunteers, farming equipment removal may be to heavy for people, could use machinery
MPL013.M001	5	Bank	PLASTIC SAILBOAT		Volunteers
MPN051.M001	5	Bank	Tires	scrap metal	should be cleaned up, especially the tires. Can be done by volunteers
MPN054.M001	5	Bank	Appliances		
MPQ013.M001	5	Instream	Tires	old car parts, 300 SQ FT	
MPQ013.M002	5	Instream	Tires	car parts, 300 SQ FT	
MPQ013.M003	5	Instream	Tires	car parts, 500 SQ FT	
MPQ013.M004	5	Instream	Tires	cars, 800 SQ FT	
MPQ017.M001	5	Instream	Trash	1,500 SF, IN STREAM CHANNEL	OLD WINDOWS, TRASH, OLD META
MPS012.M001	5	Bank	WOOD DEBRIS	wood debris, 100 SQ FT	can be cleaned by volunteers
MPT008.M001	5	Bank	Appliances	Apppliances, tires	
MPT014.M001	5	Floodplain	Tires	tires, metal debris, 200 ft from stream, outer edge of floodplain, 400 sqft	
MPT016.M001	5	Bank	Trash	glass bottles, tires	
MPU007.M001	5	Floodplain	Trash	bottles, 1000 sq feet	
MPZ001.M001	5	Floodplain	Trash	TIRES, METAL, OLD COMPUTERS, 250 SQ FT	ACCESS IS DIFFICULT, DOWN STEEP SLOPE

Site ID	Impact Score	Location	Materials	Comments	Cleanup Comments
MPZ006.M001	5	Floodplain	Appliances	APPLIANCES AND CONCRETE, 200 FQ FT	ACCESS GOOD
MPZ024.M001	5	Floodplain	Trash	TIRES, APPLIANCES, TRASH, BOTTLES, WIDESPREAD THROUGHOUT LARGE AREA; COVERS AREA OF 200,000+ SF FT SPARSELY SCATTED THROUGHOUT	ACCESS DECENT; ADJACENT TRAILER PARK
HB0019.M001	1	Floodplain	CAR PARTS AND LARGE METAL DEBRIS		ACCESS POSSIBLE BUT RESTORATION POTENTIAL LOW, MACHINERY NECESSARY
HB1040.M001	1	Floodplain	CARS AND OLD APPLIANCES		CLEAN UP NOT WORTHWHILE AND REQUIRES MACHINERY
HB2053.M001	1	Bank	CAR		Will need machinery to remove
MP0016.M001	1	Bank	Trash	old farm equipment/materials that have rusted	can be removed by volunteers with permission from the property owner
MP1008.M001	1	Floodplain	Appliances	GLASS BOTTLES, 150 SQ FT	ACCESS IS DIFFICULT
MP6007.M001	1	Floodplain	Trash	OLD MILK JUGS	100 SQFT
MP6009.M004	1	Bank	Trash	plastics, glassware	volunteers
MP6009.M005	1	Bank	Trash	plastics	Volunteers
MPA032.M001	1	Instream	Tires	100 sqft	
MPE009.M001	1	Floodplain	Appliances	appliances, 100 SQ FT	both banks in floodplain
MPG010.M001	1	Instream	55-gal Drums (Closed)	<100 SQ FT, HAS BEEN SITTING THERE FOR A WHILE	Volunteers
MPH024.M001	1	Instream	Tires		Volunteers
MPI002.M001	1	Instream	plastic tarp	hay tarp that has been blown into channel	200 sq ft, can easily be cleaned up by volunteers
MPJ003.M001	1	Floodplain	CAR PARTS, METAL OBJECTS, GLASS BOTTLES		Volunteers for partial cleanup of glass bottles, car parts will require removal by machinery
MPJ010.M001	1	Bank	LARGE METAL CONTAINER, >300GAL	OBJECTS ON OPPOSITE SIDE	ENHANCE STREAM, EASY ACCESS
MPL008.M001	1	Floodplain	Trash	MULTITUDE OF TRASH	Volunteers

Site ID	Impact Score	Location	Materials	Comments	Cleanup Comments
MPL010.M001	1	Floodplain	Appliances	SCATTERED ON BOTH BANKS MOSTLY IN FLOODPLAIN	Volunteers
MPL015.M001	1	Instream	CEMENT BLOCKS		MANUAL CLEAN UP
MPM016.M001	1	Bank	Tires		VOLUNTEERS
MPN005.M001	1	Bank	Trash		
MPN005.M002	1	Floodplain	Tires		
MPN006.M001	1	Bank	Appliances		
MPN050.M001	1	Bank	Trash	old scrap metal	will need multiple people or small equipment to move
MPQ023.M001	1	Instream	WOOD DEBRIS	BOTH BANKS AND INSTREAM, 100 SQFT, WOOOD DEBRIS FENCE POSTS, BENCH OR WOOD MATTING	
MPQ026.M001	1	Floodplain	Appliances	200 sqft	
MPQ030.M001	1	Bank	CAR	SINGLE CAR	
MPR011.M001	1	Floodplain	Tires	100 sqft	
MPU004.M001	1	Floodplain	Appliances	Both banks, 100 sq feet	
MPW018.M001	1	Floodplain	Tires	Some metal debris	
MPX017.M001	1	Floodplain	Trash		Volunteers
MPZ028.M001	1	Floodplain	Trash	drum, old vehicle, trash	

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APPENDIX A – FLOODING POTENTIAL TECHNICAL MEMORANDUM

KCI TECHNOLOGIES

TECHNICAL MEMORANDUM

TO:	Rick Fisher, Anne Arundel County
FROM:	Mike Pieper, KCI Technologies
DATE:	October 23, 2017
SUBJECT:	Herring Bay, Middle and Lower Patuxent Watershed Assessment Crossing Modeling Site Selection and Survey Results
COPIES	Susanna Brellis, KCI Technologies, Inc. Nate Drescher, KCI Technologies, Inc. Bill Medina, KCI Technologies, Inc. Sean Sipple, Coastal Resources, Inc. Matt Drennan, Coastal Resources, Inc.

INTRODUCTION

Stream crossing modeling is to be conducted by County staff for selected crossings in the Herring Bay, Middle and Lower Patuxent River Watersheds. The KCI and Coastal Resources team is scoped to survey up to 20 total crossings, assumed to be split approximately 10 in each of the two major watersheds, Herring Bay and Middle/Lower Patuxent. This technical memorandum reviews the selection criteria and process that was followed to select the sites for survey and modeling using HY-8.

SITE SELECTION

Selection Criteria

The consultant team selected the sites based on the criteria and process described below. The criteria were viewed strictly such that a crossing would be selected only if it met *all* of the criteria.

The selection criteria are as follows:

1. The crossing must be owned by the County. Roadways at the crossing included all classifications in the County's Master Transportation Plan, including Freeway, Principal Arterial, Minor Arterial, Collector, Local, or TBD.

3. Crossings were selected if flooding will completely cut off an area from emergency

services where the stream crosses a single or multiple access point(s) to a community or business area.

4. Crossings were selected if overtopping is likely, determined by both the height of the road surface above the top of the structure and the channel and floodplain characteristics. In general, the vertical distance between top of roadway and stream water surface should be less than 20 feet to consider it for selection, under the assumption that high stream crossings would not represent the most imminent flooding hazards.

Process

The procedure for selecting sites to be surveyed and modeled using HY-8 follows the criteria listed above.

The site selection was conducted using base County GIS data and Crossing information from the Physical Habitat Condition Assessment. An ArcMap .mxd file was created. Important Features in ArcMap are listed below:

- *Contours*
- *Stream Reaches (updated from the Physical Habitat Condition Assessment)*
- *Crossings (point file from the Physical Habitat Condition Assessment)*
- *AACO Transportation Centerline Road Class*
- *Subwatershed Boundaries*
- *AACO Parcels*
- *Aerial Photography*
- *ESRI World Street Map basemap*

The Physical Habitat Condition Assessment Crossing information was utilized as a shapefile with the addition of six fields to the original crossings database table. The six additional fields are detailed below.

- Ownership – Indicates whether or not the roadway at the crossing is County owned. Ownership was determined using the County GIS roadway layer. Only culverts crossing a County owned roadway were selected. Foot/trail bridges, culverts under interstates, driveway culverts, utility road culverts, SWM associated culverts, and farm field access culverts were all eliminated from HY8 culvert selection.
- Isolate – Refers to the potential for overtopped roads to completely cut off an area from emergency services where the stream crosses a single or multiple access point(s) to a community or business area. This analysis considered both the mapped crossings from the Physical Habitat Condition Assessment and stream crossings that were unmapped during the Assessment due to lack of property access. The planimetric roads and county master transportation plan were utilized to determine alternate routes from a particular culvert location.
- Crossing_T – Lists crossing type for each County owned crossing. Includes, bridge, box, circular, and elliptical.

- Overtop – Refers to the potential for stormwater to flow over a road embankment due to the magnitude of runoff. Contours, culvert dimensions, embankment height, drainage area, and upstream/downstream floodplain characteristics were all used to determine the potential for overtopping at all road culverts that intersected identified channels. In general, the vertical distance between top of roadway and stream water surface should be less than 20 feet, under the assumption that high stream crossings would not represent the most imminent flooding hazards. Small culverts at the headwaters of a stream were not selected because they had small drainage areas that would not make them likely to overtop.
- Final_Sites – Refers to whether a culvert is selected for field survey to support HY8 modeling.
- Selection_Notes – Brief description or explanation as to why a culvert was selected or not selected. In most cases, the notes provided a good space to record why a culvert was eliminated from selection process.

Selection Results

A total of 295 crossings were evaluated against the selection criteria. A total of 245 crossings did not meet the County ownership criteria and were thus eliminated. The remaining 50 crossings were identified as being County owned.

Of the 50 retained, 1 site (MP7050.C002) is a bridge and cannot be adequately modeled using HY-8. Ten sites did not isolate communities or businesses, 18 sites were not likely to overtop, and 6 sites would both not isolate or have a high likelihood of overtopping. A total of 35 sites were eliminated, leaving 15 sites selected for field survey.

Table 1 lists the selected sites and notable property permission information. The property owner of the upstream side of the crossing denied access during the Physical Habitat Condition Assessment portion of the fieldwork at three sites.

Table 1. Selected Site List

Site ID	Site Permission Notes
MP8027.C002	
MP1001.C001	County owns upstream property
MP0023.C001	Upstream property owner denied access
MP0030.C001	
MP1008.C001	
MPW016.C001	
MPO020.C001	County owns upstream and downstream properties
MPA001.C001	Upstream property owner denied access
HBF001.C001	
HBF005.C001	
MPV001.C001	Nearby upstream property owner denied access

MPV001.C002	County owns upstream and downstream properties
HB0014.C001	
HB0022.C001	
HB0022.C002	

Survey Results and Site Notes

Field work was initiated on August 21, 2017 and completed on September 15, 2017. Table 2 below provides a listing of the survey sites and the status (date surveyed or not surveyed). Notes related to either reasons for elimination or field notes to assist with the modeling component of the project are included below. Figure 1 shows the locations of the surveyed crossings in the watershed.

Table 2. Surveyed Site List

Site ID	Status
MP8027.C002	Surveyed 09/13/2017
MP1001.C001	Surveyed 08/21/2017
MP0023.C001	Surveyed 09/13/2017
MP0030.C001	Surveyed 09/13/2017
MP1008.C001	Surveyed 08/21/2017
MPW016.C001	Surveyed 09/15/2017
MPO020.C001	Surveyed 09/15/2017
MPA001.C001	Surveyed 09/15/2017
HBF001.C001	Surveyed 09/07/2017
HBF005.C001	Surveyed 09/07/2017
MPV001.C001	Surveyed 08/21/2017
MPV001.C002	Surveyed 08/21/2017
HB0014.C001	Not Surveyed – tidal conditions
HB0022.C001	Surveyed 09/15/2017
HB0022.C002	Surveyed 09/07/2017

<u>MP8027.C002</u>

The upstream end of the pipe at site MP8027.C002 is completely buried in sediment and debris. The survey crew could not find the upstream invert. Flow is piping underground beneath sediment and debris roughly 10 feet upstream of the invert area. Based on the pipe depth below the road surface on the downstream end of the pipe, the upstream end is significantly buried. The upstream end should be cleaned out by the County.

The downstream invert of the pipe drops roughly 6 inches into a riprap pool. There is a small pond on private property to the east of the site that drains into a small channel which meets the study channel just downstream of the riprap pool. The left floodplain on the downstream end of the site is a dense bamboo stand.

MP1001.C001

The pipe and headwalls at site MP1001.C001 appear relatively new with riprap about 30 feet upstream and downstream. There is no debris or obstructions on the upstream side, and no evidence of roadway overtopping.

MP0023.C001

The channel on the upstream side of site MP0023.C001 is very incised and eroded. The downstream invert of the pipe drops roughly 6 inches into a large (20-30 feet wide, bottom not visible) pool.

MP0030.C001

The upstream end of the pipe at site MP0030.C001 is an RCP, and the downstream end is a CMP. It is unclear where the CMP portion of pipe starts. The downstream invert is filled more than halfway with fine, soft sediment. The downstream channel runs parallel to Upper Pindell Rd, and there is no floodplain on the right side of the channel. The left bank is vertical and eroded for roughly 25 feet downstream of the pipe.

MP1008.C001

The pipe arch at site MP1008.C001 does not have a consistent bottom slope. The upstream end slopes upward for roughly 10 feet, the middle 30 feet is flat, and the bottom 15 feet has rusted out and collapsed downward roughly 1 foot. There is a large (10-20 feet wide) scour pool downstream of the pipe invert and the channel is somewhat over widened. There is no evidence of the road being overtopped.

MPW016.C001

There is some sediment and debris blocking the upstream invert of the pipe at site MPW016.C001. There is a large (18 inch) tree lodged in the downstream end of the pipe that should be removed by the County. There is asphalt filling in the left side and bottom of the downstream end of the pipe.

MPO020.C001

The upstream channel at site MPO020.C001 is not well defined. The downstream channel is shallow with a wide floodplain. The channel was completely dry at the time of site survey.

MPA001.C001

The upstream channel at site MPA001.C001 enters the pipe invert area at roughly a 90 degree angle. Flow is beginning to cut behind and under the pipe. Flows exit the pipe roughly 5 feet above the channel grade onto a steep, broken up concrete apron, which drops off roughly 2 feet to the channel bed. The downstream channel is in a steep, narrow valley with very little floodplain access. A neighbor driving by during site survey said he has not seen the channel overtop the road at this site.

HBF001.C001

The channel at site HBF001.C001 has good floodplain access on the upstream and downstream sides. A neighbor walking by during site survey said she has not seen the channel overtop the road at this site.

HBF005.C001

The channel at site HBF005.C001 originates from a storm water pond adjacent to Deale Elementary School. A resident at 767 Masons Beach Road said there is no problem with flooding during storm events at this site.

MPV001.C001

The pipe at site MPV001.C001 has a metal wing wall end section on the upstream and downstream ends that does not match any of the barrel codes in the HY8 field data form. Each wing on the wing wall is roughly 7 feet long. The modeler should select the closest match based on the site photos and measurements. The bottom of the pipe is slightly corroded, and the top of the pipe seems to be slightly compressed by the road. There is a large debris jam in the channel at the downstream end of the pipe that is causing some backwatering in the pipe, and should be cleaned out by the County.

MPV001.C002

The pipe at site MPV001.C002 has a metal wing wall end section on the upstream and downstream ends that does not match any of the barrel codes in the HY8 field data form. Each wing on the wing wall is roughly 8 feet long. The modeler should select the closest match based on the site photos and measurements. The bottom of the upstream side of the pipe is slightly corroded, and the channel enters the pipe at a 30 degree angle.

HB0014.C001

Site HB0014.C001 was not surveyed. The channel was determined to be tidal through wetland data, visual investigation, and proximity to known tidal waters. The determination to not survey the crossing was made in coordination with the County project manager.

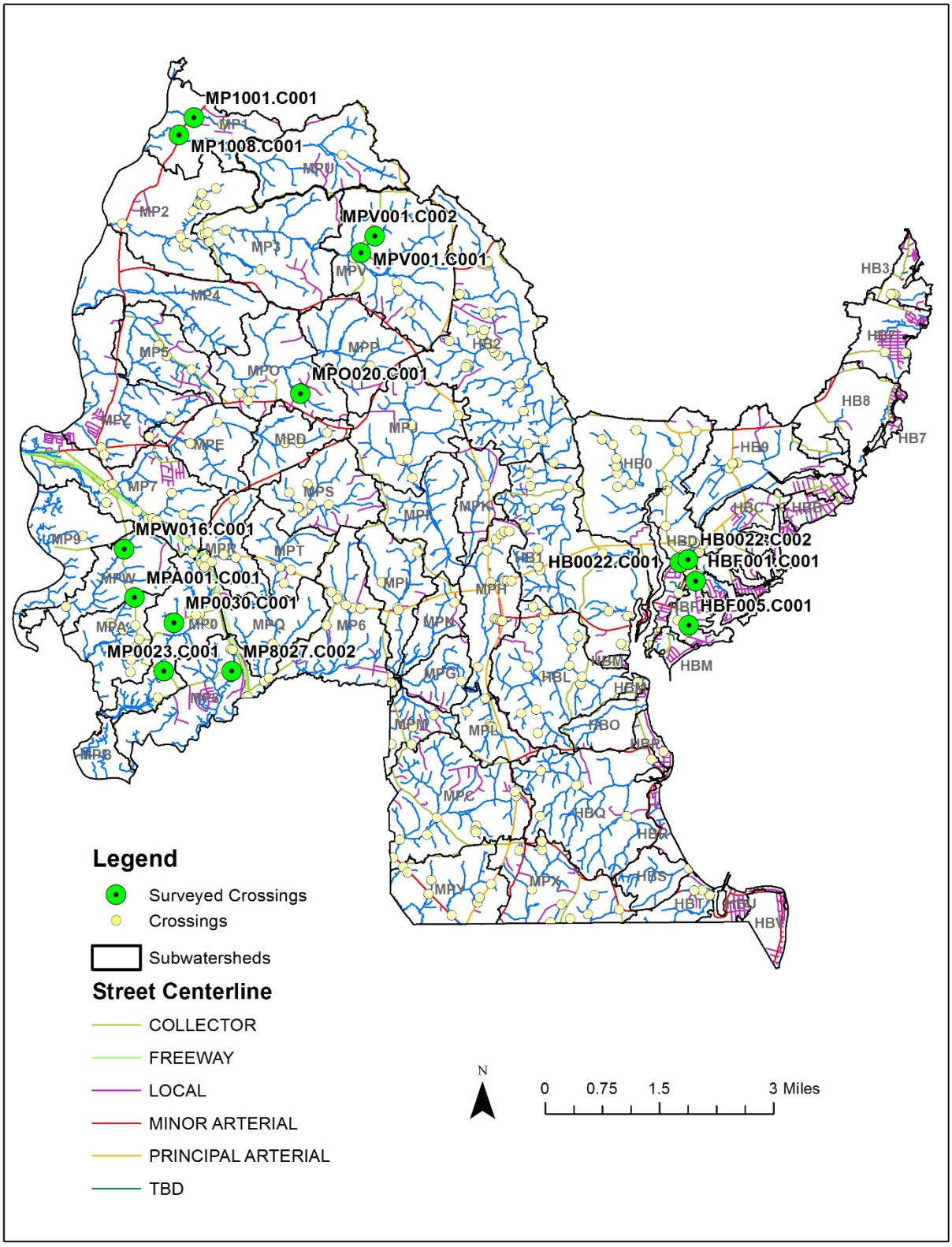
HB0022.C001

The pipe at site HB0022.C001 has a metal wing wall end section on the upstream and downstream ends that does not match any of the barrel codes in the HY8 field data form. Each wing on the wing wall is roughly 4.5 feet long. The modeler should select the closest match based on the site photos and measurements. The channel is lined with riprap upstream and downstream for 150+ feet and is straightened in between properties.

HB0022.C002

The channel at site HB0022.C002 is backwatered at the downstream end. The pipe is a smooth polyethylene pipe encased within a circular CMP and grouted together. The downstream channel has been straightened in between properties, is slightly incised, and shows signs of limited to no floodplain access.

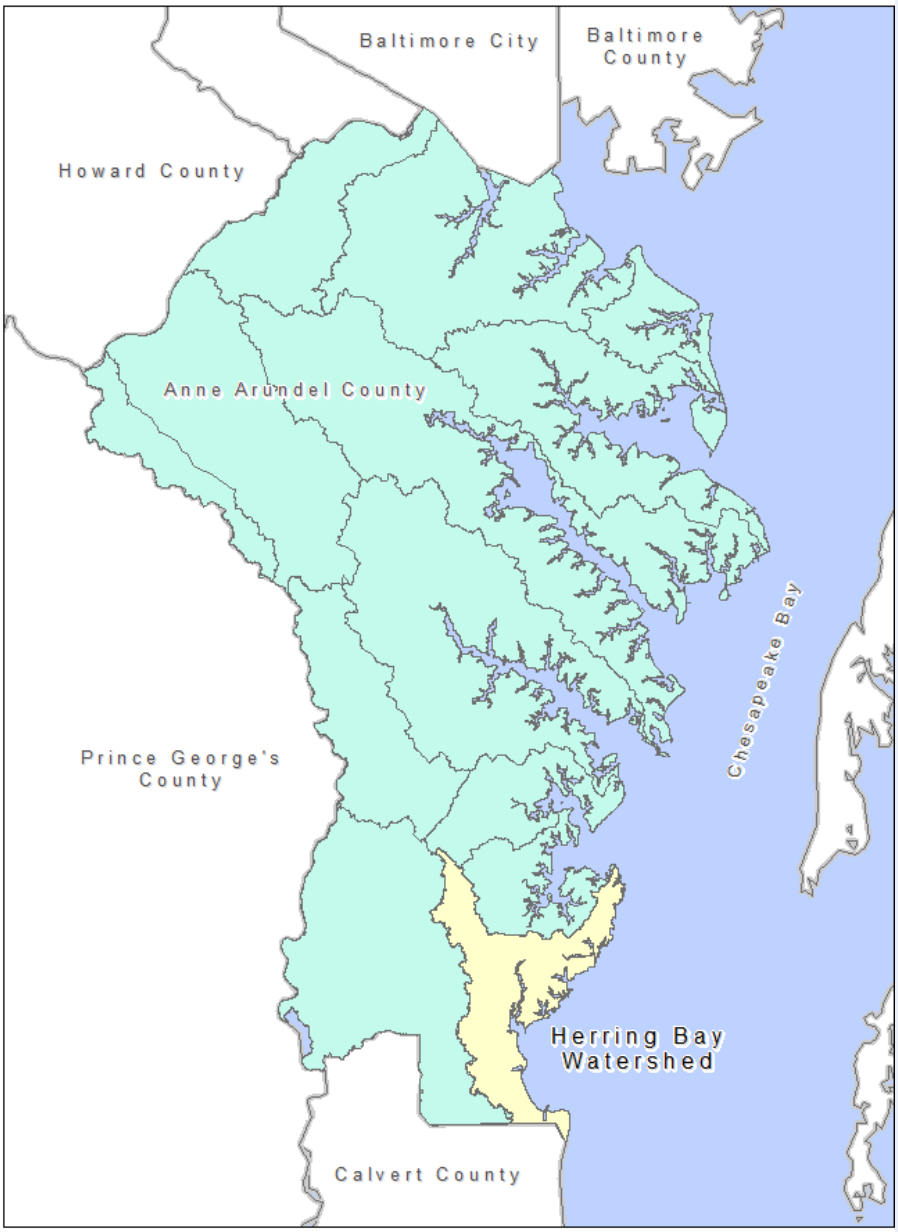
Figure 1. Selected HY8 Sites



APPENDIX B – BIOASSESSMENT REPORT

Anne Arundel County
Department of Public Works
Watershed, Ecosystem, and Restoration Services

Targeted Biological Assessment of Streams in the Herring Bay Watershed, Anne Arundel County, Maryland



August 2013

Targeted Biological Assessment of Streams in the Herring Bay Watershed, Anne Arundel County, Maryland

August 2013

Prepared for:

Anne Arundel County
Department of Public Works
Watershed, Ecosystem, and Restoration Services
2662 Riva Road, P.O. Box 6675
Annapolis, Maryland 21401

Prepared by:

25 Old Solomons Island Road, Annapolis, Maryland 21401
Phone: (410) 956-9000 Fax: (410) 956-0566

Acknowledgements

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For more information about this report, please contact

Richard Fisher
Watershed Model Administrator
Anne Arundel County Department of Public Works
Watershed, Ecosystem, and Restoration Services Division
2662 Riva Road
Annapolis, Maryland 21401
Phone: 410-222-4240 ext. 3321
rfisher@aacounty.org

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Introduction

The Clean Water Act (CWA), administered in 1972, was intended to protect and restore the chemical, physical, and biological integrity of the Nation's waters. Section 402 of the CWA includes the National Pollutant Discharge Elimination System (NPDES) Permit Program, which regulates point sources that discharge pollutants into waters of the U.S. Polluted stormwater runoff is commonly transported through Municipal Separate Storm Sewer Systems (MS4s), where it is often discharged into waters of the U.S. without being treated. In 1990, the U.S. Environmental Protection Agency (EPA) issued final regulations requiring NPDES permits for stormwater discharges from MS4s. Subsequently, Anne Arundel County was issued a MS4 permit in 1993 by the Maryland Department of the Environment (MDE). As required by the permit, the County must conduct an assessment of the water quality of streams within their jurisdiction.

To meet their MS4 permit obligations, the Anne Arundel County Department of Public Works (DPW) has contracted Coastal Resources, Inc. to conduct a targeted assessment of the biological community and physical habitat of streams within the Herring Bay watershed. The DPW will incorporate data from this study into their Watershed Management Tool (WMT). In combination with other watershed data, these data will also be used to assist in the completion of a comprehensive watershed assessment and management plan to prioritize restoration within the Herring Bay watershed.

The Herring Bay watershed is part of Maryland's West Chesapeake Bay basin in southeastern Anne Arundel County (MDE 8-digit watershed 02131005; ***Figure 1 – Vicinity Map***). The watershed encompasses 14,682 acres (23 square miles) in drainage and contains approximately 109 miles of streams based on the County's GIS stream data. The watershed includes numerous unnamed 1st order tributaries draining directly to Herring Bay as well as several larger 2nd order tributaries.

The Herring Bay watershed was subdivided into 21 subwatersheds, by the County's Watershed Assessment and Planning Program (WAP) (***Figure 2 – Biological Monitoring Location Map***). Only subwatersheds containing sampleable streams and those completely within the County were targeted for this study (13 out of 21 subwatersheds). These subwatersheds include Broadwater Creek, Cedarhurst, Deep Cove Creek, Deep Creek, Jack Creek, Parker Creek, Rockhold Creek, Tracy's Creek I, Tracy's Creek II, Trott's Branch, Unnamed Tributary, Unnamed Tributary II, and Unnamed Tributary III. Within these subwatersheds, 24 targeted sites were selected, at which benthic macroinvertebrate samples were collected, *in-situ* water quality was measured, and physical habitat was assessed between March 15 and April 26, 2013 (***Figure 2 – Biological Monitoring Location Map***). Detailed methods and results of these assessments are presented below.

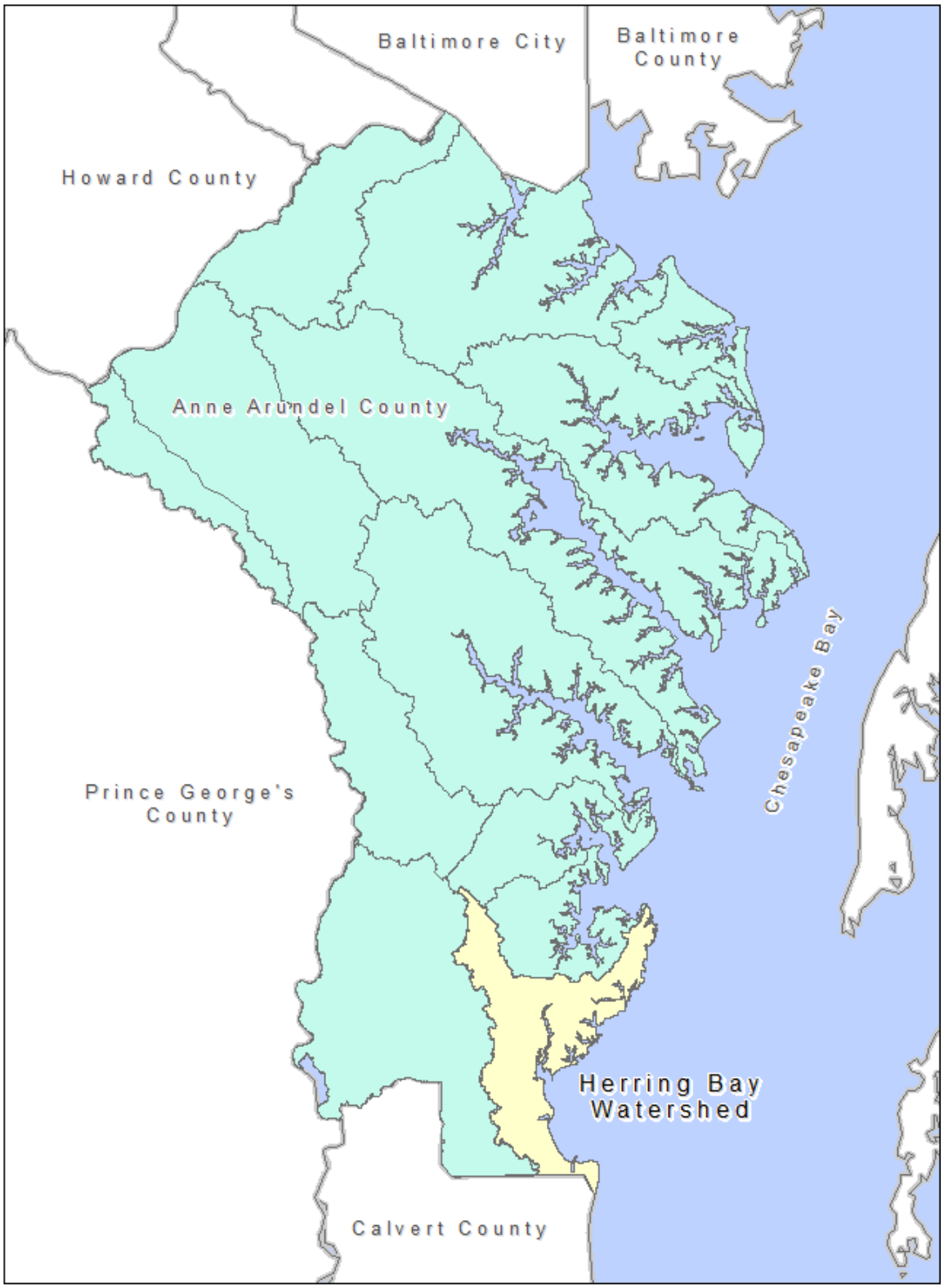

Figure 1 – Herring Bay watershed vicinity map.

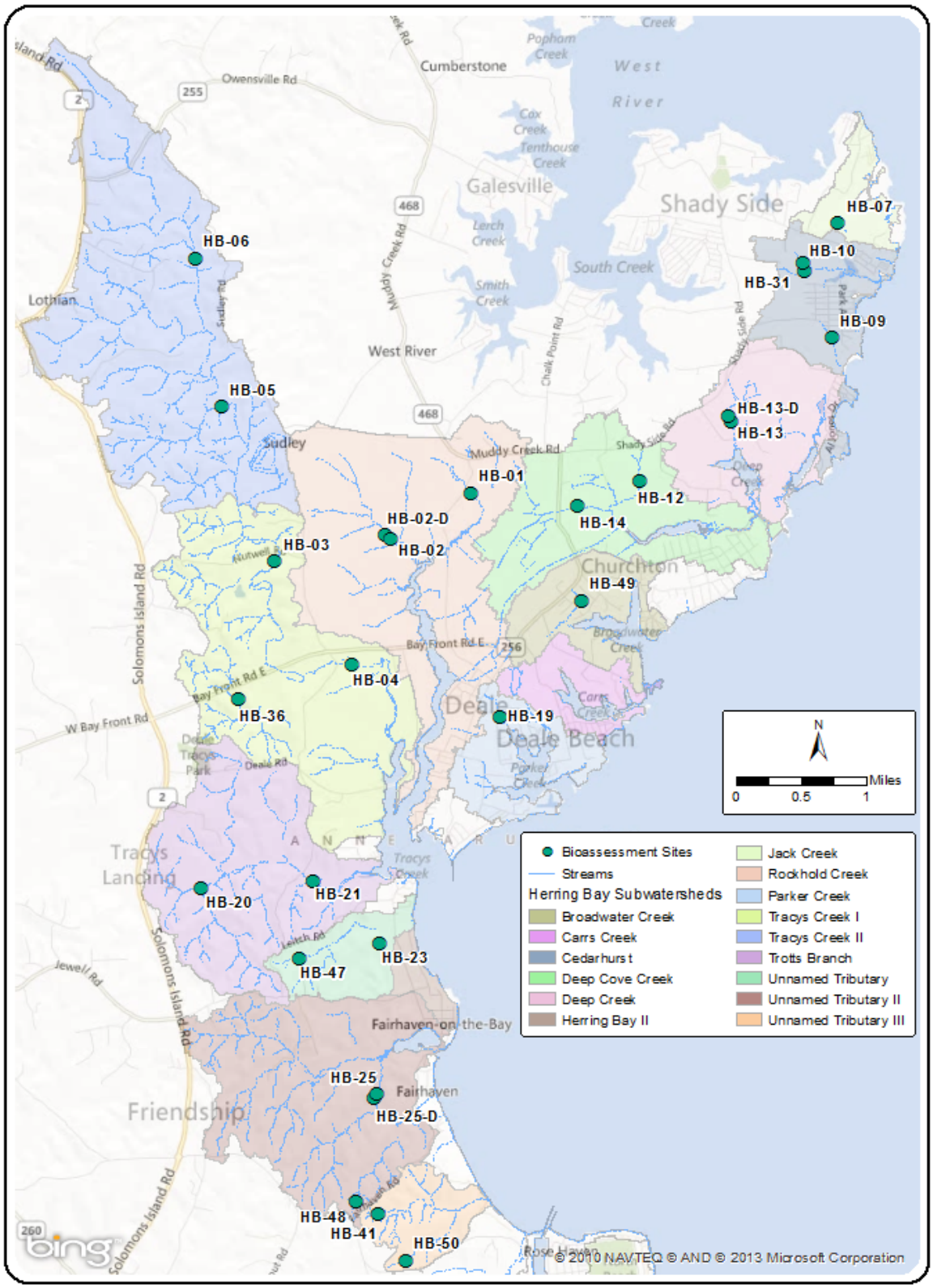

Figure 2 – Biological monitoring location map.

Methodology

The 24 biological monitoring sites within the Herring Bay watershed were sampled using Standard Operating Procedures (SOP) described in the County's Quality Assurance Project Plan (QAPP) for the Anne Arundel County Biological Monitoring and Assessment Program (Anne Arundel County 2011). These methods are consistent with methods used by the Maryland Department of Natural Resources Maryland Biological Stream Survey (MBSS; DNR, 2010). In addition to the 24 targeted sites, three duplicate sites were assessed as a quality control measure. Prior to the sampling fieldwork, all field crew leaders received training and certification in MBSS Spring Index Period sampling protocols. Stream monitoring included assessments of *in-situ* water quality, benthic macroinvertebrates, and physical habitat. A summary of these methods are presented below.

Site Selection and Property Owner Notification

Candidate site locations were pre-determined by DPW's Watershed Assessment and Planning Program staff in ArcGIS using a targeted selection approach. Only subwatersheds containing potentially sampleable streams and subwatersheds completely within the County were targeted for this study. Smaller subwatersheds were allocated one site and larger watersheds were given two or more sites to provide adequate characterization of the conditions throughout the basin. Numerous alternate sites were also chosen to account for a percentage of unsampleable streams or sites without property owner access. As a result, a total of 50 candidate sites were generated.

Using a combination of GIS property layers (provided by the County) and Maryland Department of Assessments and Taxation Real Property Data Search (vw3.1A), the 50 candidate sites were analyzed to determine which private parcels may be accessed to complete the stream sampling fieldwork. These property owners were sent a letter from the County explaining the survey and requesting permission to access the stream sites through their property. As a result, several candidate sites were eliminated due to a lack of property owner permissions. Other sites were determined in the field to be unsampleable and also eliminated. When possible, these sites were replaced with alternate sites within the same subwatershed. The locations of the resulting 24 sample sites are depicted in ***Figure 2*** and included in ***Table 1***, below.

In-situ Water Quality Assessment

In-situ water quality data were collected at each site using methods prescribed in the QAPP. At each site, temperature, dissolved oxygen, pH, specific conductance, and turbidity data were recorded using a ***Quanta Hydrolab***©. Measurements were collected from the upstream end, mid-point, and downstream end of each reach and averaged to capture water quality conditions throughout the entire reach. Data collected for each site were compared to the Code of Maryland Regulations (COMAR), Water Quality Criteria Specific to Designated Uses. All sites discussed in this report are classified as Use I. The associated criteria for Use I streams are presented below in ***Table 2***. Note that there are currently no standards available for specific conductivity. However, Morgan et al. (2007) established a conductivity threshold for biological impairment in Maryland streams at 247 µS/cm. This threshold was used as a guideline in determining elevated conductivity levels in the Herring Bay watershed.

Table 1 – List of sampling sites and corresponding subwatersheds.

Subwatershed	Subwatershed Code	Site
Broadwater Creek	HBC	HB-49-2013
Cedarhurst	HB7	HB-09-2013
		HB-10-2013
		HB-31-2014
Deep Cove Creek	HB9	HB-12-2013
		HB-14-2013
Deep Creek	HB8	HB-13-2013
Jack Creek	HB3	HB-07-2013
Parker Creek	HBF	HB-19-2013
Rockhold Creek	HB0	HB-01-2013
		HB-02-2013
Tracy's Creek I	HB1	HB-03-2013
		HB-04-2013
		HB-36-2014
Tracy's Creek II	HB2	HB-05-2013
		HB-06-2013
Trotts Branch	HBL	HB-20-2013
		HB-21-2013
Unnamed Tributary	HBO	HB-23-2013
		HB-47-2013
Unnamed Tributary II	HBQ	HB-25-2013
		HB-48-2013
Unnamed Tributary III	HBS	HB-41-2013
		HB-50-2013

Table 2 – Water quality parameters and associated Use I stream class criteria.

Parameter	**Use I (Water Contact Recreation, and Protection of Nontidal Warmwater Aquatic Life)**
Temperature	Maximum of 32°C (90°F) or the ambient temperature of the surface waters, whichever is greater
pH	6.5 to 8.5
Dissolved Oxygen	Minimum of 5 mg/L at any time, with a minimum daily average of not less than 6 mg/l
Turbidity	Maximum of 150 NTU and maximum monthly average of 50 NTU

Aquatic Habitat Assessment

Both the U.S. Environmental Protection Agency's Rapid Bioassessment Protocol (RBP) for low gradient streams and the MBSS aquatic habitat assessment methodology were used to assess the condition and availability of the stream habitat for aquatic biota at each site (Barbour et al. 1999; Paul et al. 2002). The RBP uses a qualitative rating of ten habitat parameters for coastal plain streams, including Epifaunal Substrate/Available Cover, Pool Substrate Characterization, Pool Variability, Sediment Deposition, Channel Flow Status, Channel Alteration, Channel Sinuosity, Bank Stability, Vegetative Protection, and Riparian Vegetative Zone Width. Each parameter is given a score from 0-20, with the exception of Bank Stability, Vegetation Protection, and Riparian Vegetative Zone Width, which are scored from 0-10 for each bank. The scores for each parameter are then summed for a total score, which is compared to reference conditions and given a narrative ranking. Because there were no reference sites within Anne Arundel County with RBP habitat data, the total habitat score was compared to a reference condition in Prince George's County (Stribling et. al 1999). The RPB habitat ranking criteria are presented in ***Table 3*** below.

Table 3 – RBP habitat ranking criteria.

Total Score	Comparability to Reference	Narrative Ranking
>151	>90%	Comparable to Reference
126-150	75-89%	Supporting
101-125	60-74%	Partially Supporting
≤100	≤60	Non-Supporting

The MBSS habitat assessment methodology uses a qualitative rating of 12 habitat parameters, including Instream Habitat, Epifaunal Substrate, Velocity/Depth Diversity, Pool/Glide/Eddy Quality, Riffle Run Quality, Bank Stability, Embeddedness, Shading, Riparian Buffer Zone Width, Remoteness, Aesthetic Rating (Trash), and the Number of Woody Debris and Rootwads. Each parameter is given a score from 0-20, with the exception of Bank Stability, Embeddedness, Shading, and the Number of Woody Debris and Rootwads. Bank stability is scored from 0-10 for each bank, Shading and Embeddedness are estimated as percentages, and the Number of Woody Debris and Rootwads are presented as a total number counted throughout the reach. Six of these parameters are used to determine the Physical Habitat Index (PHI) for Coastal Plain streams, including Instream Habitat, Epifaunal Substrate, Number of Rootwads and Woody Debris, Remoteness, Shading, and Bank Stability. Each of the six parameters are then scaled using the formulas presented in Paul et al. 2002. These scaled parameters are averaged to determine the PHI, which takes into account watershed size. The PHI is set on a zero to 100 scale and has a narrative ranking as compared to reference streams within the State (***Table 4***).

Table 4 – PHI ranking criteria.

Score	Narrative Ranking
81-100	Minimally Degraded
66-80	Partially Degraded
51-65	Degraded
0-50	Severely Degraded

Benthic Macroinvertebrate Assessment

Benthic macroinvertebrates were collected during the Spring Index Period (March 1 through April 30) using guidance established in the QAPP. Field collection included sampling 20 square feet (sf) of best available benthic macroinvertebrate habitat at each site using a D-net. Habitat types sampled include cobble/gravel, snags/leafpacks, under-cut banks, root-wads, and submerged vegetation. Beginning at the downstream end of the 75-meter (m) site, the D-net was placed firmly in the substrate of the riffle area or other habitat feature while organisms were dislodged through rubbing or kicking of the substrate in a one sf area in front of the net. This process was repeated until 20 sf of substrate was sampled throughout the reach. The sample was washed into a 500 µm sieve bucket and placed in a labeled sample container with 90% ethanol solution and transported to the laboratory.

Benthic macroinvertebrate samples were processed, subsampled, and identified using protocols detailed in the QAPP and in *Laboratory Methods for Benthic Macroinvertebrate Processing and Taxonomy* (Boward 2000). In the laboratory, samples were transferred to a gridded (numbered) tray and subsampled using a fixed-count method. Grids were randomly selected and organisms were picked until a total of 100 organisms were collected and the final grid was picked in its entirety. If the total number of organisms exceeded 120 after picking the final grid, the organisms were subsampled until the total was between 100 and 120.

Samples from each monitoring site were identified to genus, or the lowest taxonomic level possible. Chironomidae larvae and Oligochaeta were mounted and identified using MBSS methods (Boward 2000). The final classification and abundance of each organism was entered into an Excel spreadsheet containing information on the tolerance value, functional feeding group, and habit (characteristic behavior) of each taxonomic group.

Benthic macroinvertebrate data were used to calculate a Benthic Index of Biotic Integrity (BIBI) for Coastal Plain Streams for each site. This method compares the macroinvertebrate community within a given stream to reference macroinvertebrate communities in least-impaired, state-wide reference streams. The BIBI uses six community metrics found to characterize macroinvertebrate community health in Maryland's Coastal Plain streams, including:

1. Total Number of Taxa – This metric reflects the health of the community through a measurement of the total number of unique taxa in a sample. An increase in taxa is directly related to the increase in water quality, habitat diversity, and/or habitat suitability.

2. Number of EPT Taxa – The richness of the generally intolerant insect orders of Ephemeroptera (mayflies), Plecoptera (stoneflies), and Trichoptera (caddisflies). This value summarizes taxa richness with macroinvertebrates that are generally considered to be intolerant of pollution. Therefore, a higher number of taxa within the sample suggests better water quality conditions.

3. Number of Ephemeroptera Taxa – The richness of mayfly taxa indicates the ability of a stream to support this generally intolerant insect order.

4. Percent Intolerant to Urban – Intolerant taxa are the first to be eliminated by disturbances. This metric is the percentage of insects with tolerance ratings from zero to three on the zero to ten scale that make up the total sample.

5. Number of Scraper Taxa – Scrapers feed on pollution intolerant microfauna; therefore, stream conditions that affect this food source can also affect scraper populations. This metric is expected to decrease with increasing stressors.

6. Percent Climbers – The percentage of taxa that live primarily on stem type surfaces. This metric generally increases without stressors.

The BIBI is calculated by assigning each metric a score based on its value. The combined scores of the six metrics are then averaged to determine the BIBI. The BIBI scores and associated narrative rankings are presented below in ***Table 5*****.**

Table 5 – MBSS BIBI scores and rankings.

BIBI Score	Narrative Ranking	Characteristics
4.00 – 5.00	Good	Comparable to reference streams considered to be minimally impacted, biological metrics fall within the upper 50% of reference site conditions.
3.00 – 3.90	Fair	Comparable to reference conditions, but some aspects of biological integrity may not resemble the qualities of minimally impacted streams.
2.00 – 2.90	Poor	Significant deviation from reference conditions, indicating some degradation. On average, biological metrics fall below the 10^{th} percentile of reference site values.
1.00 - 1.90	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 10^{th} percentile of reference site values.

Impervious Surface/GIS Analysis

ArcHydro was used to delineate drainage areas for the Herring Bay biological assessment sites. ArcHydro is a free ArcGIS software extension geared to support water resources applications. The County used the most current 2011 Digital Elevation Model (DEM), which consists of three foot resolution, as the basis for the Herring Bay ArcHydro model. Several Geographic Information System (GIS) vector layers were burned into the DEM to provide proper representation of water conveyance, including County planimetric streams, County storm pipes and culverts, and Maryland State Highway Administration pipes and culverts. Then, the County created the model using the following Terrain Processing tasks; Fill Sinks, Flow Direction, Flow Accumulation, Stream Definition, Stream Segmentation, Catchment Grid Delineation, Catchment Polygon Processing, Drainage Line Processing, and Adjoint Catchment Processing. The biological assessment sites were all manually reviewed and placed on the closest Flow Accumulation grid cell. The Batch Watershed Delineation tool was then used to create drainage areas for each biological assessment site, which were also manually QA/QC'd to ensure proper data integrity. The impervious surface acreage and percentage was calculated for the drainage area to each site using a 2011 vector polygon dataset of impervious land cover maintained by the DPW, Bureau of Engineering, Watershed Assessment and Planning Program. The GIS impervious layer was developed from six-inch pixel resolution four band color infrared aerial ortho-photography resampled to one meter during leaf-off conditions. The results include all of the impervious surfaces (e.g., roads, buildings, and parking lots) and do not distinguish between connected versus disconnected surfaces.

Statistical Analysis

Non-parametric correlation analysis was performed using the Kendall rank correlation test with XLSTAT version 2010.3.07 (Addinsoft, 2010). This analysis was conducted to determine which environmental variables are associated with biological response indicators. This specific test was selected because it is a way to analyze correlations among the data that have been ranked differently. Since these data were collected using different "rankings" (e.g., PHI "rank" vs. RBP "rank"), the significance of the correlation can be tested even though the scales by which they were measured are different. The output of this analysis gives the Kendall rank correlation coefficient, p-value, and coefficient of determination for each test. A total of 40 environmental variables were analyzed for this study. Only significant/strong relationships (p value <0.05) are presented in the discussion section. ***Appendix C*** includes a list of the variables analyzed and detailed results of the analysis.

Quality Assurance/Quality Control

Quality Assurance/Quality Control (QA/QC) measures were performed for all aspects of this study, including field sampling, benthic processing and taxonomy, field duplicates, data entry, data analysis, and report preparation. A detailed summary of QA/QC measures undertaken for this study is included in ***Appendix B***.

Results

The results of the 24 biological monitoring sites and three duplicates are presented in detail below. Individual site summaries are included in ***Appendix A***.

Impervious Surface Analysis

The results of the impervious surface analysis are presented below in ***Table 6*** and ***Figure 3***. Drainage areas for the sites sampled in the Herring Bay watershed ranged from 9.59 acres at site HB-48 to 3,548.83 acres at HB-04, with the median drainage area 141.61 acres. Generally, imperviousness was low throughout the Herring Bay watershed, ranging from 0.82% at HB-02 to 31.45% at HB-19, with a median of 3.51%.

Table 6 – Impervious percentages sites sampled in Herring Bay watershed.

Site	Drainage Area Acreage	Impervious Acreage	Impervious Percentage
HB-01-2013	121.21	3.77	3.11
HB-02-2013	243.60	2.00	0.82
HB-03-2013	2632.13	81.83	3.11
HB-04-2013	3548.83	106.44	3.00
HB-05-2013	1942.88	64.86	3.34
HB-06-2013	693.41	37.98	5.48
HB-07-2013	31.15	3.51	11.27
HB-09-2013	60.32	5.59	9.27
HB-10-2013	35.07	2.29	6.53
HB-12-2013	196.77	11.83	6.01
HB-13-2013	178.62	9.24	5.17
HB-14-2013	366.80	11.78	3.21
HB-19-2013	33.51	10.54	31.45
HB-20-2013	428.38	7.96	1.86
HB-21-2013	1135.18	24.51	2.16
HB-23-2013	105.70	3.89	3.68
HB-25-2013	456.16	5.75	1.26
HB-31-2013	67.05	1.91	2.85
HB-36-2013	126.41	4.16	3.29
HB-41-2013	13.05	0.50	3.83
HB-47-2013	28.30	1.41	4.98
HB-48-2013	9.59	0.31	3.23
HB-49-2013	156.81	18.19	11.60
HB-50-2013	10.60	0.66	6.22
Duplicates Sites for QC			
HB-02-2013 DUP	242.76	2.00	0.82
HB-13-2013 DUP	173.95	9.24	5.31
HB-25-2013 DUP	455.22	5.75	1.26

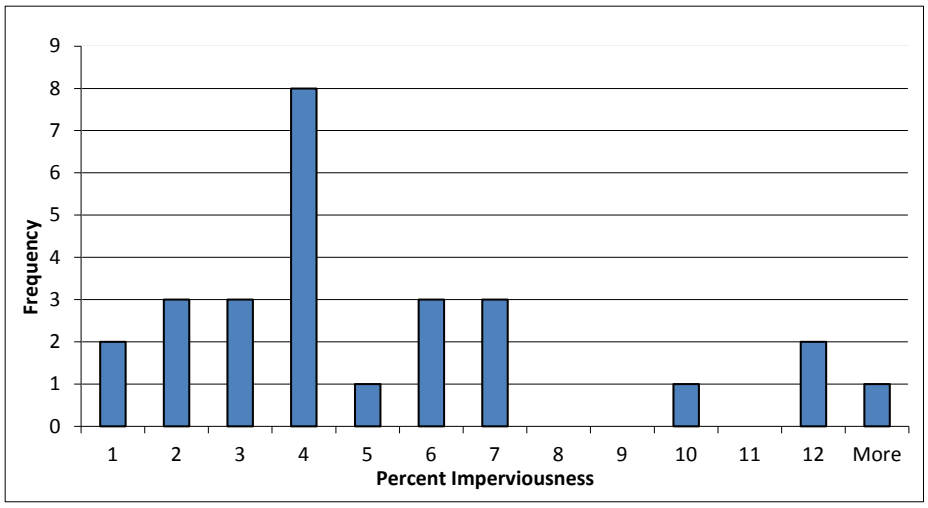

Figure 3 – Distribution of impervious surface percentages sites sampled in the Herring Bay watershed.

In-situ Water Quality Assessment

The results of the *in-situ* water quality assessment for the 24 biological monitoring sites sampled in the Herring Bay watershed in 2013 are summarized below in ***Table 7***. In general, *in-situ* water quality parameters were within COMAR limits or impairment thresholds, with the exception of pH and conductivity. All water temperature, dissolved oxygen, and turbidity values were acceptable by COMAR standards. Water temperatures ranged from 3.5 °C to 17.4 °C; dissolved oxygen ranged from 6.88 mg/L to 16.15 mg/L; and turbidity ranged from 8.3 NTU to 83.7 NTU. pH values ranged from 6.55 to 8.72, with two sites (HB-06 and HB-21) having pH values above the COMAR water quality standard of 8.5. Conductivity values ranged from 39.0 µS/cm to 527.3 µS/cm, and six sites (HB-19, HB-41, HB-47, HB-48, HB-49, and HB-50) had conductivity values above the impairment threshold of 247 µS/cm.

Table 7 – In-situ water quality results for sites sampled in the Herring Bay watershed.[1]

Site	pH	Temperature (°C)	Dissolved Oxygen (mg/L)	Conductivity (µS/cm)	Turbidity (NTU)[2]
HB-01-2013	7.21	3.5	7.80	140.0	30.1
HB-02-2013	7.7	5.0	12.17	108.3	8.8
HB-03-2013	6.85	9.8	12.98	182.3	8.3
HB-04-2013	6.55	7.1	15.34	180.3	12.8
HB-05-2013	7.12	9.3	13.36	178.7	9.3
HB-06-2013	8.72	10.2	15.66	216.7	9.7
HB-07-2013	6.99	6.8	9.00	83.7	20.6
HB-09-2013	7.16	11.6	11.75	166.0	83.7
HB-10-2013	7.46	6.6	7.45	48.7	29.7
HB-12-2013	7.27	7.9	6.88	174.3	26.3
HB-13-2013	7.06	6.4	9.39	120.7	18.3
HB-14-2013	7.46	4.2	10.55	149.0	17.3
HB-19-2013	7.85	12.2	9.15	308.7	51.7
HB-20-2013	8.01	11.6	16.14	144.7	14.6
HB-21-2013	8.71	12.5	16.15	148.0	13.3
HB-23-2013	8.18	14.8	13.80	184.3	16.2
HB-25-2013	7.74	14.3	9.99	211.3	13.8
HB-31-2013	7.11	4.0	8.71	39.0	20.3
HB-36-2013	6.58	7.0	11.23	201.7	15.4
HB-41-2013	7.56	11.0	10.66	321.0	10.9
HB-47-2013	7.11	14.5	12.63	358.7	26.7
HB-48-2013	7.49	17.4	12.50	527.3	13.6
HB-49-2013	7.58	12.7	7.26	260.3	17.5
HB-50-2013	6.99	13.0	9.12	289.5	-
Duplicate Sites for QC					
HB-02-DUP-2013	7.72	6.3	12.20	108.0	8.0
HB-13-DUP-2013	6.88	15.7	8.56	96.3	18.1
HB-25-DUP-2013	7.40	14.4	10.25	211.7	10.5

[1]Shaded cells represent values that were outside acceptable COMAR water quality standards or impairment thresholds.

[2]Sites without turbidity readings were too shallow to obtain an accurate measurement.

Aquatic Habitat Assessment

The aquatic habitat assessment results for the 24 biological monitoring sites sampled in the Herring Bay watershed in 2013 are summarized below in ***Table 8*** and ***Figures 4 and 5***. Total RBP habitat scores ranged from 91 (Non-supporting) to 154 (Comparable to Reference), with an average of 125 (Partially Supporting) for the 24 sites sampled. The majority of sites were classified as either Partially Supporting or Supporting, comprising 50% and 34% of the sites, respectively (***Figure 4***). Site HB-04, in the Tracy's Creek I subwatershed and site HB-25, in the Unnamed Tributary II subwatershed, were the only sites classified as Comparable to Reference. Similarly, site HB-07, in the Jack Creek subwatershed and site HB-49, in the Broadwater Creek subwatershed, were the only sites classified as Non-supporting.

The distributions of total RBP habitat scores and individual metric scores were examined for normality (***Figure 6***). The RBP scores and Epifaunal Substrate/Available Cover scores showed a normal distribution. Pool Variability and Pool Substrate Characterization were tended towards low values. Sediment Deposition, Bank Stability, Vegetative Protection, and Riparian Vegetative Zone Width tended towards high values.

The PHI scores ranged from 39.44 (Severely Degraded) to 89.15 (Minimally Degraded), with an average of 73.33 (Partially Degraded) for the 24 sites sampled. The majority of sites were classified as either Partially Degraded or Minimally Degraded, comprising 63% and 25% of the sites, respectively (***Figure 4***). Site HB-03, in the Tracy's Creek I subwatershed was the only site classified as Severely Degraded. Site HB-09, in the Cedarhurst subwatershed and site HB-49, in the Broadwater Creek subwatershed, were the only sites classified as Degraded.

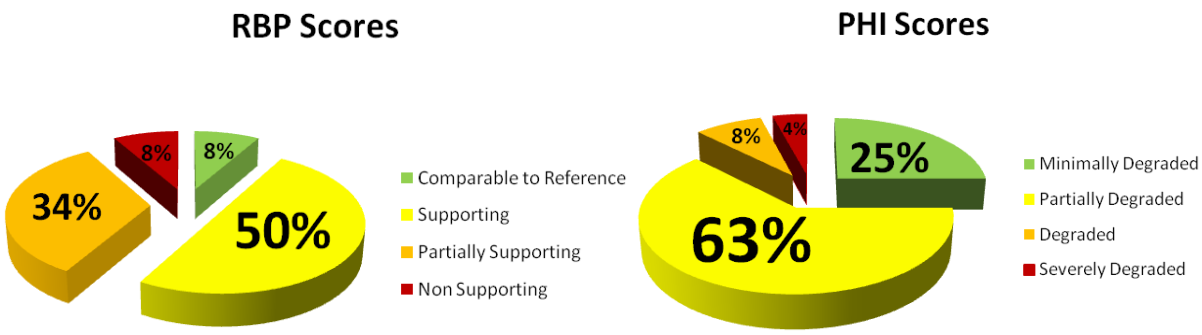

Figure 4 – PHI and RBP scoring criteria distribution for sites sampled in the Herring Bay watershed.

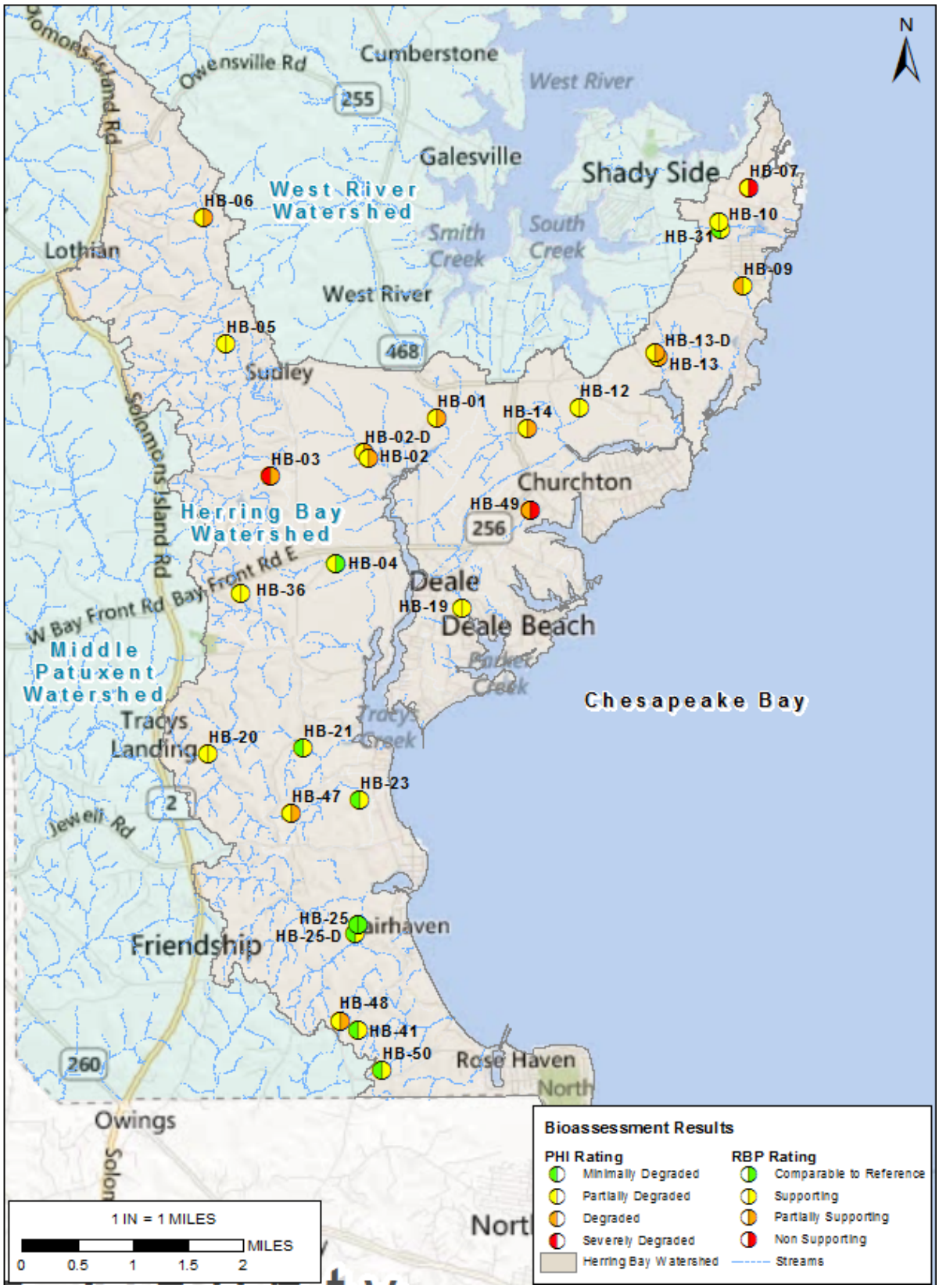

Figure 5 – 2013 aquatic habitat assessment results map for Herring Bay watershed.

Table 8 – Aquatic habitat assessment results for sites sampled in the Herring Bay watershed.

Site	Total RBP	Percent Reference	RBP Classification	PHI Score	PHI Narrative Rating
HB-01-2013	107	63.69	Partially Supporting	67.12	Partially Degraded
HB-02-2013	120	71.43	Partially Supporting	71.27	Partially Degraded
HB-03-2013	109	64.88	Partially Supporting	39.44	Severely Degraded
HB-04-2013	153	91.07	Comparable to Reference	72.72	Partially Degraded
HB-05-2013	135	80.36	Supporting	72.40	Partially Degraded
HB-06-2013	122	72.62	Partially Supporting	68.64	Partially Degraded
HB-07-2013	91	54.17	Non Supporting	68.68	Partially Degraded
HB-09-2013	126	75.00	Supporting	65.05	Degraded
HB-10-2013	129	76.79	Supporting	77.53	Partially Degraded
HB-12-2013	135	80.36	Supporting	75.39	Partially Degraded
HB-13-2013	112	66.67	Partially Supporting	73.97	Partially Degraded
HB-14-2013	110	65.48	Partially Supporting	69.61	Partially Degraded
HB-19-2013	132	78.57	Supporting	72.80	Partially Degraded
HB-20-2013	148	88.10	Supporting	76.73	Partially Degraded
HB-21-2013	143	85.12	Supporting	84.14	Minimally Degraded
HB-23-2013	134	79.76	Supporting	81.13	Minimally Degraded
HB-25-2013	154	91.67	Comparable to Reference	88.30	Minimally Degraded
HB-31-2013	138	82.14	Supporting	83.18	Minimally Degraded
HB-36-2013	134	79.76	Supporting	78.49	Partially Degraded
HB-41-2013	127	75.60	Supporting	89.15	Minimally Degraded
HB-47-2013	106	63.10	Partially Supporting	67.25	Partially Degraded
HB-48-2013	104	61.90	Partially Supporting	74.25	Partially Degraded
HB-49-2013	98	58.33	Non Supporting	58.37	Degraded
HB-50-2013	131	77.98	Supporting	84.40	Minimally Degraded
Mean	**125**	**74.36**	Partially Supporting	**73.33**	Partially Degraded
Std. Dev.	**17**	**10.24**	-	**10.45**	-
Duplicate Sites for QC					
HB-02-DUP-2013	124	73.81	Partially Supporting	79.84	Partially Degraded
HB-13-DUP-2013	116	69.05	Partially Supporting	74.18	Partially Degraded
HB-25-DUP-2013	143	85.12	Supporting	85.68	Minimally Degraded

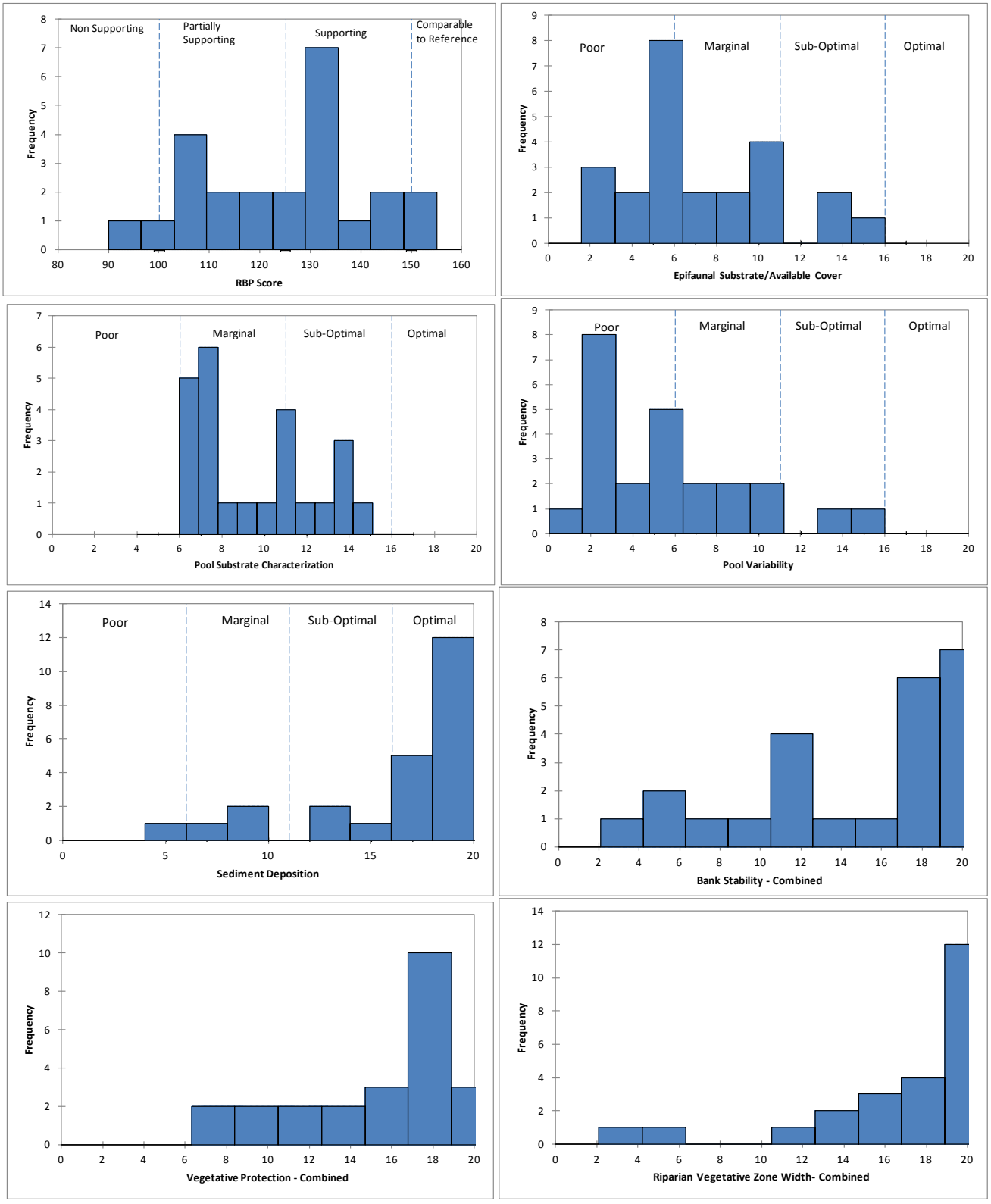

Figure 6 – Distribtions of RBP scores and selected RBP metric scores for sites sampled in the Herring Bay watershed.

Benthic Macroinvertebrate Assessment

The benthic macroinvertebrate assessment results for the 24 biological monitoring sites sampled in the Herring Bay watershed in 2013 are summarized below in ***Table 9*** and ***Figures 7 and 8***. The BIBI scores ranged from 1.00 (Very Poor) to 3.29 (Fair), with an average of 1.95 (Very Poor) for the 24 sites sampled. The majority of sites were in the Very Poor and Poor ranges, at 54% and 38% of the sites, respectively (***Figure 7***). The remaining 8% of sites were in the Fair range. The two sites scoring in the Fair range were HB-05 in the Tracy's Creek II subwatershed and HB-23 in the Unnamed Tributary subwatershed.

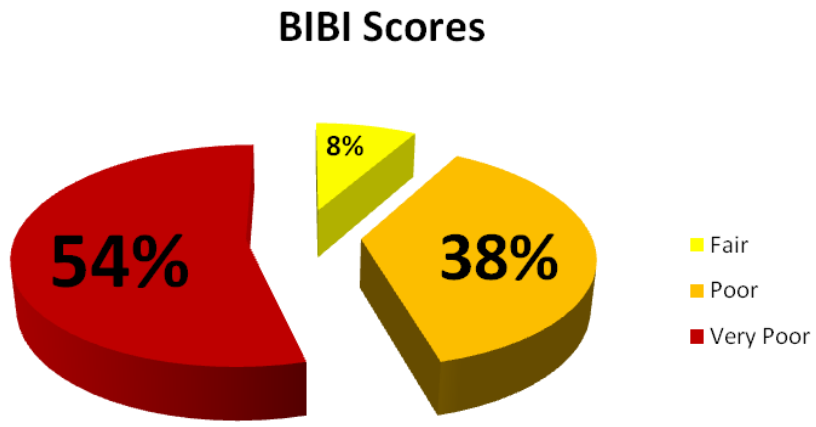

Figure 7 – BIBI scoring criteria distribution for sites sampled in the Herring Bay watershed.

The distributions of BIBI scores and individual metric scores were examined for normality (***Figure 9***). The BIBI, Total Number of Taxa, and Percent Intolerant to Urban generally showed a normal distribution. However, most other metrics tended towards low values. An analysis of percent abundance and percent occurrence of the top 30 taxa indicates that tubificid worms (Family Tubificidae) were the most abundant and most commonly occurring taxa ***(Tables 10 and 11***). Tubificid worms, a pollution-tolerant taxon, comprised 14.2% of collected individuals and occurred in 95.8% of the sites sampled. The second most abundant and most commonly occurring taxon was the relatively intolerant aquatic isopod *Caecidotea*, which was found at 66.7% of the sites and comprised 9.8% of the community. Non-biting midges (Family Chironomidae), which are generally pollution-tolerant, were also abundant in the samples. A total of eight Chironomidae taxa were collected, comprising 27.1% of the community.

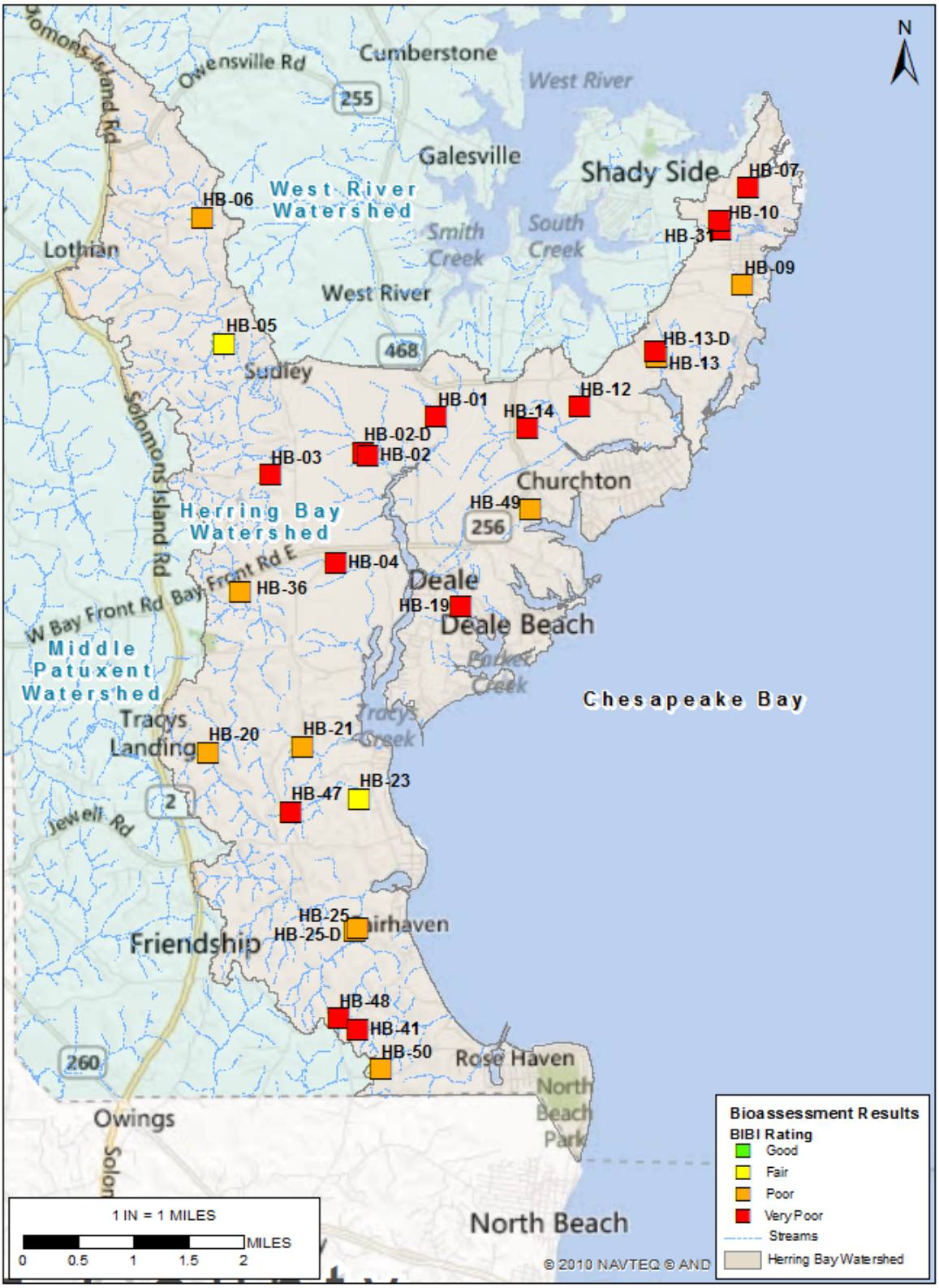

Figure 8 – 2013 benthic macroinvertebrate assessment results map for the Herring Bay watershed.

Table 9 – BIBI scores for sites sampled in the Herring Bay watershed.

Site	BIBI Score	Narrative Rating
HB-01-2013	1.00	Very Poor
HB-02-2013	1.86	Very Poor
HB-03-2013	1.57	Very Poor
HB-04-2013	1.86	Very Poor
HB-05-2013	3.29	Fair
HB-06-2013	2.43	Poor
HB-07-2013	1.29	Very Poor
HB-09-2013	2.43	Poor
HB-10-2013	1.29	Very Poor
HB-12-2013	1.57	Very Poor
HB-13-2013	2.43	Poor
HB-14-2013	1.57	Very Poor
HB-19-2013	1.57	Very Poor
HB-20-2013	2.43	Poor
HB-21-2013	2.43	Poor
HB-23-2013	3.00	Fair
HB-25-2013	2.43	Poor
HB-31-2013	1.00	Very Poor
HB-36-2013	2.71	Poor
HB-41-2013	1.86	Very Poor
HB-47-2013	1.00	Very Poor
HB-48-2013	1.57	Very Poor
HB-49-2013	2.14	Poor
HB-50-2013	2.14	Poor
Mean	**1.95**	Very Poor
Std. Dev.	**0.63**	
Duplicate Sites for QC		
HB-02-DUP-2013	1.57	Very Poor
HB-13-DUP-2013	1.29	Very Poor
HB-25-DUP-2013	2.43	Poor

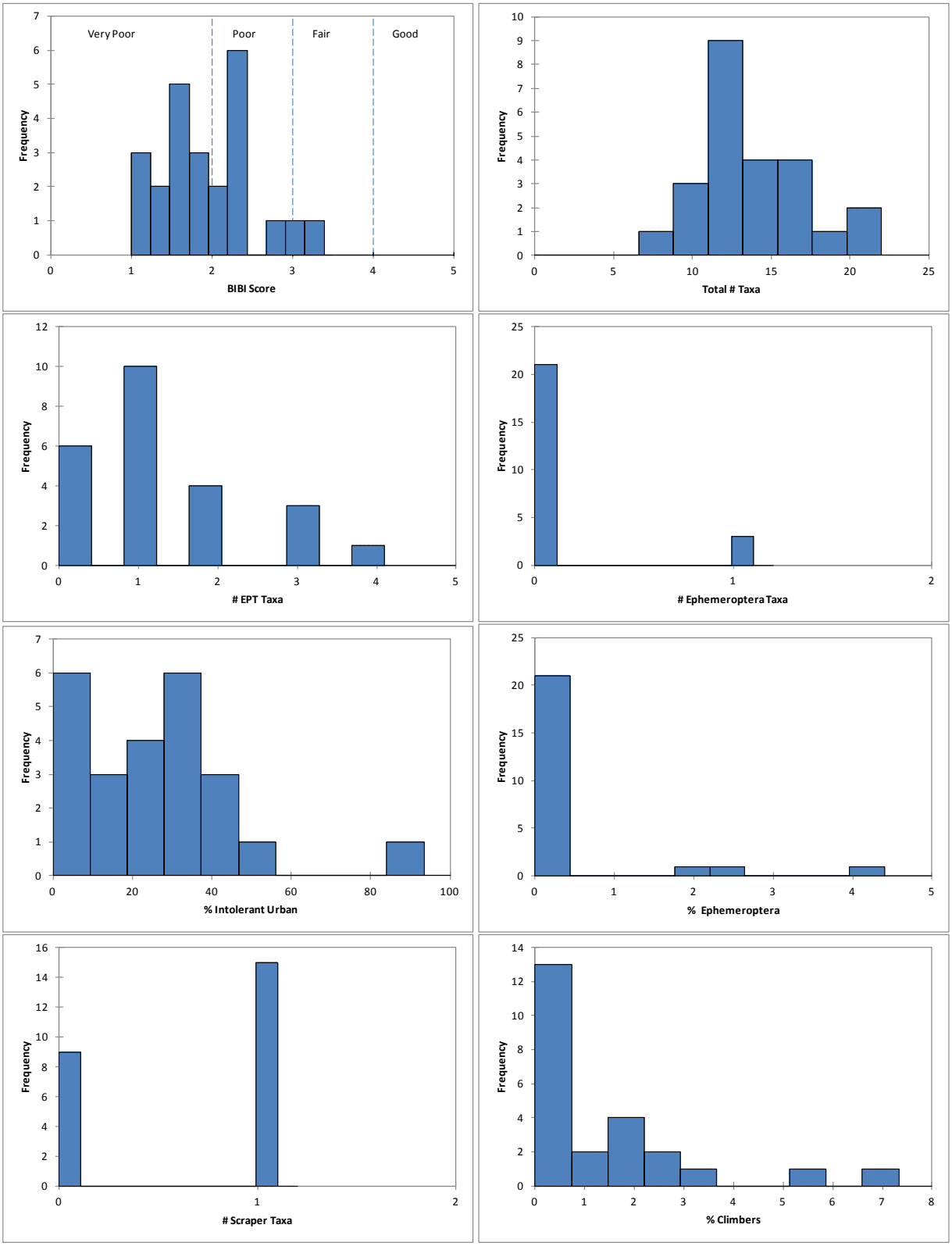

Figure 9 – Distribtions of BIBI scores and individual metric scores for sites sampled in the Herring Bay watershed.

Table 10 – Percent abundance by the top 30 taxa.[1]

Final Identification	Functional Feeding Group	Habit[2]	Tolerance Value	Total Number of Individuals	Percent of Collected Individuals
Tubificidae	Collector	cn	8.4	320	14.2
Caecidotea	Collector	sp	2.6	222	9.8
Orthocladius	Collector	sp, bu	9.2	191	8.5
Stegopterna	Filterer	cn	2.4	155	6.9
Diplocladius	Collector	sp	5.9	139	6.2
Asellidae	-	-	3.3	122	5.4
Pseudorthocladius	Collector	sp	6	120	5.3
Crangonyctidae	Collector	sp	6.5	102	4.5
Amphinemura	Shredder	sp, cn	3	71	3.1
Crangonyx	Collector	sp	6.7	64	2.8
Gammaridae	-	-	6	61	2.7
Simulium	Filterer	cn	5.7	50	2.2
Isoperla	Predator	cn, sp	2.4	47	2.1
Parametriocnemus	Collector	sp	4.6	47	2.1
Rheocricotopus	Collector	sp	6.2	41	1.8
Synurella	-	-	0.4	41	1.8
Naididae	Collector	bu	8.5	35	1.6
Gammarus	Shredder	sp	6.7	31	1.4
Hydrobaenus	Scraper	sp	7.2	30	1.3
Enchytraeidae	Collector	bu	9.1	29	1.3
Lumbriculidae	Collector	bu	6.6	25	1.1
Pisidium	Filterer	bu	5.7	25	1.1
Ironoquia	Shredder	sp	4.9	23	1.0
Chaetocladius	Collector	sp	7	23	1.0
Orthocladiinae	Collector	-	7.6	21	0.9
Erioptera	Collector	bu	4.8	18	0.8
Tipula	Shredder	bu	6.7	18	0.8
Sphaeriidae	Filterer	bu	6.5	18	0.8
Dasyhelea	Collector	sp	3.6	14	0.6
Chrysops	Predator	sp, bu	2.9	11	0.5

[1]Note that duplicate sites were excluded from this table.
[2]bu = burrower, cn = clinger, cb = climber, sp = sprawler, dv = diver, sk = skater

Table 11 – Percent occurrence of the top 30 taxa.[1]

Final Identification	Functional Feeding Group	Habit[1]	Tolerance Value	Number of Sites Present	Percent of Sites Present
Tubificidae	Collector	cn	8.4	23	95.8
Caecidotea	Collector	sp	2.6	16	66.7
Asellidae	-	-	3.3	15	62.5
Diplocladius	Collector	sp	5.9	15	62.5
Orthocladius	Collector	sp, bu	9.2	14	58.3
Synurella	-	-	0.4	13	54.2
Crangonyx	Collector	sp	6.7	12	50.0
Naididae	Collector	bu	8.5	12	50.0
Rheocricotopus	Collector	sp	6.2	11	45.8
Ironoquia	Shredder	sp	4.9	11	45.8
Orthocladiinae	Collector		7.6	10	41.7
Tipula	Shredder	bu	6.7	10	41.7
Stegopterna	Filterer	cn	2.4	9	37.5
Pseudorthocladius	Collector	sp	6	9	37.5
Crangonyctidae	Collector	sp	6.5	9	37.5
Enchytraeidae	Collector	bu	9.1	9	37.5
Hydrobaenus	Scraper	sp	7.2	9	37.5
Chrysops	Predator	sp, bu	2.9	9	37.5
Erioptera	Collector	bu	4.8	8	33.3
Parametriocnemus	Collector	sp	4.6	7	29.2
Lumbriculidae	Collector	bu	6.6	7	29.2
Amphinemura	Shredder	sp, cn	3	6	25.0
Gammaridae	-	-	6	6	25.0
Isoperla	Predator	cn, sp	2.4	6	25.0
Gammarus	Shredder	sp	6.7	6	25.0
Nemouridae	Shredder	sp, cn	2.9	6	25.0
Pisidium	Filterer	bu	5.7	5	20.8
Sphaeriidae	Filterer	bu	6.5	5	20.8
Chaetocladius	Collector	sp	7	4	16.7
Dasyhelea	Collector	sp	3.6	4	16.7
Amphipoda	-	sp	6	4	16.7
Polypedilum	Shredder	cb, cn	6.3	4	16.7
Stygobromus	Collector	-	4	4	16.7
Dolichopodidae	Predator	sp, bu	7.5	4	16.7

[1]Note that duplicate sites were excluded from this table.
[2]bu = burrower, cn = clinger, cb = climber, sp = sprawler, dv = diver, sk = skate

Discussion

Below is a discussion and interpretation of the physical, chemical, biological and land use conditions of the sites sampled in the Herring Bay watershed for this study.

Land Use and Impervious Surface Analysis

The majority of sites sampled in the Herring Bay watershed (79%) were predominantly forested. Overall, the percentage of forested land cover in each drainage area ranged from 26.79% forested at HB-07 to 99.87% forested at HB-41, with a median of 58.12%. The drainage areas of the remaining 21% of sites were dominated by developed land, which was the second most common land use in the drainages of the 24 sites sampled. Developed land consisted of mostly low density residential land use and ranged from 0.13% at HB-41 to 60.21% at HB-50, with a median of 24.05%. Although no sites were dominated by agricultural land use, agriculture is common in the watershed, comprising from zero to 34.28% of the sampled drainage areas. Generally, imperviousness was low throughout the watershed, ranging from 0.82% at HB-02 to 31.45% at HB-19, and with a median of 3.51%. Only sites HB-07, HB-19, and HB-49 had impervious percentages that were over 10%, which is the threshold generally associated with notable stream impairment.

In-situ Water Quality Assessment

In-situ water quality data was within COMAR state water quality standards or impairment thresholds for most sites, with the exception of pH and conductivity. High pH was observed at two sites (HB-06 and HB-21), and may be due in part to algae in the stream, which can have dramatic effects on pH. During the day, algae and underwater plants remove dissolved carbon dioxide from the water during photosynthesis. As a result, the concentration of the hydroxide ion (OH-) in the water increases (NCDENR 2013). Because the hydroxide ion is a strong base, the pH of the stream increases during the day. During the time of the field sampling, a large amount of filamentous algae was observed at HB-21, which may explain the elevated pH value. High conductivity was observed at six sites (HB-19, HB-41, HB-47, HB-48, HB-49, and HB-50). The high conductivity may have been due to low stream flow or pollution inputs. Three out of the six sites with high levels of conductivity were characterized by low flow conditions, which may produce a higher level of ions in solution. High conductivity can also be caused by anthropogenic sources such as human and animal waste, fertilizers, pesticides, herbicides, and road salt. Two of the sites characterized by high conductivity (HB-19 and HB-49) had the highest percent impervious of any of the sites sampled (31.45% and 11.60%, respectively). It is important to note that the *in-situ* water quality measurements provide a snap-shot of the water quality conditions during the time of the assessment and don't necessarily reflect the overall water quality of the streams sampled. Sites with water quality readings exceeding water quality standards or impairment thresholds would need to be investigated further to identify if consistent problems exist.

Aquatic Habitat Assessment

The results of the aquatic habitat assessment indicated that relatively low physical habitat degradation is present in many areas across the Herring Bay watershed, which is consistent with the generally low imperviousness and predominantly forested land use in the watershed. Low habitat assessment scores, when present, may be due to stream size, the location in the watershed

or historic land use. Many of the sites appeared to have been ditched historically or may have been created as a ditch to drain high water tables for agricultural or other land uses and naturalized as more of a stream over time (***Figure 10***). Such sites may be exhibiting residual effects of past disturbances such as agriculture, channelization and deforestation, as much of the County has historically experienced deforestation and extensive alteration of the landscape from agricultural practices.

Figure 10 – Site HB-09-2013 depicting the lack of physical habitat due to past channelization of the stream.

The streams sampled in the western and southern portions of the watershed were generally characterized by higher gradients and contained more epifaunal substrate for benthic macroinvertebrates. Conversely, many of the sites on the eastern portion of the watershed were generally flat, with lower gradient stream/wetland complexes and were closer to tidal elevations. These low-gradient sites lacked sinuosity and diverse instream features and had little flow, resulting in lower estimates of epifaunal substrate for benthic macroinvertebrates. Furthermore, based on the geomorphology and weak flow observed during the fieldwork, many of the smaller sites sampled may have intermittent flow regimes or become vegetated later in the growing season. Note that there was also a significant positive correlation between stream size (measured

in watershed acres) and RBP scores (p=0.034), however, the goodness of fit was very low (R^2=0.0883).

When comparing RBP and PHI habitat scores at the 24 sampling sites, there was a highly significant correlation between the two assessment types and a moderate goodness of fit (p=0.001 and R^2=0.3459; ***Figure 11***). However, RBP and PHI scores were not necessarily consistent with one another due to differences in the scoring methodologies between the two methods. Only seven sites (29%) received a PHI rating that was comparable to the RBP habitat assessment score.

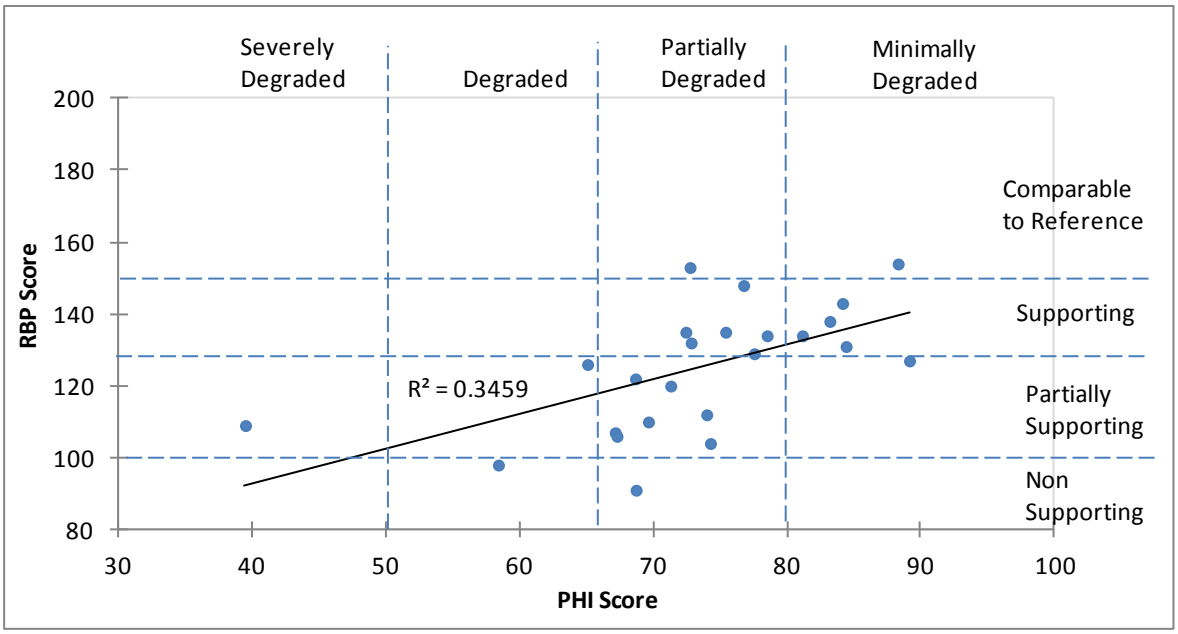

Figure 11 – Comparison of RBP and PHI habitat assessment scores for the sites sampled in the Herring Bay watershed.

Benthic Macroinvertebrate Assessment

The BIBI results indicated that benthic macroinvertebrate communities are degraded in many areas across the Herring Bay watershed. Ninety-two percent of sites assessed in 2013 had impaired biological conditions (i.e., Poor or Very Poor BIBI scores). The remaining 8% of sites were rated as Fair. On average, BIBI scores were rated as Very Poor (1.95) for this study. These results are lower than the findings from the Round 2 county-wide assessment in 2010 (Crunkelton et al. 2010), but more similar to observations made in Round 1 (Roberts et al. 2006). In 2010, the average BIBI score for the Herring Bay sampling unit was 3.17 (Fair) while the Round 1 average, collected in 2005, was 2.80 (Poor). However, it is important to note that the 2013 results cannot be directly compared with the County's 2010 or 2005 results due to differences in sampling design (i.e., targeted vs. probabilistic design). It should also be noted that the majority of the sites sampled by the County in both 2005 and 2010 were located in the

western and southern portions of the watershed, where BIBI scores were generally found to be higher in this study.

Integrated Assessment

The integrated assessment results for the 24 targeted biological monitoring sites sampled in the Herring Bay watershed in 2013 are summarized below in ***Table 12*** and ***Figure 12***. The RBP habitat assessment scores showed a weak but significant relationship ($p=0.045$ and $R^2=0.1775$) to BIBI scores (***Figure 13***). This suggests that water quality or flow regime may be a greater limitation on the benthic macroinvertebrate community than overall habitat. A significant relationship did not occur between the BIBI scores and the PHI. In addition, several sites (shown in bold in ***Tables 13 and 14***) differed by at least two BIBI categories from the corresponding habitat condition, which further supports the fact that the sites may be water quality or flow limited.

Although only a weak relationship existed between overall aquatic habitat and the benthic community, significant correlations were found between BIBI scores and several individual habitat variables. Significant positive correlations were found between BIBI scores and two RBP physical habitat variables, including Epifaunal Substrate/Available Cover ($p = 0.005$ and $R^2=0.3466$; ***Figure 14***) and Channel Sinuosity ($p = 0.015$ and $R^2=0.2011$; ***Figure 15***). Significant correlations were also observed between BIBI scores and two PHI parameters, including Epifaunal Substrate ($p = 0.007$ and $R^2=0.3627$; ***Figure 16***) and Instream Habitat ($p = 0.006$ and $R^2=0.2994$; ***Figure 17***). Thus, despite the weak correlation between overall habitat and BIBI scores, the BIBI scores generally increased at sites with greater sinuosity, epifaunal substrate, and instream habitat.

The results of the *in-situ* water quality assessment indicate that two sites had high pH and six sites had high conductivity (***Tables 15 and 16***). All of these sites had Poor or Very Poor BIBI rankings. Other sites with low BIBI scores that were not linked to low aquatic habitat or water quality exceedences may also be affected by water quality, but by factors not measured in this assessment. Further investigations may be required to identify the sources of these biological impairments.

Table 12 – Integrated assessment results for the sites sampled in the Herring Bay watershed.

Site	Subwatershed code	Drainage Area (acres)	Percent Impervious	Percent Forest	Percent Agriculture	Percent Developed	BIBI Score	RBP Score	RBP Percent of Reference	PHI Score
HB-01-2013	HB0	121.21	3.11	39.05	34.28	17.26	1.00	107	63.69	67.12
HB-02-2013	HB0	243.60	0.82	42.68	31.13	7.24	1.86	120	71.43	71.27
HB-03-2013	HB1	2632.13	3.11	58.25	10.29	22.87	1.57	109	64.88	39.44
HB-04-2013	HB1	3548.83	3.00	57.98	10.18	23.16	1.86	153	91.07	72.72
HB-05-2013	HB2	1942.88	3.34	56.54	11.42	24.94	3.29	135	80.36	72.40
HB-06-2013	HB2	693.41	5.48	42.11	10.98	35.29	2.43	122	72.62	68.64
HB-07-2013	HB3	31.15	11.27	26.79	0.15	48.88	1.29	91	54.17	68.68
HB-09-2013	HB7	60.32	9.27	53.63	2.14	40.69	2.43	126	75.00	65.05
HB-10-2013	HB7	35.07	6.53	44.05	0.00	50.54	1.29	129	76.79	77.53
HB-12-2013	HB9	196.77	6.01	68.53	0.00	28.20	1.57	135	80.36	75.39
HB-13-2013	HB8	178.62	5.17	71.38	7.65	20.97	2.43	112	66.67	73.97
HB-14-2013	HB9	366.80	3.21	69.81	15.23	14.71	1.57	110	65.48	69.61
HB-19-2013	HBF	33.51	31.45	47.36	0.00	49.68	1.57	132	78.57	72.80
HB-20-2013	HBL	428.38	1.86	63.39	15.98	22.30	2.43	148	88.10	76.73
HB-21-2013	HBL	1135.18	2.16	62.12	9.00	22.90	2.43	143	85.12	84.14
HB-23-2013	HBO	105.70	3.68	61.75	0.00	22.85	3.00	134	79.76	81.13
HB-25-2013	HBQ	456.16	1.26	85.66	0.42	12.91	2.43	154	91.67	88.30
HB-31-2013	HB7	67.05	2.85	69.99	0.00	30.01	1.00	138	82.14	83.18
HB-36-2013	HB1	126.41	3.29	60.35	7.54	25.31	2.71	134	79.76	78.49
HB-41-2013	HBS	13.05	3.83	99.87	0.00	0.13	1.86	127	75.60	89.15
HB-47-2013	HBO	28.30	4.98	41.87	28.83	28.14	1.00	106	63.10	67.25
HB-48-2013	HBQ	9.59	3.23	76.96	0.00	23.04	1.57	104	61.90	74.25
HB-49-2013	HBC	156.81	11.60	47.57	0.00	52.43	2.14	98	58.33	58.37
HB-50-2013	HBS	10.60	6.22	36.49	3.31	60.21	2.14	131	77.98	84.40

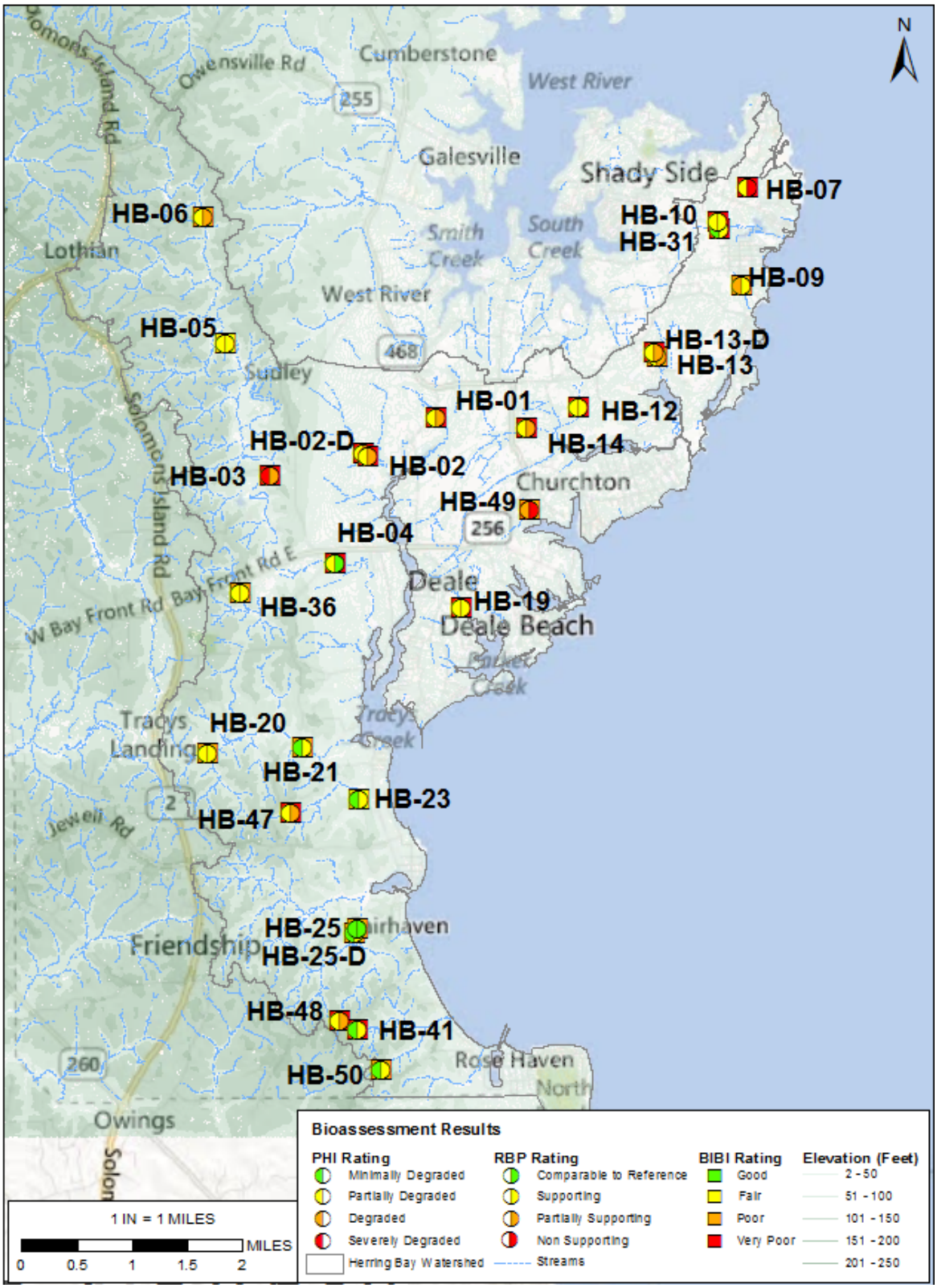

Figure 12 – Integrated assessment results map for Herring Bay watershed.

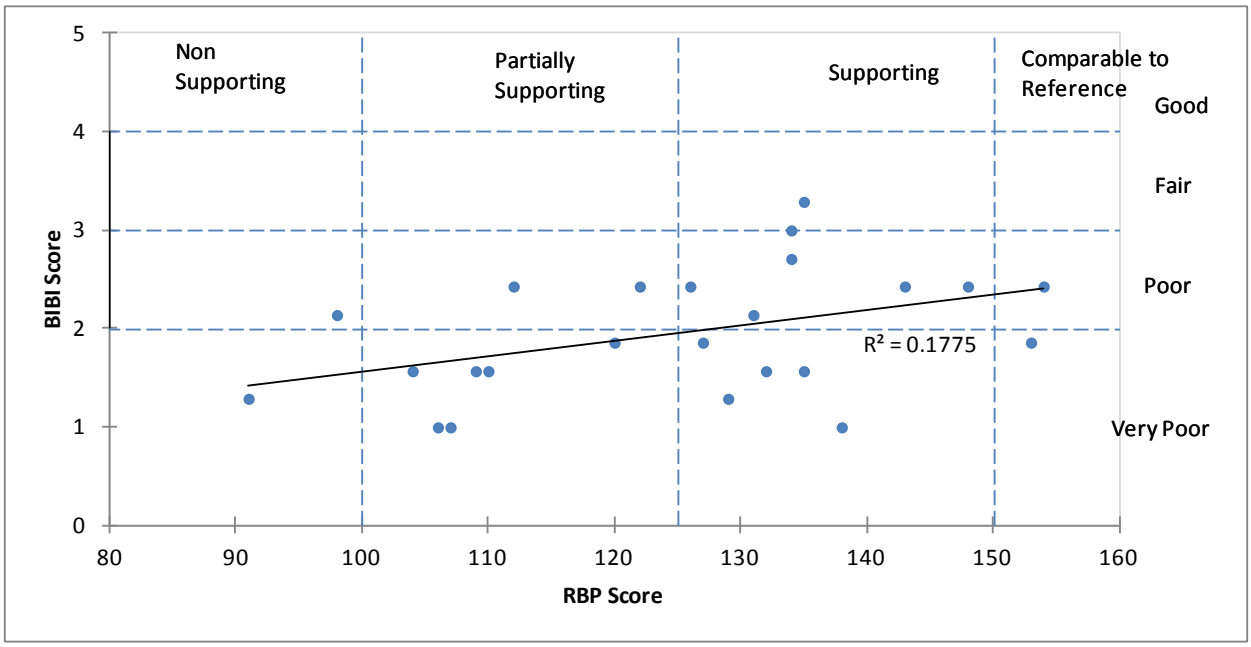

Figure 13 – Comparison of BIBI and RBP scores for the sites sampled in Herring Bay watershed.

Table 13 – Biological potential matrix comparing BIBI rankings to RBP for the sites sampled in the Herring Bay watershed.[1]

RBP Habitat Ranking	**BIBI Ranking**			
	Good	*Fair*	*Poor*	*Very Poor*
Comparable				**HB-04, HB-25**
Supporting		HB-05, HB-23	HB-09, HB-20, HB-21, HB-36, HB-50	**HB-10, HB-12, HB-19, HB-31, HB-41**
Partially Supporting			HB-06, HB-13	HB-01, HB-02, HB-03, HB-14, HB-47, HB-48
Non Supporting			HB-49	HB-07

[1] Cells shaded in blue contain sites where the BIBI was higher than habitat scores would predict (i.e., BIBI exceeded predicted habitat potential). Cells shaded in green contain sites where the BIBI matched the habitat conditions (i.e., BIBI reached predicted habitat potential). Cells shaded in gray contain sites where the BIBI was lower than the habitat scores would predict (i.e., BIBI did not reach predicted habitat potential). Sites in bold had a BIBI that differed by at least two categories from the expected corresponding habitat condition class.

***Table 14 – Biological potential matrix comparing BIBI rankings to PHI for the sites sampled in the Herring Bay watershed.*[1]**

PHI Habitat Ranking	BIBI Ranking			
	Good	*Fair*	*Poor*	*Very Poor*
Minimally Degraded		HB-23	**HB-21, HB-25, HB-50**	**HB-31, HB-41**
Partially Degraded		HB-05	HB-06, HB-13, HB-20, HB-36	**HB-01, HB-02, HB-04, HB-07, HB-10, HB-12, HB-14, HB-19, HB-47, HB-48**
Degraded			HB-09, HB-49	
Severely Degraded				HB-03

[1] *Cells shaded in blue contain sites where the BIBI was higher than habitat scores would predict (i.e., BIBI exceeded predicted habitat potential). Cells shaded in green contain sites where the BIBI matched the habitat conditions (i.e., BIBI reached predicted habitat potential). Cells shaded in gray contain sites where the BIBI was lower than the habitat scores would predict (i.e., BIBI did not reach predicted habitat potential). Sites in bold had a BIBI that differed by at least two categories from the expected corresponding habitat condition class.*

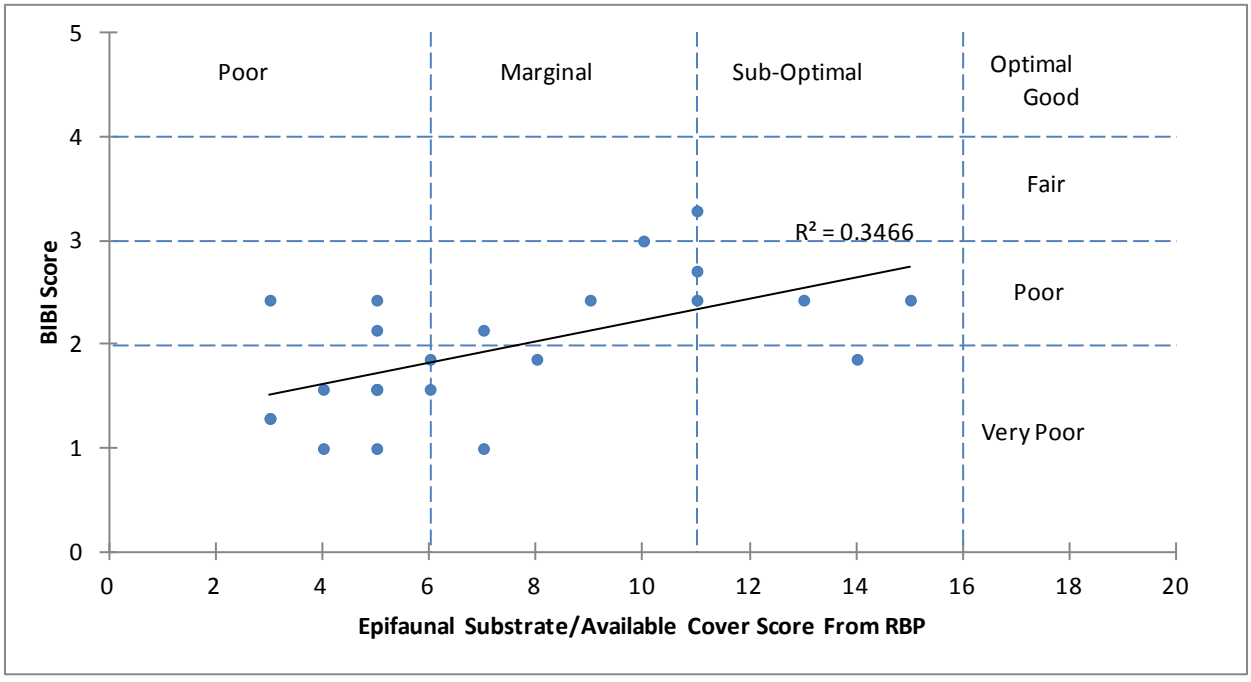

Figure 14 – Comparison of BIBI and Epifaunal Substrate/Available Cover RBP scores for the sites sampled in the Herring Bay watershed.

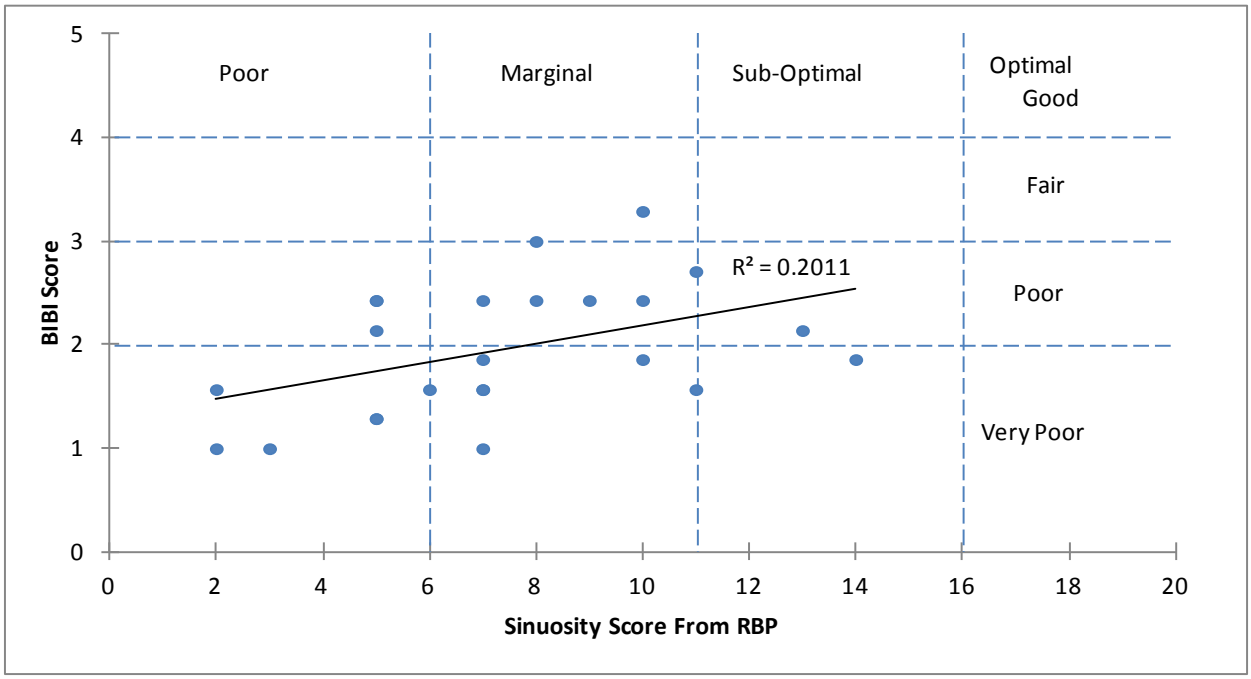

Figure 15 – Comparison of BIBI and Channel Sinuosity RBP scores for the sites sampled in the Herring Bay watershed.

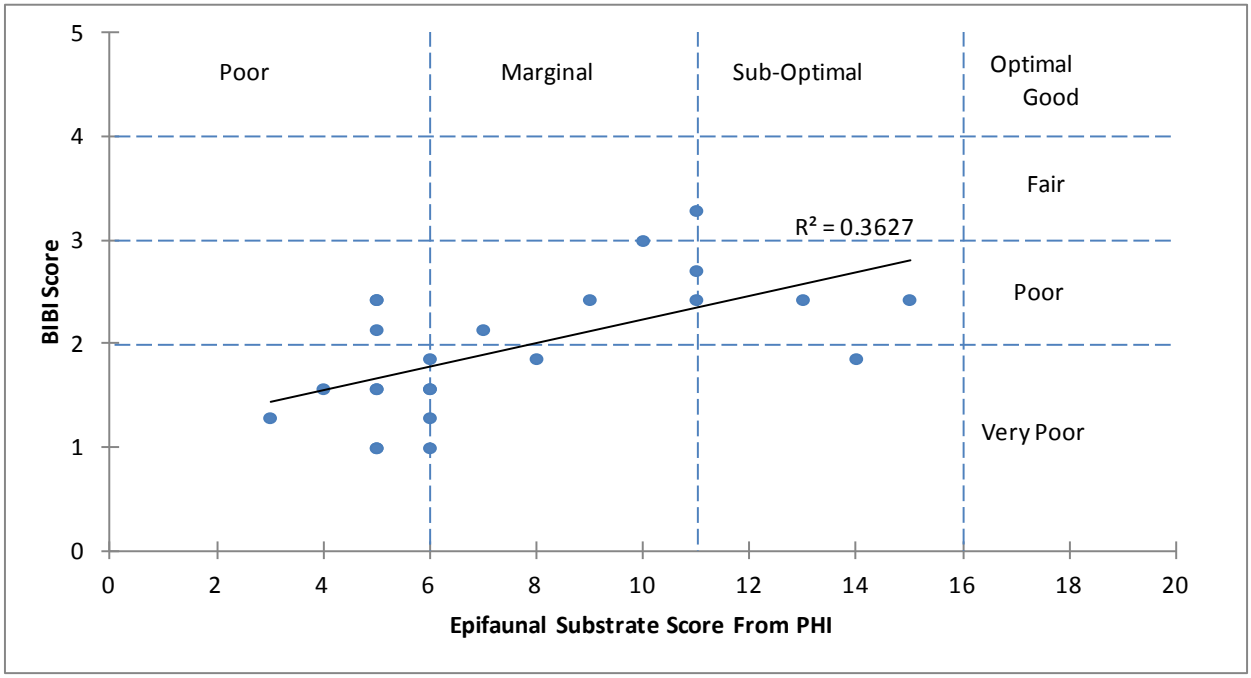

Figure 16 – Comparison of BIBI and Epifaunal Substrate scores from PHI for the sites sampled in the Herring Bay watershed.

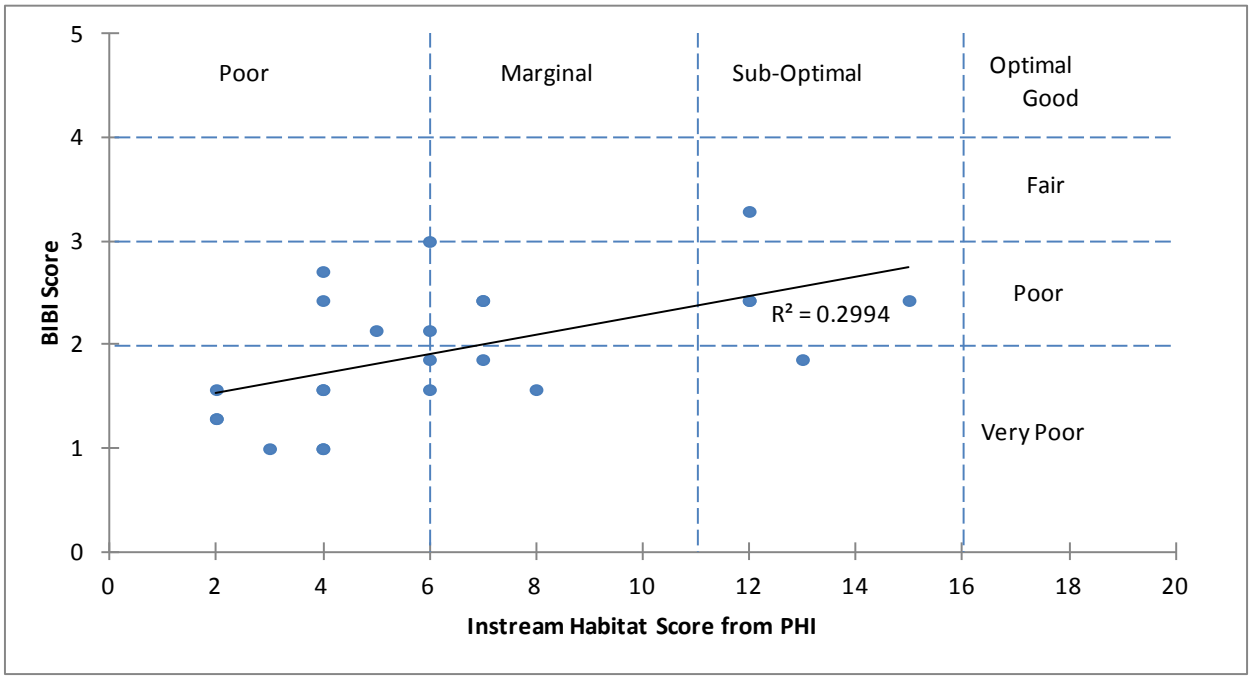

Figure 17 – Comparison of BIBI and Instream Habitat scores from PHI for the sites sampled in the Herring Bay watershed.

Table 15 – Water quality exceedences for the sites sampled in the Herring Bay watershed. Colors correspond with the comparison of BIBI and RBP from Table 13.[1]

Site	High pH (>8.5)	Low DO (5.0 mg/L)	Elevated Conductivity (>247 µg/cm)	No Threshold Exceedences
HB-49			X	
HB-05				X
HB-06	X			
HB-07				X
HB-13				X
HB-23				X
HB-01				X
HB-02				X
HB-03				X
HB-04				X
HB-09				X
HB-10				X
HB-12				X
HB-14				X
HB-19			X	
HB-20				X
HB-21	X			
HB-25				X
HB-31				
HB-36				X
HB-41			X	
HB-47			X	
HB-48			X	
HB-50			X	

[1]Sites in bold had BIBI scores that differed by at least two categories from the corresponding RBP habitat condition.

Table 16 – Water quality exceedences for the sites sampled in the Herring Bay watershed. Colors correspond with the comparison of BIBI and PHI from Table 14.[1]

Site	High pH (>8.5)	Low DO (5.0 mg/L)	Elevated Conductivity (>247 µg/cm)	No Threshold Exceedences
HB-03				X
HB-05				X
HB-09				X
HB-49			X	
HB-01				X
HB-02				X
HB-04				X
HB-06	X			
HB-07				X
HB-10				X
HB-12				X
HB-13				X
HB-14				X
HB-19			X	
HB-20				X
HB-21	X			
HB-23				X
HB-25				X
HB-31				X
HB-36				X
HB-41			X	
HB-47			X	
HB-48			X	
HB-50			X	

[1]Sites in bold had BIBI scores that differed by at least two categories from the corresponding PHI habitat condition.

Current land use and stream size did not seem to be a determining factor for the BIBI results. Generally, imperviousness was low throughout the watershed and didn't have an effect on BIBI scores. Most sites had impervious percentages that were well under 10%, which is generally considered the threshold for measurable impairment to benthic macroinvertebrate communities (Schueler, 1994). Furthermore, there was not a significant relationship between BIBI scores and percent developed, percent forested, percent agriculture, or watershed size. However, BIBI scores may have been affected by topography, which varied throughout the watershed. The western and southern portions of the watershed are generally characterized by higher gradient streams with deeper valleys. Many of the sites sampled in this portion of the watershed contained more suitable epifaunal substrate for benthic macroinvertebrates, which resulted in higher BIBI scores than sites in the eastern portion of the watershed. The eastern portion of the watershed is generally flatter, with lower gradient stream/wetland complexes that are closer to tidal elevations. Many of the sites on the eastern portion of the watershed lacked diverse instream features and gradient and had little flow. As a result, these streams had poor epifaunal substrate for benthic macroinvertebrates, which is reflected in the lower BIBI scores.

Furthermore, many of the sites appeared to have been ditched historically or may be exhibiting residual effects of past disturbances such as deforestation and agriculture. Much of the County has historically experienced deforestation and extensive alteration of the landscape from past agricultural practices that may have altered the function of these streams, which have not fully naturalized.

In conclusion, the benthic macroinvertebrate communities are degraded in many areas across the Herring Bay watershed, despite generally low overall physical habitat degradation. Our results showed significant correlations between the benthic macroinvertebrate community and several physical habitat parameters, including instream habitat, epifaunal substrate, and channel sinuosity. This suggests that these habitat parameters may be a limitation on the benthic macroinvertebrate community; however, the community may also be limited by other factors such as low flow conditions, differences in topography, past land use, and water quality.

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Appendix A:

Individual Site Summary Sheet

HB-01-2013 HB0 Subwatershed

Upstream View:

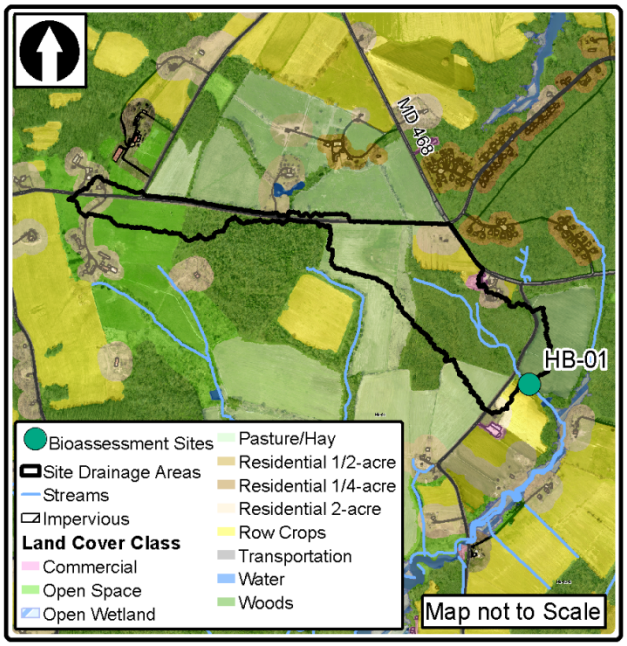
Downstream View:

(Latitude: 38.810560, **Longitude:** -76.551806**)**

Site HB-01-2013 is located south of Muddy Creek Road within the Rockhold Creek subwatershed. Primary land uses within this site's drainage area include forest and agriculture and imperviousness is approximately 3%. At the time of the benthic macroinvertebrate assessment, the stream flow at this site was very low and the lower end of the reach was backwatered, potentially due to a farm pond located downstream of the site. The stream in this area is very straight, probably from historic channelization for agriculture. Aquatic habitat is dominated by shallow runs and glides, and defined riffles and overall complex habitat for stream biota are lacking. This is likely an intermittent stream that functions more as a wetland swale during the growing season. The benthic macroinvertebrate community at this site was rated as Very Poor and was dominated by aquatic worms. No intolerant individuals and very few specialized feeding groups or habits were collected at this site. Low flow conditions, an intermittent water regime, and poor habitat complexity are likely affecting the biological community at this site.

Summary Results:

- Benthic macroinvertebrate community – "*Very Poor*"
- Habitat scores "*Partially Supporting"* and "*Partially Degraded*"
- Aquatic worms (Tubificidae) heavily dominated the community.
- *In-situ* water quality values met COMAR standards.
- This is an intermittent stream primarily consisting of shallow runs and glides, with no well defined riffles. Benthic and instream habitats are poor due to shallow and homogenous flow conditions.



HB-01-2013 HB0 Subwatershed

Biological Assessment

Raw Metric Values

Total Taxa	12
EPT Taxa	0
Ephemeroptera Taxa	0
Intolerant Urban %	2.22
Ephemeroptera %	0
Scraper Taxa	0
% Climbers	0

Calculated Metric Scores

Total Taxa	1
EPT Taxa	1
Ephemeroptera Taxa	1
Intolerant Urban %	1
Ephemeroptera %	1
Scraper Taxa	1
% Climbers	1
BIBI Score	**1.00**
BIBI Narrative Rating	**Very Poor**

Taxa	Count
ORTHOCLADIINAE	1
ORTHOCLADIUS	2
ZALUTSCHIA	2
CHRYSOPS	1
ERIOPTERA	1
ENCHYTRAEIDAE	7
LUMBRICINA	1
TUBIFICIDAE	65
SPHAERIIDAE	4
CRANGONYX	3
ASELLIDAE	2
TURBELLARIA	1
TOTAL:	**90**

In-situ Water Quality

pH (SU)	7.21
Temperature (°C)	3.5
Dissolved Oxygen (mg/L)	7.80
Specific Conductivity (µS/cm)	140.0
Turbidity (NTU)	30.1

Physical Habitat Assessment

EPA Rapid Bioassessment Protocol

Epifaunal Substrate/Available Cover	7	Bank Stability- Left Bank	9
Pool Substrate Characterization	7	Bank Stability- Right Bank	9
Pool Variability	3	Vegetative Protection - Left Bank	8
Sediment Deposition	18	Vegetative Protection - Right Bank	8
Channel Flow Status	17	Riparian Vegetative Zone Width- Left Bank	2
Channel Alteration	13	Riparian Vegetative Zone Width- Right Bank	3
Channel Sinuosity	3		
EPA Habitat Score			**107**
EPA Narrative Rating			**Partially Supporting**

MBSS Physical Habitat Index

	Value	Score		Value	Score
Instream Habitat	3	48.24	Shading	80	78.67
Epifaunal Substrate	5	54.00	Remoteness	5	26.93
Bank Stability	18	94.87	Woody Debris/Rootwads	12	100.00
PHI Score					**67.12**
PHI Narrative Rating					**Partially Degraded**

Land Use/Land Cover Analysis:

Total Drainage Area (acres) 121.21

Cover	Acres	%Area
Developed Land	**20.92**	**17.26**
Commercial	1.09	0.90
Industrial	0	0
Residential 1/8-acre	0	0
Residential 1/4-acre	0	0
Residential 1/2-acre	0	0
Residential 1-Acre	0	0
Residential 2-Acre	10.73	8.85
Transportation	9.10	7.51
Utility	0	0
Forest Land	**47.33**	**39.05**
Forested Wetland	0	0
Residential Woods	0	0
Woods	47.33	39.05
Open Land	**11.42**	**9.42**
Open Space	11.42	9.42
Open Wetland	0	0
Water	0	0
Agricultural Land	**41.55**	**34.28**
Pasture/Hay	34.87	28.77
Row Crops	6.68	5.51

Impervious Surface	Acres	% Area
Impervious Land	3.77	3.11

HB-02-2013 HB0 Subwatershed

Upstream View:

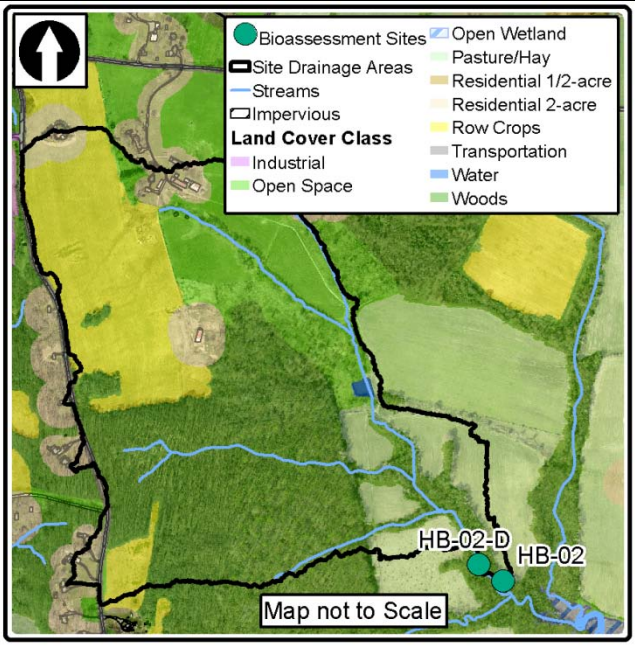
Downstream View:

(Latitude: 38.805556, **Longitude:** -76.563333)

Site HB-02-2013 is located west of a newly planted reforestation area within the Rockhold Creek subwatershed. Forest and agriculture are the primary land uses comprising the site's drainage area and imperviousness is less than 1%. At the time of sampling, the stream channel was relatively shallow but had a moderate diversity of velocities including some fast flowing areas. A few shallow pools and riffles are present, but the segment consists mainly of long run/glide complexes. The benthic macroinvertebrate community at this site was rated Very Poor and dominated by black fly larvae (*Stegopterna)*. Although 92% of the individuals were intolerant to urban stressors, a lack of Ephemeroptera taxa and poor taxa diversity resulted in a low biological score. Low amounts of favorable and stable substrates for benthic macroinvertebrates are likely affecting the biological community at this site.

Summary Results:

- Benthic macroinvertebrate community – "*Very Poor"*
- Habitat scores *"Partially Supporting"* and "*Partially Degraded"*
- Black flies (*Stegopterna*) heavily dominated the community.
- *In-situ* water quality values met COMAR standards.
- This channel is shallow and incised with a few small pools and marginal velocity depth diversity. Rootwads and woody debris are present, but in small amounts. The banks are raw and eroded, but have optimal riparian width.



HB-02-2013 HB0 Subwatershed

Biological Assessment

Raw Metric Values

Total Taxa	9
EPT Taxa	2
Ephemeroptera Taxa	0
Intolerant Urban %	92
Ephemeroptera %	0
Scraper Taxa	0
% Climbers	0

Calculated Metric Scores

Total Taxa	1
EPT Taxa	3
Ephemeroptera Taxa	1
Intolerant Urban %	5
Ephemeroptera %	1
Scraper Taxa	1
% Climbers	1
BIBI Score	**1.86**
BIBI Narrative Rating	**Very Poor**

Taxa	**Count**
Nemouridae	2
Ironoquia	1
Diplocladius	2
Orthocladiinae	1
Tvetenia	1
Prosimulium	1
Stegopterna	94
Tubificidae	1
Synurella	1
Asellidae	2
TOTAL:	**106**

In-situ Water Quality

pH (SU)	7.70
Temperature (°C)	5.0
Dissolved Oxygen (mg/L)	12.17
Specific Conductivity (µS/cm)	108.3
Turbidity (NTU)	8.8

Physical Habitat Assessment

EPA Rapid Bioassessment Protocol

Epifaunal Substrate/Available Cover	8	Bank Stability- Left Bank	1
Pool Substrate Characterization	12	Bank Stability- Right Bank	2
Pool Variability	5	Vegetative Protection - Left Bank	5
Sediment Deposition	17	Vegetative Protection - Right Bank	6
Channel Flow Status	17	Riparian Vegetative Zone Width- Left Bank	9
Channel Alteration	18	Riparian Vegetative Zone Width- Right Bank	10
Channel Sinuosity	10		
EPA Habitat Score			**120**
EPA Narrative Rating			**Partially Supporting**

MBSS Physical Habitat Index

	Value	Score		Value	Score
Instream Habitat	7	63.29	Shading	85	84.56
Epifaunal Substrate	8	66.89	Remoteness	18	96.93
Bank Stability	3	38.73	Woody Debris/Rootwads	6	77.25
PHI Score					**71.27**
PHI Narrative Rating					**Partially Degraded**

Land Use/Land Cover Analysis:

Total Drainage Area (acres) 243.60

Cover	**Acres**	**%Area**
Developed Land	**17.64**	**7.24**
Commercial	0	0
Industrial	0	0
Residential 1/8-acre	0	0
Residential 1/4-acre	0	0
Residential 1/2-acre	0	0
Residential 1-Acre	0	0
Residential 2-Acre	15.48	6.35
Transportation	2.16	0.89
Utility	0	0
Forest Land	**103.96**	**42.68**
Forested Wetland	0	0
Residential Woods	0	0
Woods	103.96	42.68
Open Land	**46.16**	**18.95**
Open Space	45.55	18.70
Open Wetland	0	0
Water	0.61	0.25
Agricultural Land	**75.84**	**31.13**
Pasture/Hay	22.47	9.22
Row Crops	53.37	21.91

Impervious Surface	**Acres**	**% Area**
Impervious Land	2.00	0.82

HB-02-Dup-2013 HB0 Subwatershed

Upstream View:

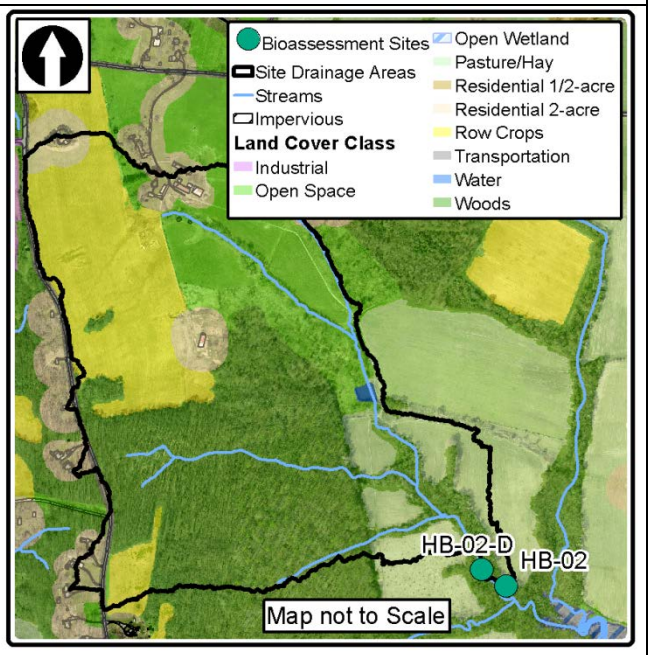
Downstream View:

(Latitude: 38.805955, **Longitude:** -76.564078**)**

Site HB-02-Dup-2013 is located immediately upstream of site HB-02-2013 within the Rockhold Creek subwatershed. Instream features consist mostly of long run/glide complexes, but a few shallow pools and riffles are present. The majority of stable benthic macroinvertebrate habitat consists of instream rootwads and woody debris as well as a few riffles covered in filamentous algae. Both banks are moderately unstable with long patches of erosion. The benthic macroinvertebrate community at this site was rated Very Poor and was dominated by black fly larvae (*Stegopterna).* Although 93% of the individuals were intolerant to urban stressors, specialized feeding groups and Ephemeroptera taxa were absent which contributed to the low biological score. Forest and agriculture are the primary land uses comprising the site's drainage area and imperviousness is less than 1%.

Summary Results:

- Benthic macroinvertebrate community – *"Very Poor"*
- Habitat scores *"Partially Supporting"* and *"Partially Degraded"*
- Black flies (*Stegopterna*) heavily dominated the community.
- *In-situ* water quality values met COMAR standards.
- This site has a shallow incised channel with moderate flow and optimal riparian vegetative width. Instream rootwads and woody debris are present in moderate amounts providing the majority of stable habitat for the benthic macroinvertebrate community. Both banks are moderately unstable.



HB-02-Dup-2013 HB Subwatershed

Biological Assessment

Raw Metric Values

Total Taxa	7
EPT Taxa	1
Ephemeroptera Taxa	0
Intolerant Urban %	93
Ephemeroptera %	0
Scraper Taxa	0
% Climbers	0

Calculated Metric Scores

Total Taxa	1
EPT Taxa	1
Ephemeroptera Taxa	1
Intolerant Urban %	5
Ephemeroptera %	1
Scraper Taxa	1
% Climbers	1
BIBI Score	**1.57**
BIBI Narrative Rating	**Very Poor**

Taxa	**Count**
Nemouridae	1
Diplocladius	4
Diptera	1
Stegopterna	96
Enchytraeidae	1
Tubificidae	1
Synurella	1
Prosimulium	2
TOTAL:	**107**

In-situ Water Quality

pH (SU)	7.72
Temperature (°C)	6.3
Dissolved Oxygen (mg/L)	12.20
Specific Conductivity (µS/cm)	108.0
Turbidity (NTU)	8.0

Physical Habitat Assessment

EPA Rapid Bioassessment Protocol

Epifaunal Substrate/Available Cover	9	Bank Stability- Left Bank	6
Pool Substrate Characterization	11	Bank Stability- Right Bank	3
Pool Variability	3	Vegetative Protection - Left Bank	8
Sediment Deposition	16	Vegetative Protection - Right Bank	6
Channel Flow Status	16	Riparian Vegetative Zone Width- Left Bank	9
Channel Alteration	18	Riparian Vegetative Zone Width- Right Bank	10
Channel Sinuosity	9		
EPA Habitat Score			**124**
EPA Narrative Rating			**Partially Supporting**

MBSS Physical Habitat Index

	Value	Score		Value	Score
Instream Habitat	6	57.77	Shading	85	84.56
Epifaunal Substrate	9	72.72	Remoteness	18	96.93
Bank Stability	9	67.08	Woody Debris/Rootwads	17	100.00
PHI Score					**79.84**
PHI Narrative Rating					**Partially Degraded**

Land Use/Land Cover Analysis:

Total Drainage Area (acres) 242.76

Cover	**Acres**	**%Area**
Developed Land	**17.64**	**7.27**
Commercial	0	0
Industrial	0	0
Residential 1/8-acre	0	0
Residential 1/4-acre	0	0
Residential 1/2-acre	0	0
Residential 1-Acre	0	0
Residential 2-Acre	15.48	6.38
Transportation	2.16	0.89
Utility	0	0
Forest Land	**103.52**	**42.64**
Forested Wetland	0	0
Residential Woods	0	0
Woods	103.52	42.64
Open Land	**46.16**	**19.02**
Open Space	45.55	18.76
Open Wetland	0	0
Water	0.61	0.25
Agricultural Land	**75.44**	**31.07**
Pasture/Hay	22.07	9.09
Row Crops	53.37	21.98

Impervious Surface	**Acres**	**% Area**
Impervious Land	2.00	0.82

HB-03-2013 HB1 Subwatershed

Upstream View:

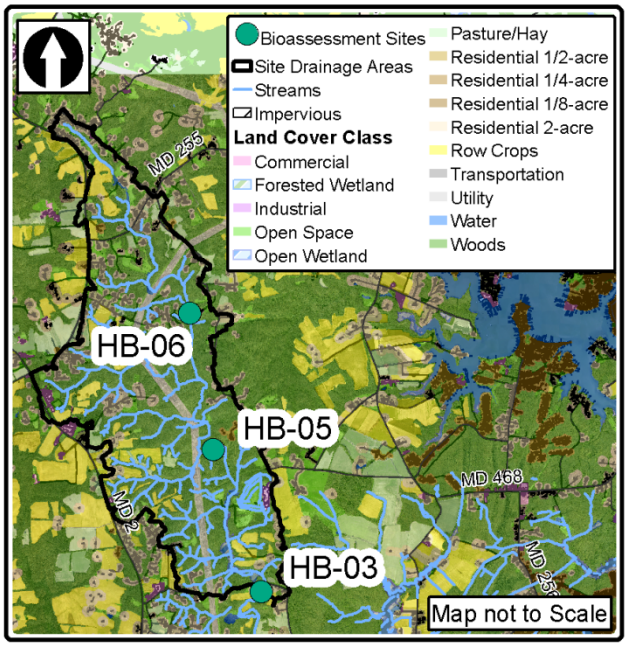
Downstream View:

(Latitude: 38.803045, **Longitude:** -76.579752**)**

Site HB-03-2013 is located downstream (south) of Nutwell Road on Tracy's Creek within the Tracy's Creek I subwatershed. A large beaver pond is located directly upstream of Nutwell Road approximately 300 meters from this site. Of the 2,632 acre drainage area, more than 50% is forested land and almost 25% is developed. This is the second largest drainage area sampled within the Herring Bay Watershed and only 3% consists of impervious surfaces. The entirety of this site runs within a pasture, and a forested riparian buffer is completely lacking. Instream features at this site are dominated by runs and glides. Riffles, pools, and instream rootwads and woody debris are uncommon. The stream substrate is comprised of silt and clay and at the time of sampling, filamentous algae covered the channel. About 20% of the individuals collected at this site were intolerant to urban stressors, but an absence of scrapers, climbers, and Ephemeroptera taxa resulted in a Very Poor score for the biological community.

Summary Results

- Benthic macroinvertebrate community – *"Very Poor"*
- Habitat scores *"Partially Supporting"* and *"Severely Degraded"*
- Black flies (*Simulium*) and midges (*Orthocladius*) heavily dominated the community.
- *In-situ* water quality values met COMAR standards.
- Stream runs through pasture with minimal riparian width. Velocity depth diversity is optimal with fast flowing areas present, but overall habitat is lacking. High amounts of filamentous algae are present covering the entire channel.



HB-03-2013 HB1 Subwatershed

Biological Assessment

Raw Metric Values

Total Taxa	11
EPT Taxa	2
Ephemeroptera Taxa	0
Intolerant Urban %	19
Ephemeroptera %	0
Scraper Taxa	0
% Climbers	0

Calculated Metric Scores

Total Taxa	1
EPT Taxa	3
Ephemeroptera Taxa	1
Intolerant Urban %	3
Ephemeroptera %	1
Scraper Taxa	1
% Climbers	1
BIBI Score	**1.57**
BIBI Narrative Rating	**Very Poor**

Taxa	**Count**
Isoperla	1
Perlesta	3
Diplocladius	9
Orthocladiinae	1
Orthocladius	17
Prosimulium	4
Simulium	50
Stegopterna	9
Naididae	1
Tubificidae	1
Cambaridae	2
Asellidae	1
TOTAL:	**99**

In-situ Water Quality

pH (SU)	6.85
Temperature (°C)	9.8
Dissolved Oxygen (mg/L)	12.98
Specific Conductivity (µS/cm)	182.3
Turbidity (NTU)	8.3

Physical Habitat Assessment

EPA Rapid Bioassessment Protocol

Epifaunal Substrate/Available Cover	5	Bank Stability- Left Bank	8
Pool Substrate Characterization	13	Bank Stability- Right Bank	4
Pool Variability	7	Vegetative Protection - Left Bank	3
Sediment Deposition	18	Vegetative Protection - Right Bank	4
Channel Flow Status	18	Riparian Vegetative Zone Width- Left Bank	1
Channel Alteration	19	Riparian Vegetative Zone Width- Right Bank	2
Channel Sinuosity	7		
EPA Habitat Score			**109**
EPA Narrative Rating			**Partially Supporting**

MBSS Physical Habitat Index

	Value	Score		Value	Score
Instream Habitat	8	44.48	Shading	15	15.33
Epifaunal Substrate	5	33.95	Remoteness	5	26.93
Bank Stability	12	77.46	Woody Debris/Rootwads	2	38.47
PHI Score					**39.44**
PHI Narrative Rating					**Severely Degraded**

Land Use/Land Cover Analysis:

Total Drainage Area (acres) 2632.14

Cover	**Acres**	**%Area**
Developed Land	**601.95**	**22.87**
Commercial	15.60	0.59
Industrial	8.74	0.33
Residential 1/8-acre	0	0
Residential 1/4-acre	0	0
Residential 1/2-acre	17.00	0.65
Residential 1-Acre	31.24	1.19
Residential 2-Acre	365.43	13.88
Transportation	36.06	1.37
Utility	127.88	4.86
Forest Land	**1533.30**	**58.25**
Forested Wetland	5.98	0.23
Residential Woods	0	0
Woods	1527.32	58.03
Open Land	**225.98**	**8.59**
Open Space	195.82	7.44
Open Wetland	19.65	0.75
Water	10.51	0.40
Agricultural Land	**270.91**	**10.29**
Pasture/Hay	61.13	2.32
Row Crops	209.77	7.97

Impervious Surface	**Acres**	**% Area**
Impervious Land	81.83	3.11

HB-04-2013 HB1 Subwatershed

Upstream View:

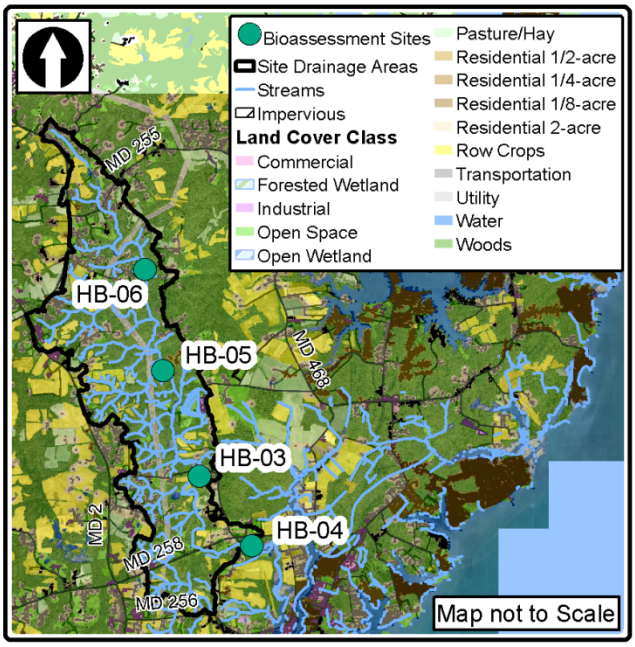
Downstream View:

(Latitude: 38.79153, **Longitude:** -76.568821**)**

Site HB-04-2013 is located upstream of Franklin Gibson Road on Tracy's Creek within the Tracy's Creek I subwatershed. Beaver activity is present in the floodplain and is affecting the stream within the vicinity of the site. The area was once completely flooded, resulting in numerous dead trees on both banks. The site is close to the upper reaches of tidal influence. Of the 3,549 acre drainage area, 50% is forested land and almost 25% is developed. This is the largest drainage area sampled within the Herring Bay Watershed and only 3% of the drainage consists of impervious surfaces. A few deep pools with moderate cover are present, but aquatic habitat consists primarily of instream woody debris. Run/glide complexes are the dominant instream features and the substrate is predominately comprised of silt and clay. Although the habitat is Comparable to Reference/Partially Degraded, moderately low taxa diversity with no Ephemeroptera or scraper taxa, and a low percentage of individuals intolerant to urban stressors resulted in a Very Poor biological community.

Summary Results:

- Benthic macroinvertebrate community – *"Very Poor"*
- Habitat scores *"Comparable to Reference"* and *"Partially Degraded"*
- Midges (*Orthocladius*) dominated the community.
- *In-situ* water quality values met COMAR standards.
- This is a wide fast flowing channel with optimal riparian width. Banks are stable with very little evidence of erosion. There is an abundance of submerged woody debris along with optimal velocity depth diversity and pool/glide/eddy quality.



HB-04-2013 HB1 Subwatershed

Biological Assessment

Raw Metric Values

Total Taxa	13
EPT Taxa	1
Ephemeroptera Taxa	0
Intolerant Urban %	14
Ephemeroptera %	0
Scraper Taxa	0
% Climbers	1.2

Calculated Metric Scores

Total Taxa	1
EPT Taxa	1
Ephemeroptera Taxa	1
Intolerant Urban %	3
Ephemeroptera %	1
Scraper Taxa	3
% Climbers	3
BIBI Score	**1.86**
BIBI Narrative Rating	**Very Poor**

Taxa	**Count**
Isoperla	2
Tropisternus	1
Diplocladius	10
Hydrobaenus	2
Orthocladius	43
Ceratopogoninae	1
Lumbriculidae	1
Naididae	1
Tubificidae	3
Crangonyctidae	1
Crangonyx	3
Cambaridae	5
Asellidae	4
Caecidotea	3
Dasyhelea	1
TOTAL:	**81**

In-situ Water Quality

pH (SU)	6.55
Temperature (°C)	7.1
Dissolved Oxygen (mg/L)	15.34
Specific Conductivity (µS/cm)	180.3
Turbidity (NTU)	12.8

Physical Habitat Assessment

EPA Rapid Bioassessment Protocol

Epifaunal Substrate/Available Cover	14	Bank Stability- Left Bank	10
Pool Substrate Characterization	14	Bank Stability- Right Bank	10
Pool Variability	9	Vegetative Protection - Left Bank	6
Sediment Deposition	18	Vegetative Protection - Right Bank	8
Channel Flow Status	18	Riparian Vegetative Zone Width- Left Bank	10
Channel Alteration	19	Riparian Vegetative Zone Width- Right Bank	10
Channel Sinuosity	7		
EPA Habitat Score			**153**
EPA Narrative Rating			**Comparable to Reference**

MBSS Physical Habitat Index

	Value	Score		Value	Score
Instream Habitat	13	69.16	Shading	35	36.34
Epifaunal Substrate	14	84.29	Remoteness	13	70.01
Bank Stability	20	100.00	Woody Debris/Rootwads	16	76.50
PHI Score					**72.72**
PHI Narrative Rating					**Partially Degraded**

Land Use/Land Cover Analysis:

Total Drainage Area (acres) 3548.85

Cover	**Acres**	**%Area**
Developed Land	**821.93**	**23.16**
Commercial	25.80	0.73
Industrial	8.74	0.25
Residential 1/8-acre	0	0
Residential 1/4-acre	0	0
Residential 1/2-acre	17.00	0.48
Residential 1-Acre	74.55	2.10
Residential 2-Acre	470.44	13.26
Transportation	54.72	1.54
Utility	170.67	4.81
Forest Land	**2057.56**	**57.98**
Forested Wetland	5.98	0.17
Residential Woods	0	0
Woods	2051.58	57.81
Open Land	**307.92**	**8.68**
Open Space	268.28	7.56
Open Wetland	21.37	0.60
Water	13.26	0.51
Agricultural Land	**361.44**	**10.18**
Pasture/Hay	88.39	2.49
Row Crops	273.05	7.69

Impervious Surface	**Acres**	**% Area**
Impervious Land	106.44	3.00

HB-05-2013 HB2 Subwatershed

Upstream View:

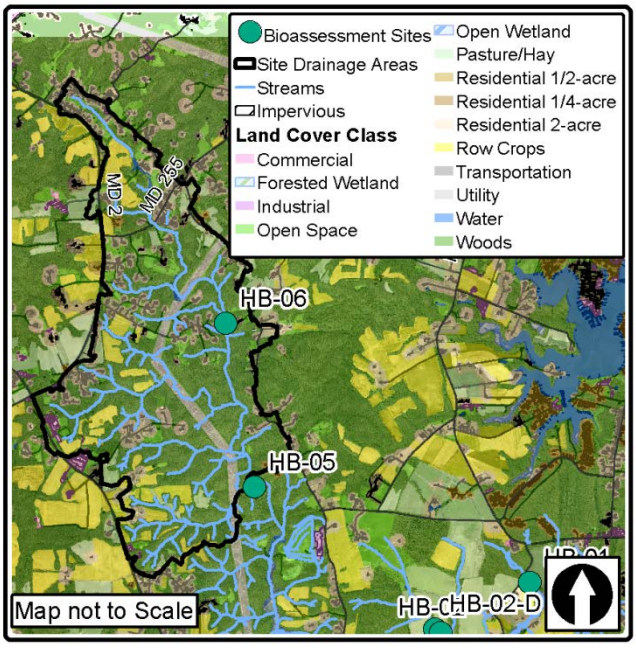
Downstream View:

(Latitude: 38.820346, **Longitude:** -76.587253**)**

Site HB-05-2013 is located west of Sudley Road, on Tracy's Creek in a large stream valley, within the Tracy's Creek II subwatershed. Forest and development are the primary land uses comprising this site's drainage area and imperviousness is just over 3%. The reach is comprised mainly of shallow runs and glides, but a few shallow pools and sandy riffles are present. A large woody debris jam is located in a deep pool in the middle of the reach, creating suboptimal habitat. The benthic macroinvertebrate community at this site was rated as Fair and was dominated by stoneflies (*Isoperla*). Over 50% of the total indviduals collected were considered intolerant to urban stressors. The benthic community also had relatively high taxa and EPT diversity. This could be attributed to the diverse stable habitat substrates and diversity of flows.

Summary Results:

- Benthic macroinvertebrate community – *"Fair"*
- Habitat scores *"Supporting"* and *"Partially Degraded"*
- Stoneflies (*Isoperla*) dominated the community.
- *In-situ* water quality values met COMAR standards.
- Instream rootwads and woody debris provide the majority of stable substrates. The bottom of the channel is sandy and comprised of a few sandy/gravel riffles. The right bank is unstable but has a good riparian width.



HB-05-2013 HB2 Subwatershed

Biological Assessment

Raw Metric Values

Total Taxa	15
EPT Taxa	4
Ephemeroptera Taxa	1
Intolerant Urban %	52
Ephemeroptera %	2.4
Scraper Taxa	1
% Climbers	2.4

Calculated Metric Scores

Total Taxa	3
EPT Taxa	3
Ephemeroptera Taxa	3
Intolerant Urban %	5
Ephemeroptera %	3
Scraper Taxa	3
% Climbers	3
BIBI Score	**3.29**
BIBI Narrative Rating	**Fair**

Taxa	Count
Ameletus	2
Isoperla	34
Nemouridae	1
Ironoquia	1
Agabus	1
Diplocladius	4
Hydrobaenus	8
Orthocladiinae	2
Orthocladius	19
Rheocricotopus	1
Erioptera	1
Stegopterna	5
Tipula	1
Tubificidae	1
Synurella	1
Stygobromus	1
TOTAL:	**83**

In-situ Water Quality

pH (SU)	7.12
Temperature (°C)	9.3
Dissolved Oxygen (mg/L)	13.36
Specific Conductivity (µS/cm)	178.7
Turbidity (NTU)	9.3

Physical Habitat Assessment

EPA Rapid Bioassessment Protocol

Epifaunal Substrate/Available Cover	11	Bank Stability- Left Bank	6
Pool Substrate Characterization	15	Bank Stability- Right Bank	2
Pool Variability	9	Vegetative Protection - Left Bank	8
Sediment Deposition	18	Vegetative Protection - Right Bank	4
Channel Flow Status	18	Riparian Vegetative Zone Width- Left Bank	6
Channel Alteration	19	Riparian Vegetative Zone Width- Right Bank	9
Channel Sinuosity	10		
EPA Habitat Score			**135**
EPA Narrative Rating			**Supporting**

MBSS Physical Habitat Index

	Value	Score		Value	Score
Instream Habitat	12	69.78	Shading	85	84.56
Epifaunal Substrate	11	70.79	Remoteness	10	53.85
Bank Stability	8	63.25	Woody Debris/Rootwads	19	92.20
PHI Score					**72.40**
PHI Narrative Rating					**Partially Degraded**

Land Use/Land Cover Analysis:

Total Drainage Area (acres) 1942.88

Cover	Acres	%Area
Developed Land	**484.58**	**24.94**
Commercial	15.6	0.80
Industrial	0	0
Residential 1/8-acre	0	0
Residential 1/4-acre	0	0
Residential 1/2-acre	11.31	0.58
Residential 1-Acre	26.51	1.36
Residential 2-Acre	315.40	16.23
Transportation	25.08	1.29
Utility	90.67	4.67
Forest Land	**1098.51**	**56.54**
Forested Wetland	0	0
Residential Woods	0	0
Woods	1098.51	56.54
Open Land	**137.87**	**7.10**
Open Space	130.10	6.70
Open Wetland	0	0
Water	7.77	0.40
Agricultural Land	**221.92**	**11.42**
Pasture/Hay	59.64	3.07
Row Crops	162.28	8.35

Impervious Surface	Acres	% Area
Impervious Land	64.86	3.34

HB-06-2013 HB2 Subwatershed

Upstream View:

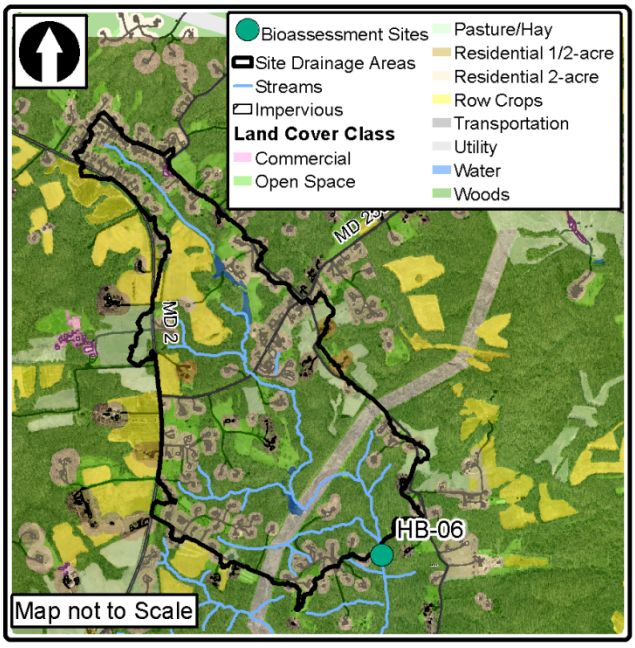
Downstream View:

(Latitude: 38.836932, **Longitude:** -76.590875**)**

Site HB-06-2013 is located west of Sudley Road within the Tracy's Creek II subwatershed. Of the 693 acre drainage area, 42% is forested land and 35% is developed land, with impervious surfaces accounting for almost 7%. The stream is relatively straight and deeply incised due to past land use, but some eroded areas are healing over. Erosion is severe in some areas, but there is a well developed riparian buffer. The stream bottom consists mostly of clay and sand with some gravel. Instream features are primarily riffle run complexes with small shallow pools. The biological community had moderate taxa diversity and a high percentage of individuals intolerant to urban stressors. However, the benthic macroinvertebrate community lacked Ephemeroptera taxa and climbers, which contributed to the Poor score. The pH reading was out of compliance with COMAR standards at 8.72, exceeding the one time standard of 8.5.

Summary Results:

- Benthic macroinvertebrate community – "Poor"
- Habitat scores *"Partially Supporting"* and *"Partially Degraded"*
- Midges (*Ortholadius*) and black flies (*Stegopterna*) dominated the community.
- Was out of compliance with COMAR standards for pH.
- The channel at this site is relatively straight and deeply incised. Some areas are highly eroded but there is optimal vegetative protection and riparian width. A good mix of aquatic habitats and velocities are present at this site.



HB-06-2013 HB2 Subwatershed

Biological Assessment

Raw Metric Values

Total Taxa	17
EPT Taxa	3
Ephemeroptera Taxa	0
Intolerant Urban %	39
Ephemeroptera %	0
Scraper Taxa	1
% Climbers	0

Calculated Metric Scores

Total Taxa	3
EPT Taxa	3
Ephemeroptera Taxa	1
Intolerant Urban %	5
Ephemeroptera %	1
Scraper Taxa	3
% Climbers	1
BIBI Score	**2.43**
BIBI Narrative Rating	**Poor**

Taxa	Count
Amphinemura	3
Isoperla	3
Nemouridae	1
Ironoquia	3
Diplocladius	5
Hydrobaenus	3
Orthocladius	32
Pseudorthocladius	1
Rheocricotopus	3
Chrysops	1
Erioptera	1
Stegopterna	26
Tipula	1
Enchytraeidae	3
Tubificidae	3
Stygobromus	1
Caecidotea	3
Nemata	2
TOTAL:	**95**

In-situ Water Quality

pH (SU)	8.72
Temperature (°C)	10.2
Dissolved Oxygen (mg/L)	15.66
Specific Conductivity (µS/cm)	216.7
Turbidity (NTU)	9.7

Physical Habitat Assessment

EPA Rapid Bioassessment Protocol

Epifaunal Substrate/Available Cover	9	Bank Stability- Left Bank	4
Pool Substrate Characterization	7	Bank Stability- Right Bank	2
Pool Variability	6	Vegetative Protection - Left Bank	9
Sediment Deposition	15	Vegetative Protection - Right Bank	9
Channel Flow Status	14	Riparian Vegetative Zone Width- Left Bank	10
Channel Alteration	19	Riparian Vegetative Zone Width- Right Bank	10
Channel Sinuosity	8		
EPA Habitat Score			**122**
EPA Narrative Rating			**Partially Supporting**

MBSS Physical Habitat Index

	Value	Score		Value	Score
Instream Habitat	7	52.58	Shading	90	91.34
Epifaunal Substrate	9	65.88	Remoteness	13	70.01
Bank Stability	6	54.77	Woody Debris/Rootwads	10	77.24
PHI Score					**68.64**
PHI Narrative Rating					**Partially Degraded**

Land Use/Land Cover Analysis:

Total Drainage Area (acres) 693.42

Cover	Acres	%Area
Developed Land	**244.72**	**35.29**
Commercial	1.09	0.16
Industrial	0	0
Residential 1/8-acre	0	0
Residential 1/4-acre	0	0
Residential 1/2-acre	6.05	0.87
Residential 1-Acre	14.94	2.15
Residential 2-Acre	177.88	25.65
Transportation	16.73	2.41
Utility	28.03	4.04
Forest Land	**292.02**	**42.11**
Forested Wetland	0	0
Residential Woods	0	0
Woods	292.02	42.11
Open Land	**80.51**	**11.61**
Open Space	72.74	10.49
Open Wetland	0	0
Water	7.77	1.12
Agricultural Land	**76.17**	**10.98**
Pasture/Hay	30.08	4.34
Row Crops	46.09	6.65

Impervious Surface	Acres	% Area
Impervious Land	37.98	5.48

HB-07-2013 HB3 Subwatershed

Upstream View:

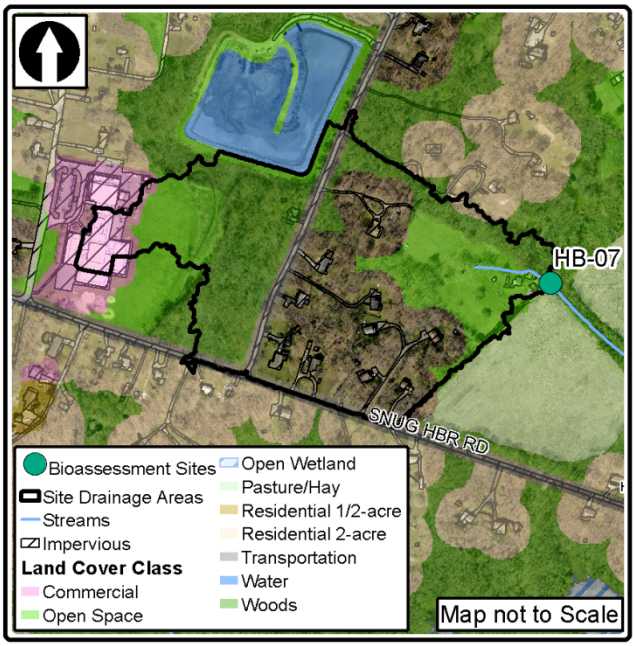
Downstream View:

(Latitude: 38.840513, **Longitude:** -76.499293**)**

Site HB-07-2013 is located on farm property east of Kay Road on Jack Creek, within the Jack Creek subwatershed. The channel has been straightened and is comprised mainly of shallow run/glide complexes. Submerged vegetation and leaf packs provide the primary habitat for benthic macroinvertebrates. Instream rootwads, woody debris, and pools are almost completely absent. Bank stability is optimal but farm structures and equipment are very close to the stream, greatly impacting the riparian zone on the right bank. The benthic macroinvertebrate community at this site was rated as Very Poor and was dominated by aquatic worms (Tubificidae). Taxa diversity was the lowest out of any site sampled. Seven taxa were collected, which included no EPT taxa. The Very Poor rating can be attributed to these factors and are likely due to low flow conditions and a lack of stable habitat. Of the 31 acre drainage area, 49% is developed, 27% is forested, and the remaining 24% is open land. Impervious surfaces make up approximately 11% of this sites drainage area.

Summary Results:

- Benthic macroinvertebrate community – *"Very Poor"*
- Habitat scores *"Non Supporting"* and *"Partially Degraded"*
- Aquatic worms (Tubificidae) heavily dominated the community.
- *In-situ* water quality values met COMAR standards.
- This is a small ditched channel that runs through an inactive pasture. The channel has very low flows. Habitat complexity is poor, consisting mainly of shallow run/glide complexes. Refuse is present in moderate amounts, and the riparian zone is moderately impacted on one bank.



HB-07-2013 HB3 Subwatershed

Biological Assessment

Raw Metric Values

Total Taxa	7
EPT Taxa	0
Ephemeroptera Taxa	0
Intolerant Urban %	2
Ephemeroptera %	0
Scraper Taxa	0
% Climbers	2

Calculated Metric Scores

Total Taxa	1
EPT Taxa	1
Ephemeroptera Taxa	1
Intolerant Urban %	1
Ephemeroptera %	1
Scraper Taxa	1
% Climbers	3
BIBI Score	**1.29**
BIBI Narrative Rating	**Very Poor**

Taxa	**Count**
Polypedilum	1
Chrysops	2
Crambidae	1
Lumbriculidae	1
Naididae	2
Tubificidae	93
Crangonyx	2
TOTAL:	**102**

In-situ Water Quality

pH (SU)	6.99
Temperature (°C)	6.8
Dissolved Oxygen (mg/L)	9.00
Specific Conductivity (µS/cm)	83.7
Turbidity (NTU)	20.6

Physical Habitat Assessment

EPA Rapid Bioassessment Protocol

Epifaunal Substrate/Available Cover	3	Bank Stability- Left Bank	9
Pool Substrate Characterization	6	Bank Stability- Right Bank	9
Pool Variability	2	Vegetative Protection - Left Bank	7
Sediment Deposition	4	Vegetative Protection - Right Bank	7
Channel Flow Status	16	Riparian Vegetative Zone Width- Left Bank	8
Channel Alteration	12	Riparian Vegetative Zone Width- Right Bank	3
Channel Sinuosity	5		
EPA Habitat Score			**91**
EPA Narrative Rating			**Non Supporting**

MBSS Physical Habitat Index

	Value	Score		Value	Score
Instream Habitat	2	56.59	Shading	90	91.34
Epifaunal Substrate	3	51.24	Remoteness	6	32.31
Bank Stability	18	94.87	Woody Debris/Rootwads	1	85.74
PHI Score					**68.68**
PHI Narrative Rating					**Partially Degraded**

Land Use/Land Cover Analysis:

Total Drainage Area (acres) 31.15

Cover	**Acres**	**%Area**
Developed Land	**15.23**	**48.88**
Commercial	1.29	4.16
Industrial	0	0
Residential 1/8-acre	0	0
Residential 1/4-acre	0	0
Residential 1/2-acre	0	0
Residential 1-Acre	11.50	36.92
Residential 2-Acre	0.19	0.62
Transportation	2.24	7.19
Utility	0	0
Forest Land	**8.35**	**26.79**
Forested Wetland	0	0
Residential Woods	0	0
Woods	8.35	26.79
Open Land	**7.53**	**24.17**
Open Space	7.53	24.17
Open Wetland	0	0
Water	0	0
Agricultural Land	**0.05**	**0.15**
Pasture/Hay	0.05	0.15
Row Crops	0	0

Impervious Surface	**Acres**	**% Area**
Impervious Land	3.51	11.27

HB-09-2013 HB7 Subwatershed

Upstream View:

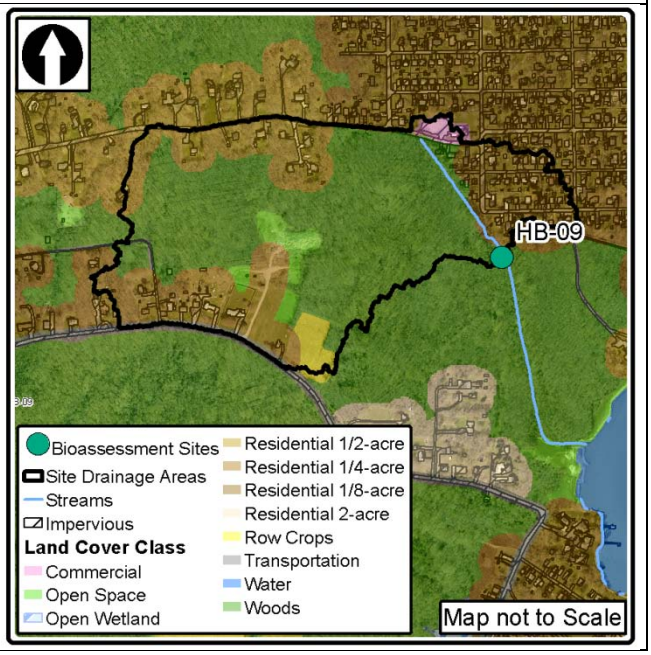
Downstream View:

(Latitude: 38.827687, **Longitude:** -76.500303**)**

Site HB-09-2013 is located south of Cedar Avenue within the Cedarhurst subwatershed. Habitat complexity is poor at this site, dominated by shallow run/glide complexes with primarily a single current velocity. Instream rootwads and woody debris are completely absent, but submerged vegetation is present, providing some habitat. Banks are stable with no evidence of erosion. This site contained specialized feeding groups and over one-third of the benthic community was comprised of individuals intolerant to urban stressors. However, Ephemeroptera and EPT taxa were completely absent resulting in a Poor benthic macroinvertebrate rating. Of this site's 60 acre drainage area, 54% is forested and 41% is development. Impervious surfaces make up approximately 9% of this site's drainage area.

Summary Results:

- Benthic macroinvertebrate community – *"Poor"*
- Habitat scores *"Supporting"* and *"Degraded"*
- Isopods (Asellidae) heavily dominated the community.
- *In-situ* water quality values met COMAR standards.
- Site is characterized by a straight channel with low flow and poor velocity depth diversity. The habitat consists mainly of leaf packs and submerged vegetation. Erosion is absent on both banks.



HB-09-2013 HB7 Subwatershed

Biological Assessment

Raw Metric Values

Total Taxa	16
EPT Taxa	0
Ephemeroptera Taxa	0
Intolerant Urban %	35
Ephemeroptera %	0
Scraper Taxa	1
% Climbers	1

Calculated Metric Scores

Total Taxa	3
EPT Taxa	1
Ephemeroptera Taxa	1
Intolerant Urban %	5
Ephemeroptera %	1
Scraper Taxa	3
% Climbers	3
BIBI Score	**2.43**
BIBI Narrative Rating	**Poor**

Taxa	Count
Belostoma	1
Hydrobaenus	2
Pseudorthocladius	1
Ceratopogoninae	1
Dolichopodidae	1
Erioptera	2
Tipula	2
Enchytraeidae	2
Lumbricina	2
Lumbriculidae	1
Tubificidae	5
Amphipoda	5
Crangonyctidae	1
Crangonyx	11
Gammarus	6
Synurella	5
Asellidae	22
Caecidotea	27
Chrysops	1
TOTAL:	**98**

In-situ Water Quality

pH (SU)	7.16
Temperature (°C)	11.6
Dissolved Oxygen (mg/L)	11.75
Specific Conductivity (µS/cm)	166.0
Turbidity (NTU)	83.7

Physical Habitat Assessment

EPA Rapid Bioassessment Protocol

Epifaunal Substrate/Available Cover	3	Bank Stability- Left Bank	9
Pool Substrate Characterization	11	Bank Stability- Right Bank	9
Pool Variability	6	Vegetative Protection - Left Bank	9
Sediment Deposition	17	Vegetative Protection - Right Bank	9
Channel Flow Status	17	Riparian Vegetative Zone Width- Left Bank	7
Channel Alteration	15	Riparian Vegetative Zone Width- Right Bank	9
Channel Sinuosity	5		
EPA Habitat Score			**126**
EPA Narrative Rating			**Supporting**

MBSS Physical Habitat Index

	Value	Score		Value	Score
Instream Habitat	4	60.93	Shading	70	68.32
Epifaunal Substrate	5	58.55	Remoteness	6	32.31
Bank Stability	18	94.87	Woody Debris/Rootwads	0	75.30
PHI Score					**65.05**
PHI Narrative Rating					**Degraded**

Land Use/Land Cover Analysis:

Total Drainage Area (acres) 60.32

Cover	Acres	%Area
Developed Land	**24.55**	**40.69**
Commercial	0.65	1.08
Industrial	0	0
Residential 1/8-acre	6.82	11.31
Residential 1/4-acre	8.76	14.52
Residential 1/2-acre	7.45	12.35
Residential 1-Acre	0	0
Residential 2-Acre	0	0
Transportation	0.86	1.43
Utility	0	0
Forest Land	**32.35**	**53.63**
Forested Wetland	0	0
Residential Woods	0	0
Woods	32.35	53.63
Open Land	**2.13**	**3.54**
Open Space	2.13	3.54
Open Wetland	0	0
Water	0	0
Agricultural Land	**1.29**	**2.14**
Pasture/Hay	0	0
Row Crops	1.29	2.14

Impervious Surface	Acres	% Area
Impervious Land	5.59	9.27

HB-10-2013 HB7 Subwatershed

Upstream View:

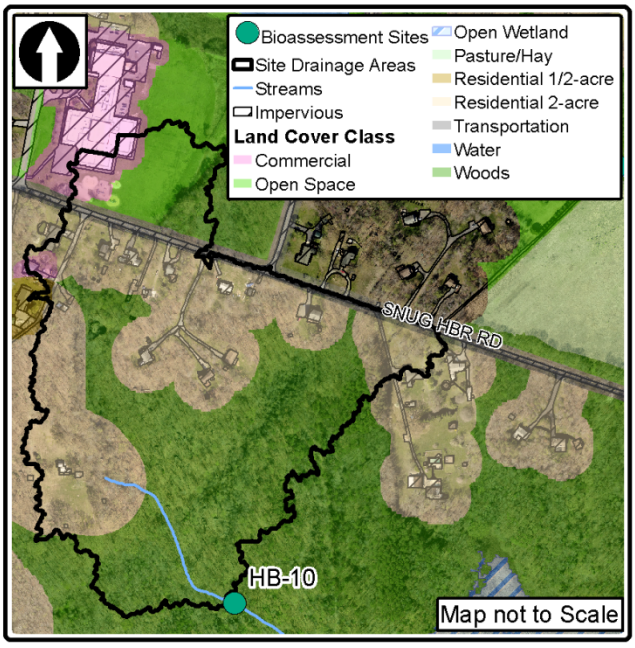
Downstream View:

(Latitude: 38.836133, **Longitude:** -76.504251**)**

Site HB-10-2013 is located south of Kellam Road within the Cedarhurst subwatershed. Of the 35 acre drainage area, 44% is forested land and 51% is developed land, with impervious surfaces accounting for almost 7%. It is likely that this channel has been straightened in the past. It has very low habitat complexity, consisting primarily of shallow runs and glides. Leaf packs make up the majority of benthic habitat along with a few pieces of instream woody debris. Both banks are stable with optimal vegetative protection and riparian width. The benthic macroinvertebrate community at this site was rated as Very Poor and dominated by midges (*Pseudorthocladius)* and isopods (Asellidae). Specialized feeding groups and EPT taxa were completely absent at this site. A lack of complex and stable habitats is likely affecting the biological community at this site.

Summary Results:

- Benthic macroinvertebrate community – *"Very Poor"*
- Habitat scores *"Supporting"* and *"Partially Degraded"*
- Midges (*Pseudorthocladius*) and Isopods (Asellidae) dominated the community.
- *In-situ* water quality values met COMAR standards.
- This site consists of a shallow channel with runs and glides. Habitat complexity is poor. Pools are absent and woody debris is only present in very small amounts. Banks are stable with optimal vegetative protection and riparian width.



HB-10-2013 HB7 Subwatershed

Biological Assessment

Raw Metric Values

Total Taxa	10
EPT Taxa	0
Ephemeroptera Taxa	0
Intolerant Urban %	11
Ephemeroptera %	0
Scraper Taxa	0
% Climbers	0

Calculated Metric Scores

Total Taxa	1
EPT Taxa	1
Ephemeroptera Taxa	1
Intolerant Urban %	3
Ephemeroptera %	1
Scraper Taxa	1
% Climbers	1
BIBI Score	**1.29**
BIBI Narrative Rating	**Very Poor**

Taxa	**Count**
Limnophyes	3
Pseudorthocladius	30
Pseudosmittia	1
Enchytraeidae	4
Lumbriculidae	10
Tubificidae	2
Amphipoda	2
Crangonyx	11
Gammarus	1
Synurella	2
Asellidae	21
Caecidotea	8
TOTAL:	**95**

In-situ Water Quality

pH (SU)	7.46
Temperature (°C)	6.6
Dissolved Oxygen (mg/L)	7.45
Specific Conductivity (µS/cm)	48.7
Turbidity (NTU)	29.7

Physical Habitat Assessment

EPA Rapid Bioassessment Protocol

Epifaunal Substrate/Available Cover	3	Bank Stability- Left Bank	10
Pool Substrate Characterization	9	Bank Stability- Right Bank	10
Pool Variability	2	Vegetative Protection - Left Bank	10
Sediment Deposition	18	Vegetative Protection - Right Bank	10
Channel Flow Status	17	Riparian Vegetative Zone Width- Left Bank	10
Channel Alteration	15	Riparian Vegetative Zone Width- Right Bank	10
Channel Sinuosity	5		
EPA Habitat Score			**129**
EPA Narrative Rating			**Supporting**

MBSS Physical Habitat Index

	Value	Score		Value	Score
Instream Habitat	2	55.38	Shading	85	84.56
Epifaunal Substrate	6	67.89	Remoteness	13	70.01
Bank Stability	20	100.00	Woody Debris/Rootwads	2	87.36
PHI Score					**77.53**
PHI Narrative Rating					**Partially Degraded**

Land Use/Land Cover Analysis:

Total Drainage Area (acres) 35.07

Cover	**Acres**	**%Area**
Developed Land	**17.73**	**50.54**
Commercial	1.09	3.11
Industrial	0	0
Residential 1/8-acre	0	0
Residential 1/4-acre	0	0
Residential 1/2-acre	0.07	0.19
Residential 1-Acre	0	0
Residential 2-Acre	15.29	43.59
Transportation	1.28	3.65
Utility	0	0
Forest Land	**15.45**	**44.05**
Forested Wetland	0	0
Residential Woods	0	0
Woods	15.45	44.05
Open Land	**1.90**	**5.41**
Open Space	1.90	5.41
Open Wetland	0	0
Water	0	0
Agricultural Land	**0**	**0**
Pasture/Hay	0	0
Row Crops	0	0

Impervious Surface	**Acres**	**% Area**
Impervious Land	2.29	6.53

HB-12-2013 HB9 Subwatershed

Upstream View:

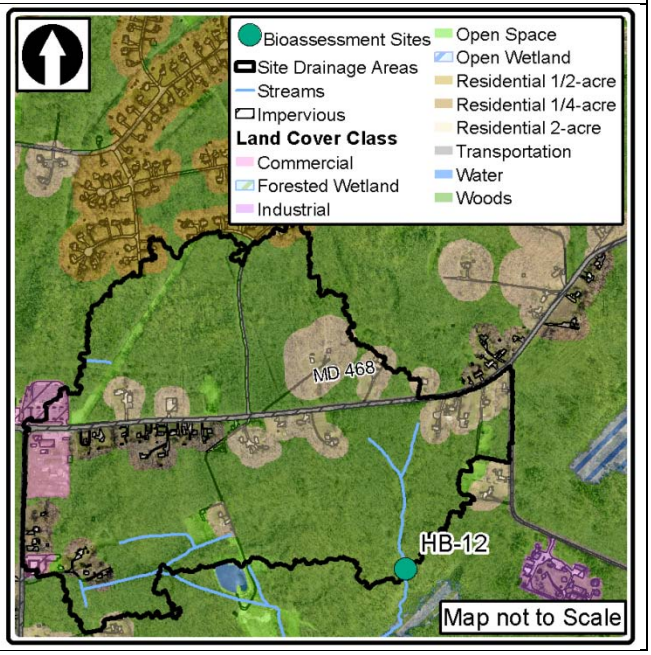
Downstream View:

(Latitude: 38.811800 , **Longitude:** -76.5277949**)**

Site HB-12-2013 is located west of Shady Side Road within the Deep Cove Creek subwatershed. The channel is relatively straight and backwatered due to a debris jam and wetlands located downstream. Benthic macroinvertebrate habitat consists primarily of submerged woody debris, instream rootwads, and leaf packs. The reach substrate is dominated by mud and sand. Banks are stable with optimal vegetative protection and riparian width. Although one-third of the benthic community consisted of individuals intolerant to urban stressors, overall taxa diversity was poor, and lacked Ephemeroptera, scrapers, and climbers. Forest and development are the primary land uses, comprising this site's 192 acre drainage area and imperviousness is approximately 6%.

Summary Results:

- Benthic macroinvertebrate community – *"Very Poor"*
- Habitat scores *"Supporting"* and *"Partially Degraded"*
- Isopods (*Caecidotea*) dominated the community.
- *In-situ* water quality values met COMAR standards.
- This straightened channel is heavily stained with tannins. It has poor habitat complexity with only a few rootwads and submerged woody debris. Banks are stable with optimal vegetative protection and riparian width.



HB-12-2013 HB9 Subwatershed

Biological Assessment

Raw Metric Values

Total Taxa	13
EPT Taxa	1
Ephemeroptera Taxa	0
Intolerant Urban %	33
Ephemeroptera %	0
Scraper Taxa	0
% Climbers	0

Calculated Metric Scores

Total Taxa	1
EPT Taxa	1
Ephemeroptera Taxa	1
Intolerant Urban %	5
Ephemeroptera %	1
Scraper Taxa	1
% Climbers	1
BIBI Score	**1.57**
BIBI Narrative Rating	**Very Poor**

Taxa	**Count**
Ironoquia	3
Agabus	2
Limnophyes	3
Pseudorthocladius	10
Pseudosmittia	1
Dasyhelea	11
Erioptera	5
Tipula	1
Naididae	2
Tubificidae	5
Amphipoda	1
Crangonyx	5
Gammaridae	12
Gammarus	5
Asellidae	2
Caecidotea	34
TOTAL:	**102**

In-situ Water Quality

pH (SU)	7.27
Temperature (°C)	7.9
Dissolved Oxygen (mg/L)	6.88
Specific Conductivity (µS/cm)	174.3
Turbidity (NTU)	26.3

Physical Habitat Assessment

EPA Rapid Bioassessment Protocol

Epifaunal Substrate/Available Cover	5	Bank Stability- Left Bank	10
Pool Substrate Characterization	6	Bank Stability- Right Bank	10
Pool Variability	4	Vegetative Protection - Left Bank	9
Sediment Deposition	18	Vegetative Protection - Right Bank	9
Channel Flow Status	19	Riparian Vegetative Zone Width- Left Bank	10
Channel Alteration	19	Riparian Vegetative Zone Width- Right Bank	10
Channel Sinuosity	6		
EPA Habitat Score			**135**
EPA Narrative Rating			**Supporting**

MBSS Physical Habitat Index

	Value	Score		Value	Score
Instream Habitat	6	64.32	Shading	70	68.32
Epifaunal Substrate	6	59.46	Remoteness	13	73.37
Bank Stability	20	100.00	Woody Debris/Rootwads	12	100.00
PHI Score					**75.39**
PHI Narrative Rating					**Partially Degraded**

Land Use/Land Cover Analysis:

Total Drainage Area (acres) 196.77

Cover	**Acres**	**%Area**
Developed Land	**55.48**	**28.20**
Commercial	6.49	3.30
Industrial	0	0
Residential 1/8-acre	0	0
Residential 1/4-acre	0	0
Residential 1/2-acre	2.12	1.08
Residential 1-Acre	13.16	6.69
Residential 2-Acre	26.76	13.60
Transportation	6.95	3.53
Utility	0	0
Forest Land	**134.84**	**68.53**
Forested Wetland	0	0
Residential Woods	0	0
Woods	134.84	68.53
Open Land	**6.44**	**3.27**
Open Space	6.44	3.27
Open Wetland	0	0
Water	0	0
Agricultural Land	**0**	**0**
Pasture/Hay	0	0
Row Crops	0	0

Impervious Surface	**Acres**	**% Area**
Impervious Land	11.83	6.01

HB-13-2013 HB8 Subwatershed

Upstream View:

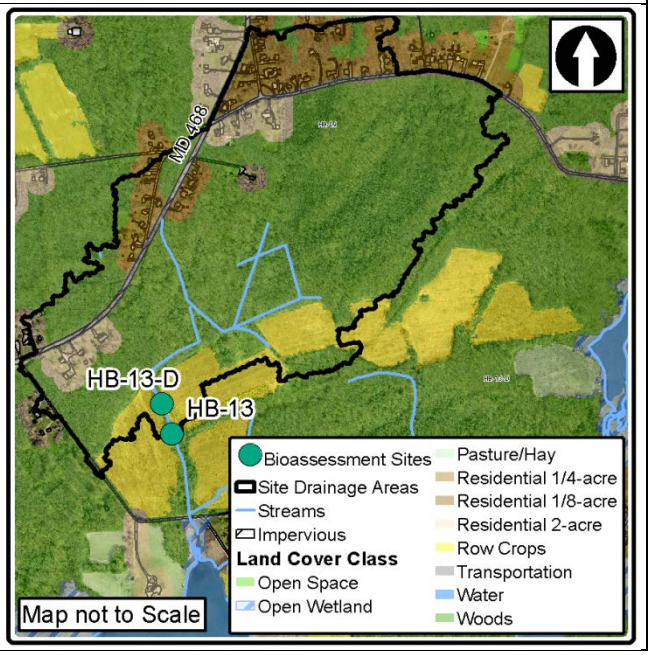
Downstream View:

(Latitude: 38.818353, **Longitude:** -76.514748**)**

Site HB-13-2013 is located northeast of Dent Road on Deep Creek within the Deep Creek subwatershed. The channel appears to have been straightened in the past. The stream is also tannic due to heavy leaf litter and low flow. Instream rootwads and woody debris are abundant, providing the majority of stable habitat for benthic macroinvertebrates. Both banks are moderately stable, with suboptimal vegetative protection and riparian width. Forest is the primary land use, comprising 71% of this site's drainage area and imperviousness is approximately 5%. Although approximately one-third of the benthic sample consisted of individuals intolerant to urban stressors, an absence of Ephemeroptera, scraper, and climber taxa contributed to a Poor biological community rating.

Summary Results:

- Benthic macroinvertebrate community – *"Poor"*
- Habitat scores *"Partially Supporting"* and *"Partially Degraded"*
- Amphipods (Gammaridae) and Isopods (Asellidae) dominated the community.
- *In-situ* water quality values met COMAR standards.
- This site is very straight and only has slow flowing water. The water is stained heavily with tannins from leaf litter. Woody debris and rootwads provide a majority of the stable habitat present. Both banks are moderately stable.



HB-13-2013 HB8 Subwatershed

Biological Assessment

Raw Metric Values

Total Taxa	15
EPT Taxa	1
Ephemeroptera Taxa	0
Intolerant Urban %	29
Ephemeroptera %	0
Scraper Taxa	1
% Climbers	2

Calculated Metric Scores

Total Taxa	3
EPT Taxa	1
Ephemeroptera Taxa	1
Intolerant Urban %	5
Ephemeroptera %	1
Scraper Taxa	3
% Climbers	3
BIBI Score	**2.43**
BIBI Narrative Rating	**Poor**

Taxa	Count
Ironoquia	2
Agabus	1
Hydroporinae	2
Hydroporus	1
Orthocladius	1
Pseudorthocladius	1
Chrysops	2
Erioptera	6
Stegopterna	2
Naididae	1
Tubificidae	6
Hydrobiidae	1
Crangonyctidae	1
Crangonyx	1
Gammaridae	13
Gammarus	14
Asellidae	19
Caecidotea	23
Synurella	2
TOTAL:	**99**

In-situ Water Quality

pH (SU)	7.06
Temperature (°C)	6.4
Dissolved Oxygen (mg/L)	9.39
Specific Conductivity (µS/cm)	120.7
Turbidity (NTU)	18.3

Physical Habitat Assessment

EPA Rapid Bioassessment Protocol

Epifaunal Substrate/Available Cover	5	Bank Stability- Left Bank	6
Pool Substrate Characterization	8	Bank Stability- Right Bank	6
Pool Variability	11	Vegetative Protection - Left Bank	9
Sediment Deposition	7	Vegetative Protection - Right Bank	8
Channel Flow Status	16	Riparian Vegetative Zone Width- Left Bank	8
Channel Alteration	15	Riparian Vegetative Zone Width- Right Bank	8
Channel Sinuosity	5		
EPA Habitat Score			**112**
EPA Narrative Rating			**Partially Supporting**

MBSS Physical Habitat Index

	Value	Score		Value	Score
Instream Habitat	7	66.46	Shading	95	99.94
Epifaunal Substrate	5	51.48	Remoteness	9	48.47
Bank Stability	12	77.46	Woody Debris/Rootwads	19	100.00
PHI Score					**73.97**
PHI Narrative Rating					**Partially Degraded**

Land Use/Land Cover Analysis:

Total Drainage Area (acres)		**178.62**
Cover	**Acres**	**%Area**
Developed Land	**37.45**	**20.97**
Commercial	0	0
Industrial	0	0
Residential 1/8-acre	9.88	5.53
Residential 1/4-acre	8.82	4.94
Residential 1/2-acre	0	0
Residential 1-Acre	2.54	1.42
Residential 2-Acre	8.93	5.00
Transportation	7.28	4.08
Utility	0	0
Forest Land	**127.50**	**71.38**
Forested Wetland	0	0
Residential Woods	0	0
Woods	127.50	71.38
Open Land	**0**	**0**
Open Space	0	0
Open Wetland	0	0
Water	0	0
Agricultural Land	**13.66**	**7.65**
Pasture/Hay	0	0
Row Crops	13.66	7.65
Impervious Surface	**Acres**	**% Area**
Impervious Land	9.24	5.17

HB-13-Dup-2013 HB8 Subwatershed

Upstream View:

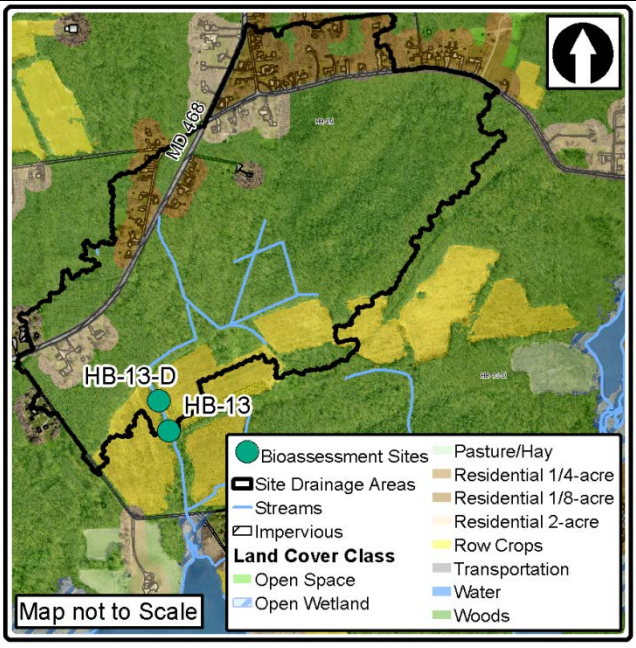
Downstream View:

(Latitude:38.819042 **Longitude:** -76.515053**)**

Site HB-13-Dup-2013 is located directly upstream of site HB-13-2013 on Deep Creek within the Deep Creek subwatershed. The channel appears to have been straightened in the past. The stream is also tannic due to heavy leaf litter and low flow. Instream rootwads and woody debris are abundant and a large debris jam is present on the upstream end of the site creating stable habitat for the benthic macroinvertebrate community. Both banks are moderately stable, with suboptimal vegetative protection and riparian width. The benthic macroinvertebrate community at this site was rated as Very Poor and dominated by isopods. No specialized feeding groups or habitats were present as well as no Ephemeroptera taxa. Low flow conditions and poor habitat complexity are likely affecting the biological community at this site. Forest is the primary land use, comprising 73% of this site's drainage area and imperviousness is approximately 5%.

Summary Results:

- Benthic macroinvertebrate community – *"Very Poor"*
- Habitat scores *"Partially Supporting"* and *"Partially Degraded"*
- Isopods (Asellidae) dominated the community.
- *In-situ* water quality values met COMAR standards.
- This site is very straight and only has slow flowing water. The water is stained heavily with tannins from leaf litter. Woody debris and rootwads provide a majority of the stable habitat present. Both banks are moderately stable.



HB-13-Dup-2013 HB8 Subwatershed

Biological Assessment

Raw Metric Values

Total Taxa	10
EPT Taxa	0
Ephemeroptera Taxa	0
Intolerant Urban %	11
Ephemeroptera %	0
Scraper Taxa	0
% Climbers	0

Calculated Metric Scores

Total Taxa	1
EPT Taxa	1
Ephemeroptera Taxa	1
Intolerant Urban %	3
Ephemeroptera %	1
Scraper Taxa	1
% Climbers	1
BIBI Score	**1.29**
BIBI Narrative Rating	**Very Poor**

Taxa	**Count**
Hydroporinae	1
Tribelos	1
Dasyhelea	1
Erioptera	1
Enchytraeidae	3
Naididae	10
Tubificidae	8
Crangonyx	3
Synurella	4
Asellidae	44
Caecidotea	5
TOTAL:	**81**

In-situ Water Quality

pH (SU)	6.88
Temperature (°C)	15.7
Dissolved Oxygen (mg/L)	8.56
Specific Conductivity (µS/cm)	96.3
Turbidity (NTU)	18.1

Physical Habitat Assessment

EPA Rapid Bioassessment Protocol

Epifaunal Substrate/Available Cover	6	Bank Stability- Left Bank	8
Pool Substrate Characterization	8	Bank Stability- Right Bank	7
Pool Variability	11	Vegetative Protection - Left Bank	9
Sediment Deposition	7	Vegetative Protection - Right Bank	8
Channel Flow Status	16	Riparian Vegetative Zone Width- Left Bank	8
Channel Alteration	15	Riparian Vegetative Zone Width- Right Bank	8
Channel Sinuosity	5		
EPA Habitat Score			**116**
EPA Narrative Rating			**Partially Supporting**

MBSS Physical Habitat Index

	Value	Score		Value	Score
Instream Habitat	6	61.18	Shading	90	91.34
Epifaunal Substrate	6	57.46	Remoteness	9	48.47
Bank Stability	15	86.61	Woody Debris/Rootwads	31	100.00
PHI Score					**74.18**
PHI Narrative Rating					**Partially Degraded**

Land Use/Land Cover Analysis:

Total Drainage Area (acres)		**173.95**
Cover	**Acres**	**%Area**
Developed Land	**37.45**	**21.53**
Commercial	0	0
Industrial	0	0
Residential 1/8-acre	9.88	5.68
Residential 1/4-acre	8.82	5.07
Residential 1/2-acre	0	0
Residential 1-Acre	2.54	1.46
Residential 2-Acre	8.93	5.13
Transportation	7.28	4.19
Utility	0	0
Forest Land	**126.55**	**72.75**
Forested Wetland	0	0
Residential Woods	0	0
Woods	126.55	126.55
Open Land	**0**	**0**
Open Space	0	0
Open Wetland	0	0
Water		
Agricultural Land	**9.94**	**5.72**
Pasture/Hay	0	0
Row Crops	9.94	5.72
Impervious Surface	**Acres**	**% Area**
Impervious Land	9.24	5.31

HB-14-2013 HB9 Subwatershed

Upstream View:

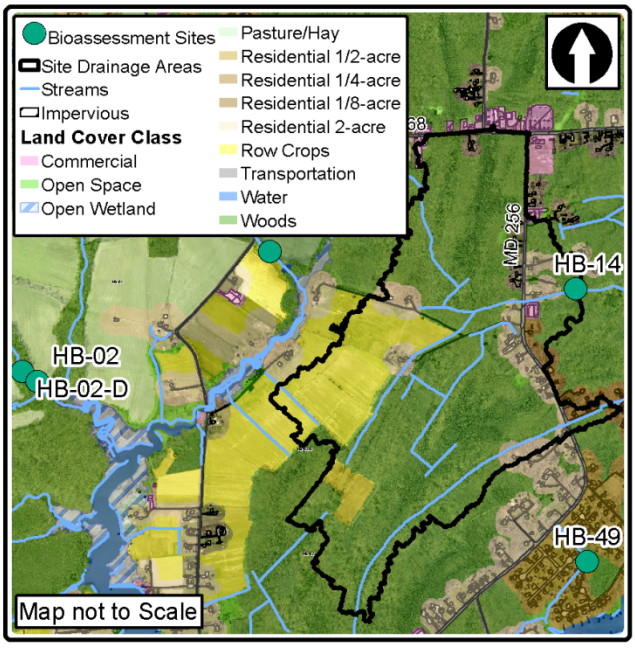
Downstream View:

(Latitude: 38.809034, **Longitude:** -76.536636**)**

Site HB-14-2013 is located east of Deale Churchton Road on Deep Cove Creek within the Deep Cove Creek subwatershed. The channel has been straightened in the past and has very poor habitat complexity. Mud and sand are the dominate substrates and the water has been heavily stained with tannins from sitting leaf litter. Leaf packs and instream rootwads and woody debris make up the majority of stable benthic macroinvertebrate habitat. Banks are moderately unstable but have well developed riparian buffers. Aquatic worms dominated the community at this site. About 20% of the benthic macroinvertebrate community consisted of individuals intolerant to urban stressors. However, taxa diversity was low and Ephemeroptera taxa were absent, resulting in a Very Poor rating. The 367 acre drainage area is dominated by forested land (70%) and only 3% of the total area is comprised of impervious surfaces.

Summary Results:

- Benthic macroinvertebrate community – *"Very Poor"*
- Habitat scores *"Partially Supporting"* and *"Partially Degraded"*
- Aquatic worms (Tubificidae) dominated the community.
- *In-situ* water quality values met COMAR standards.
- Very straight channel dominated by mud and sand substrates. Stream heavily stained with tannins due to standing leaf litter. Rootwads, woody debris, and leaf packs represent the primary benthic macroinvertebrate habitat. Human refuse is abundant and unsightly at this site.



HB-14-2013 HB9 Subwatershed

Biological Assessment

Raw Metric Values

Total Taxa	13
EPT Taxa	1
Ephemeroptera Taxa	0
Intolerant Urban %	21
Ephemeroptera %	0
Scraper Taxa	1
% Climbers	0

Calculated Metric Scores

Total Taxa	1
EPT Taxa	1
Ephemeroptera Taxa	1
Intolerant Urban %	3
Ephemeroptera %	1
Scraper Taxa	3
% Climbers	1
BIBI Score	**1.57**
BIBI Narrative Rating	**Very Poor**

Taxa	**Count**
Ironoquia	2
Chironomidae	2
Diplocladius	1
Hydrobaenus	2
Orthocladius	13
Chrysops	1
Enchytraeidae	7
Lumbriculidae	2
Naididae	1
Tubificidae	31
Crangonyx	9
Stygobromus	1
Synurella	1
Asellidae	2
Caecidotea	17
TOTAL:	**92**

In-situ Water Quality

pH (SU)	7.46
Temperature (°C)	4.2
Dissolved Oxygen (mg/L)	10.55
Specific Conductivity (µS/cm)	149.0
Turbidity (NTU)	17.3

Physical Habitat Assessment

EPA Rapid Bioassessment Protocol

Epifaunal Substrate/Available Cover	6	Bank Stability- Left Bank	6
Pool Substrate Characterization	6	Bank Stability- Right Bank	5
Pool Variability	4	Vegetative Protection - Left Bank	8
Sediment Deposition	17	Vegetative Protection - Right Bank	7
Channel Flow Status	19	Riparian Vegetative Zone Width- Left Bank	9
Channel Alteration	12	Riparian Vegetative Zone Width- Right Bank	9
Channel Sinuosity	2		
EPA Habitat Score			**110**
EPA Narrative Rating			**Partially Supporting**

MBSS Physical Habitat Index

	Value	Score		Value	Score
Instream Habitat	4	42.45	Shading	85	84.56
Epifaunal Substrate	6	52.60	Remoteness	12	64.62
Bank Stability	11	74.16	Woody Debris/Rootwads	15	99.24
PHI Score					**69.61**
PHI Narrative Rating					**Partially Degraded**

Land Use/Land Cover Analysis:

Total Drainage Area (acres) 366.80

Cover	**Acres**	**%Area**
Developed Land	**53.94**	**14.71**
Commercial	2.12	0.58
Industrial	0	0
Residential 1/8-acre	5.67	1.55
Residential 1/4-acre	0	0
Residential 1/2-acre	0	0
Residential 1-Acre	6.83	1.86
Residential 2-Acre	32.87	8.96
Transportation	6.45	1.76
Utility	0	0
Forest Land	**256.06**	**69.81**
Forested Wetland	0	0
Residential Woods	0	0
Woods	256.06	69.81
Open Land	**0.95**	**0.26**
Open Space	0.95	0.26
Open Wetland	0	0
Water	0	0
Agricultural Land	**55.86**	**15.23**
Pasture/Hay	0	0
Row Crops	55.86	15.23

Impervious Surface	**Acres**	**% Area**
Impervious Land	11.78	3.21

HB-19-2013 HBF Subwatershed

Upstream View:

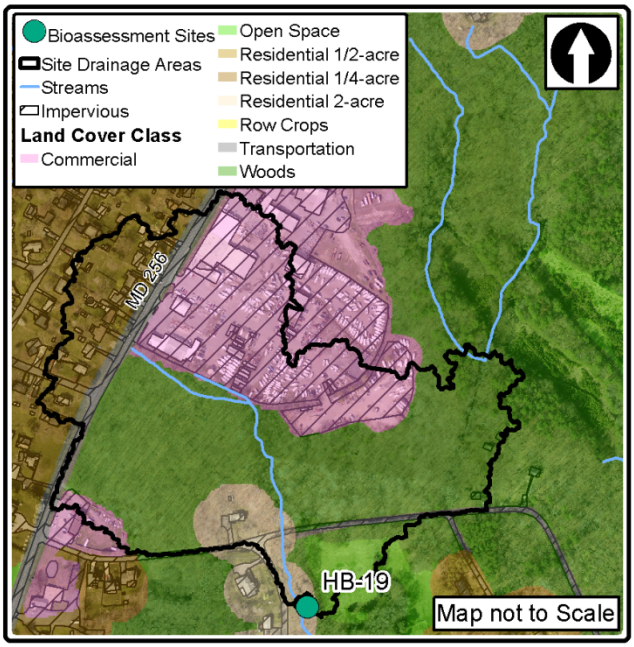
Downstream View:

(Latitude: 38.78558, **Longitude:** -76.547831**)**

Site HB-19-2013 is located approximately 15 meters east of Tyler Road within the Parker Creek subwatershed. The channel lies between two wetlands and may function more as a wetland during the growing season. Velocity depth diversity and instream habitat are both poor with the primary stable habitat consisting of instream rootwads and woody debris. Bank stability and vegetative protection are optimal but riparian width is suboptimal on the right bank due to its close proximity to Tyler Road. The benthic macroinvertebrate community at this site was rated as Very Poor due to low taxa diversity and an absence of EPT taxa. Lack of habitat complexity, low flow conditions, and an intermittent water regime are likely affecting the biological community at this site. Of the 34 acre drainage area, 50% is developed land, 47% is forested land, and the remaining 3% is open land. Thirty-one percent of the drainage area is comprised of impervious surfaces, which is the highest of all Herring Bay sites sampled.

Summary Results:

- Benthic macroinvertebrate community – *"Very Poor"*
- Habitat scores *"Supporting"* and *"Partially Degraded"*
- Aquatic worms (Tubificidae) and Isopods (Asellidae) dominated the community.
- *In-situ* water quality values met COMAR standards, but conductivity was elevated.
- This site is located in a shallow channel between two wetlands. Instream rootwads/woody debris and leaf packs are the dominate habitat. Banks are stable and vegetative protection is optimal.



HB-19-2013 HBF Subwatershed

Biological Assessment

Raw Metric Values

Total Taxa	11
EPT Taxa	0
Ephemeroptera Taxa	0
Intolerant Urban %	23
Ephemeroptera %	0
Scraper Taxa	1
% Climbers	0

Calculated Metric Scores

Total Taxa	1
EPT Taxa	1
Ephemeroptera Taxa	1
Intolerant Urban %	3
Ephemeroptera %	1
Scraper Taxa	3
% Climbers	1
BIBI Score	**1.57**
BIBI Narrative Rating	**Very Poor**

Taxa	**Count**
Copelatus	1
Gymnometriocnemus	1
Hydrobaenus	1
Orthocladius	1
Chrysops	1
Tubificidae	44
Pisidium	3
Crangonyx	4
Synurella	13
Asellidae	25
Caecidotea	10
Turbellaria	1
TOTAL:	**105**

In-situ Water Quality

pH (SU)	7.85
Temperature (°C)	12.2
Dissolved Oxygen (mg/L)	9.15
Specific Conductivity (µS/cm)	308.7
Turbidity (NTU)	51.7

Physical Habitat Assessment

EPA Rapid Bioassessment Protocol

Epifaunal Substrate/Available Cover	5	Bank Stability- Left Bank	10
Pool Substrate Characterization	7	Bank Stability- Right Bank	10
Pool Variability	3	Vegetative Protection - Left Bank	9
Sediment Deposition	19	Vegetative Protection - Right Bank	9
Channel Flow Status	17	Riparian Vegetative Zone Width- Left Bank	10
Channel Alteration	19	Riparian Vegetative Zone Width- Right Bank	7
Channel Sinuosity	7		
EPA Habitat Score			**132**
EPA Narrative Rating			**Supporting**

MBSS Physical Habitat Index

	Value	Score		Value	Score
Instream Habitat	4	66.94	Shading	90	91.34
Epifaunal Substrate	5	62.38	Remoteness	3	16.16
Bank Stability	20	100.00	Woody Debris/Rootwads	14	100.00
PHI Score					**72.80**
PHI Narrative Rating					**Partially Degraded**

Land Use/Land Cover Analysis:

Total Drainage Area (acres) 33.51

Cover	**Acres**	**%Area**
Developed Land	**16.65**	**49.68**
Commercial	9.35	27.90
Industrial	0	0
Residential 1/8-acre	0	0
Residential 1/4-acre	3.59	10.71
Residential 1/2-acre	0	0
Residential 1-Acre	0	0
Residential 2-Acre	1.98	5.91
Transportation	1.73	5.16
Utility	0	0
Forest Land	**15.87**	**47.36**
Forested Wetland	0	0
Residential Woods	0	0
Woods	15.87	47.36
Open Land	**0.99**	**2.95**
Open Space	0.99	2.95
Open Wetland	0	0
Water	0	0
Agricultural Land	**0**	**0**
Pasture/Hay	0	0
Row Crops	0	0

Impervious Surface	**Acres**	**% Area**
Impervious Land	10.54	31.45

HB-20-2013 HBL Subwatershed

Upstream View:

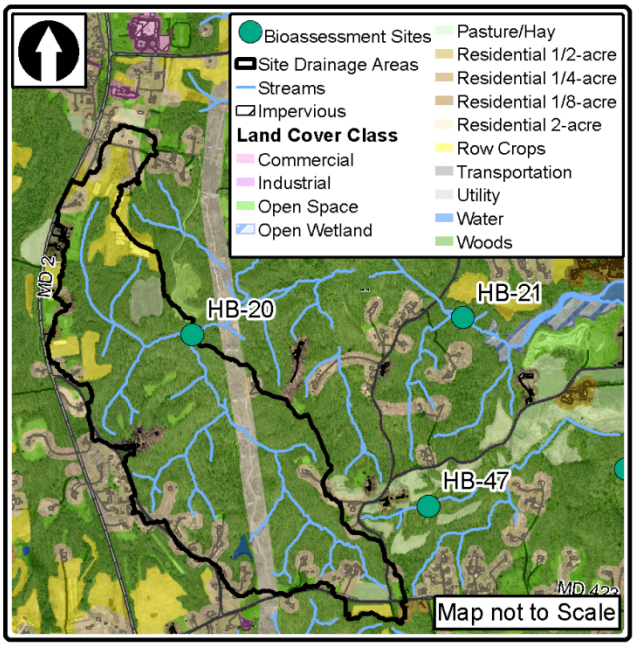
Downstream View:

(Latitude: 38.766655, **Longitude:** -76.590399**)**

Site HB-20-2013 is located south of Tracys Lane in a stream valley behind a large farm within the Trotts Branch subwatershed. The dominant land cover of the 428 acre drainage area is forest (63%) and impervious surfaces account for less than 2% of the total area. The stream is relatively straight but has good habitat complexity, consisting of a few sandy riffles, deep pools with cover, and moderate amounts of submerged woody debris and aquatic vegetation. The stream has a well developed riparian buffer and banks are moderately stable with minor erosion and good vegetative bank protection. The benthic macroinvertebrate community at this site was rated as Poor and dominated by both mayflies and midges. Although this site supported the most diverse benthic macroinvertebrate community of all Herring Bay sites sampled and had a relatively high number of EPT taxa, the absence of Ephemeroptera taxa and lack of scrapers and climbers resulted in a Poor score.

Summary Results:

- Benthic macroinvertebrate community – *"Poor"*
- Habitat scores *"Supporting"* and *"Partially Degraded"*
- Mayflies (*Amphinemura*) and midges (*Diplocladius*) dominated the community.
- *In-situ* water quality values met COMAR standards.
- This site has a small incised channel with moderate flow and good habitat complexity. The sampled reach consists of riffle/run complexes and a few deep pools with good cover. Submerged woody debris and vegetation and leaf packs provide the majority of the preferred benthic macroinvertebrate substrate.



HB-20-2013 HBL Subwatershed

Biological Assessment

Raw Metric Values

Total Taxa	21
EPT Taxa	3
Ephemeroptera Taxa	0
Intolerant Urban %	26
Ephemeroptera %	0
Scraper Taxa	1
% Climbers	2.2

Calculated Metric Scores

Total Taxa	3
EPT Taxa	3
Ephemeroptera Taxa	1
Intolerant Urban %	3
Ephemeroptera %	1
Scraper Taxa	3
% Climbers	3
BIBI Score	**2.43**
BIBI Narrative Rating	**Poor**

Taxa	Count
Amphinemura	18
Isoperla	1
Ironoquia	5
Diplocladius	14
Heterotrissocladius	1
Orthocladiinae	3
Orthocladius	8
Parametriocnemus	4
Polypedilum	1
Pseudorthocladius	1
Rheocricotopus	9
Chrysops	1
Dasyhelea	1
Pseudolimnophila	1
Stegopterna	1
Stilobezzia	1
Naididae	6
Tubificidae	1
Corbiculoidea	1
Physa	1
Crangonyctidae	8
Asellidae	3
TOTAL:	**90**

In-situ Water Quality

pH (SU)	8.01
Temperature (°C)	11.6
Dissolved Oxygen (mg/L)	16.14
Specific Conductivity (µS/cm)	144.7
Turbidity (NTU)	14.6

Physical Habitat Assessment

EPA Rapid Bioassessment Protocol

Epifaunal Substrate/Available Cover	11	Bank Stability- Left Bank	8
Pool Substrate Characterization	14	Bank Stability- Right Bank	7
Pool Variability	15	Vegetative Protection - Left Bank	9
Sediment Deposition	13	Vegetative Protection - Right Bank	9
Channel Flow Status	18	Riparian Vegetative Zone Width- Left Bank	9
Channel Alteration	18	Riparian Vegetative Zone Width- Right Bank	10
Channel Sinuosity	7		
EPA Habitat Score			**148**
EPA Narrative Rating			**Supporting**

MBSS Physical Habitat Index

	Value	Score		Value	Score
Instream Habitat	12	85.25	Shading	65	63.55
Epifaunal Substrate	11	80.64	Remoteness	12	64.62
Bank Stability	15	86.61	Woody Debris/Rootwads	9	79.73
PHI Score					**76.73**
PHI Narrative Rating					**Partially Degraded**

Land Use/Land Cover Analysis:

Total Drainage Area (acres) 428.38

Cover	Acres	%Area
Developed Land	**95.52**	**22.30**
Commercial	0	0
Industrial	0	0
Residential 1/8-acre	0	0
Residential 1/4-acre	0	0
Residential 1/2-acre	0.53	0.12
Residential 1-Acre	10.32	2.41
Residential 2-Acre	50.25	11.73
Transportation	6.26	1.46
Utility	28.15	6.57
Forest Land	**271.56**	**63.39**
Forested Wetland	0	0
Residential Woods	0	0
Woods	271.56	63.39
Open Land	**17.89**	**4.18**
Open Space	16.54	3.86
Open Wetland	0	0
Water	1.35	0.31
Agricultural Land	**43.41**	**15.98**
Pasture/Hay	11.44	2.67
Row Crops	31.97	7.46

Impervious Surface	Acres	% Area
Impervious Land	7.96	1.86

HB-21-2013 HBL Subwatershed

Upstream View:

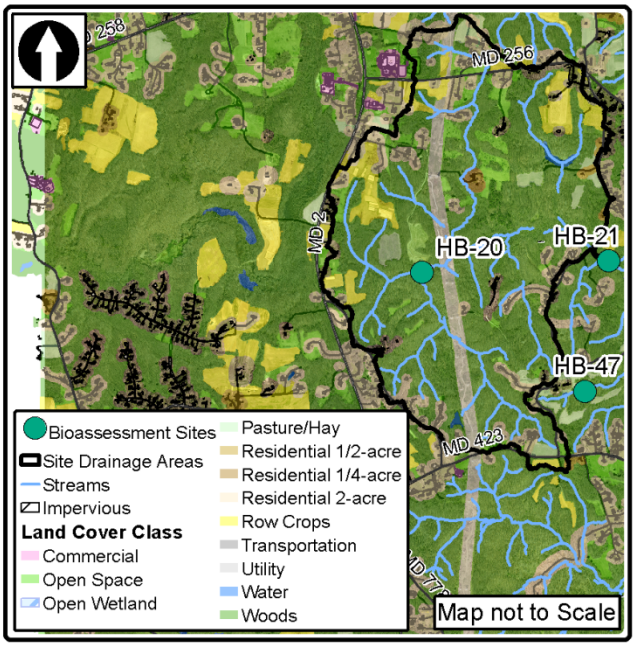
Downstream View:

(Latitude: 38.767366, **Longitude:** -76.574543**)**

Site HB-21-2013 is located downstream of Franklin Gibson Road within the Trotts Branch subwatershed. A beaver dam is present downstream of the site and the zero meter portion of the reach has been excavated and appears to be used as a fishing pool. Almost two-thirds of the 1,135 acre drainage area is forested and 23% is developed land. Imperviousness accounts for a little over 2% of the drainage area. The stream is well connected to the floodplain with vernal pools and wetlands on both banks. Habitat complexity is moderate, consisting mostly of riffle/run complexes with some pools and high amounts of instream rootwads and woody debris. Banks are moderately stable with good vegetative protection and a well developed riparian buffer. The benthic macroinvertebrate community at this site supported a relatively high number of taxa and was one of the only sites sampled in the Herring Bay Watershed to contain an Ephemeroptera taxon. Although the taxa diversity was high, it consisted mainly of midge genera, which are tolerant to urban stressors. The pH reading was out of compliance with COMAR standards at 8.71, exceeding the one time standard of 8.50, which may be due to large amounts of algae observed during the fieldwork.

Summary Results:

- Benthic macroinvertebrate community – *"Poor"*
- Habitat scores *"Supporting"* and *"Minimally Degraded"*
- Midges (*Diplocladius* & *Orthocladius*) dominated the community.
- Was out of compliance with COMAR standards for pH.
- The channel at this site is wide and shallow with a diversity of flows and little erosion. The stream bottom consists of mostly sand and clay, with some gravel riffles. High amounts of instream rootwads and woody debris account for the majority of benthic macroinvertebrate habitat.



HB-21-2013 HBL Subwatershed

Biological Assessment

Raw Metric Values

Total Taxa	17
EPT Taxa	1
Ephemeroptera Taxa	1
Intolerant Urban %	3
Ephemeroptera %	4.3
Scraper Taxa	1
% Climbers	5.4

Calculated Metric Scores

Total Taxa	3
EPT Taxa	1
Ephemeroptera Taxa	3
Intolerant Urban %	1
Ephemeroptera %	3
Scraper Taxa	3
% Climbers	3
BIBI Score	**2.43**
BIBI Narrative Rating	**Poor**

Taxa	**Count**
Siphlonurus	4
Hydroporinae	1
Chaetocladius	2
Diplocladius	12
Hydrobaenus	9
Orthocladiinae	2
Orthocladius	34
Polypedilum	1
Procladius	1
Pseudorthocladius	1
Rheocricotopus	5
Thieemannimyia group	1
Dolichopodidae	1
Tipula	1
Tubificidae	7
Crangonyx	3
Synurella	1
Asellidae	6
Caecidotea	1
TOTAL:	**93**

In-situ Water Quality

pH (SU)	8.71
Temperature (°C)	12.5
Dissolved Oxygen (mg/L)	16.15
Specific Conductivity (µS/cm)	148.0
Turbidity (NTU)	13.3

Physical Habitat Assessment

EPA Rapid Bioassessment Protocol

Epifaunal Substrate/Available Cover	13	Bank Stability- Left Bank	7
Pool Substrate Characterization	14	Bank Stability- Right Bank	7
Pool Variability	14	Vegetative Protection - Left Bank	9
Sediment Deposition	12	Vegetative Protection - Right Bank	9
Channel Flow Status	13	Riparian Vegetative Zone Width- Left Bank	10
Channel Alteration	16	Riparian Vegetative Zone Width- Right Bank	10
Channel Sinuosity	9		
EPA Habitat Score			**143**
EPA Narrative Rating			**Supporting**

MBSS Physical Habitat Index

	Value	Score		Value	Score
Instream Habitat	15	91.92	Shading	75	73.32
Epifaunal Substrate	13	85.91	Remoteness	13	70.01
Bank Stability	14	83.67	Woody Debris/Rootwads	26	100.00
PHI Score					**84.14**
PHI Narrative Rating					**Minimally Degraded**

Land Use/Land Cover Analysis:

Total Drainage Area (acres) 1135.18

Cover	**Acres**	**%Area**
Developed Land	**260.01**	**22.90**
Commercial	0	0
Industrial	0	0
Residential 1/8-acre	0	0
Residential 1/4-acre	6.38	0.56
Residential 1/2-acre	5.54	0.49
Residential 1-Acre	36.47	3.21
Residential 2-Acre	127.79	11.26
Transportation	17.23	1.52
Utility	66.59	5.87
Forest Land	**705.12**	**62.12**
Forested Wetland	0	0
Residential Woods	0	0
Woods	705.12	62.12
Open Land	**67.87**	**5.98**
Open Space	62.44	5.50
Open Wetland	0	0
Water	5.43	0.48
Agricultural Land	**102.19**	**9.00**
Pasture/Hay	28.62	2.52
Row Crops	73.56	6.48

Impervious Surface	**Acres**	**% Area**
Impervious Land	24.51	2.16

HB-23-2013 HBO Subwatershed

Upstream View:

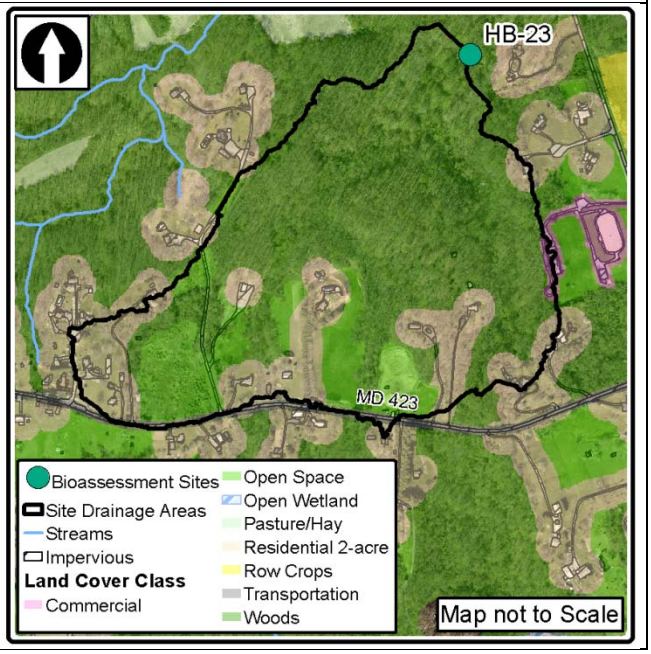
Downstream View:

(Latitude: 38.760395, **Longitude:** -76.565042)

Site HB-23-2013 is located upstream of Town Point Road within the Unnamed Tributary subwatershed. The channel is very shallow, but the site appears to be relatively unimpaired. The stream bottom consists of mud, sand, and clay, and extensive wetlands are present on the right bank. Instream features consist of run/glide complexes with small areas of shallow pools. Leaf packs and instream rootwads and woody debris are the primary habitats for benthic macroinvertebrates at this site. Banks are stable with no evidence of erosion and the riparian buffer is well developed. The benthic macroinvertebrate community at this site had moderately low taxa diversity. However, 35% of the community was intolerant to urban stressors and specialized feeding groups and habits were present, resulting in a Fair rating. Forest is the primary land use in this site's drainage area and imperviousness is approximately 4%.

Summary Results:

- Benthic macroinvertebrate community – *"Fair"*
- Habitat scores *"Supporting"* and *"Minimally Degraded"*
- Amphipods (Crangonyctidae) dominated the community.
- *In-situ* water quality values met COMAR standards.
- The stream channel is shallow and has extensive wetlands in its floodplain. The stream bottom consists of mud, sand, and clay. Moderate amounts of instream rootwads/woody debris are present and there is no evidence of erosion at this site.



HB-23-2013 HBO Subwatershed

Biological Assessment

Raw Metric Values

Total Taxa	11
EPT Taxa	2
Ephemeroptera Taxa	1
Intolerant Urban %	35
Ephemeroptera %	1.9
Scraper Taxa	1
% Climbers	1.9

Calculated Metric Scores

Total Taxa	1
EPT Taxa	3
Ephemeroptera Taxa	3
Intolerant Urban %	5
Ephemeroptera %	3
Scraper Taxa	3
% Climbers	3
BIBI Score	**3.00**
BIBI Narrative Rating	**Fair**

Taxa	**Count**
Siphlonurus	2
Amphinemura	22
Nemouridae	1
Diplocladius	5
Hydrobaenus	1
Orthocladius	8
Parametriocnemus	1
Rheocricotopus	2
Stegopterna	1
Naididae	1
Crangonyctidae	50
Synurella	3
Caecidotea	11
TOTAL:	**108**

In-situ Water Quality

pH (SU)	8.18
Temperature (°C)	14.8
Dissolved Oxygen (mg/L)	13.80
Specific Conductivity (µS/cm)	184.3
Turbidity (NTU)	16.2

Physical Habitat Assessment

EPA Rapid Bioassessment Protocol

Epifaunal Substrate/Available Cover	10	Bank Stability- Left Bank	9
Pool Substrate Characterization	6	Bank Stability- Right Bank	9
Pool Variability	3	Vegetative Protection - Left Bank	9
Sediment Deposition	18	Vegetative Protection - Right Bank	8
Channel Flow Status	15	Riparian Vegetative Zone Width- Left Bank	10
Channel Alteration	19	Riparian Vegetative Zone Width- Right Bank	10
Channel Sinuosity	8		
EPA Habitat Score			**134**
EPA Narrative Rating			**Supporting**

MBSS Physical Habitat Index

	Value	Score		Value	Score
Instream Habitat	6	66.28	Shading	70	68.32
Epifaunal Substrate	10	83.94	Remoteness	15	80.78
Bank Stability	18	94.87	Woody Debris/Rootwads	8	92.62
PHI Score					**81.13**
PHI Narrative Rating					**Minimally Degraded**

Land Use/Land Cover Analysis:

Total Drainage Area (acres) 105.70

Cover	**Acres**	**%Area**
Developed Land	**24.15**	**22.85**
Commercial	0.55	0.52
Industrial	0	0
Residential 1/8-acre	0	0
Residential 1/4-acre	0	0
Residential 1/2-acre	0	0
Residential 1-Acre	0	0
Residential 2-Acre	22.44	21.23
Transportation	1.16	1.10
Utility	0	0
Forest Land	**65.27**	**61.75**
Forested Wetland	0	0
Residential Woods	0	0
Woods	65.27	61.75
Open Land	**16.28**	**15.40**
Open Space	16.28	15.40
Open Wetland	0	0
Water	0	0
Agricultural Land	**0**	**0**
Pasture/Hay	0	0
Row Crops	0	0

Impervious Surface	**Acres**	**% Area**
Impervious Land	3.89	3.68

HB-25-2013 HBQ Subwatershed

Upstream View:

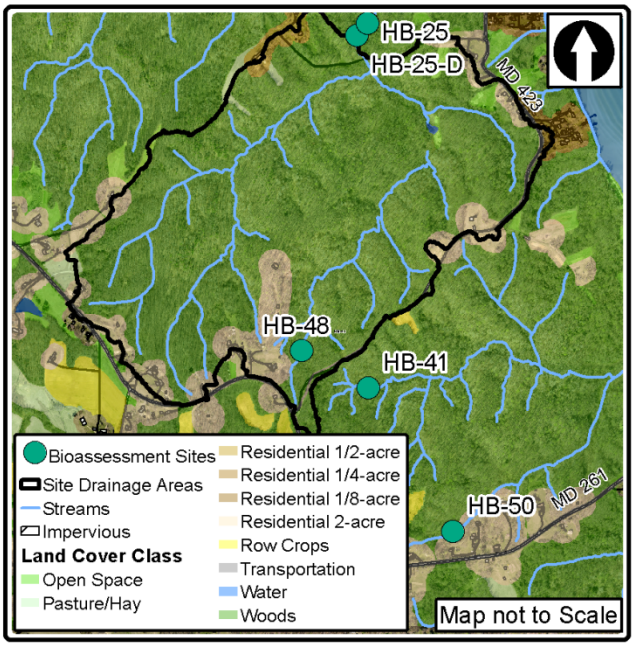
Downstream View:

(Latitude: 38.743478, **Longitude:** -76.565505**)**

Site HB-25-2013 is located downstream of Highland Road in the Unnamed Tributary II subwatershed. The stream is braided due to historic beaver activity and has extensive wetlands in its floodplain. Instream features consist mostly of run/glide complexes with a few shallow riffles. Instream woody debris and submerged vegetation account for the majority of the benthic macroinvertebrate habitat. This site has a well developed riparian buffer and stable stream banks. Taxa diversity was relatively high and the percentage of individuals intolerant to urban stressors was over 40%. However, Ephemeroptera taxa and climbers were absent, resulting in a Poor rating. Of the 456 acre drainage area, over 85% is forest and just over 1% consists of impervious surfaces.

Summary Results:

- Benthic macroinvertebrate community – *"Poor"*
- Habitat scores *"Comparable to Reference"* and *"Minimally Degraded"*
- Stoneflies (*Amphinemura*), Amphipods (Crangonyctidae), and Isopods (*Caecidotea*) dominated the community.
- *In-situ* water quality values met COMAR standards.
- This shallow stream is in excellent condition. The bottom consists of clay, mud, and sand with little gravel. The banks at this site are very stable and the riparian buffer is unimpaired. Epifaunal habitat is suboptimal.



HB-25-2013 HBQ Subwatershed

Biological Assessment

Raw Metric Values

Total Taxa	18
EPT Taxa	3
Ephemeroptera Taxa	0
Intolerant Urban %	43
Ephemeroptera %	0
Scraper Taxa	1
% Climbers	0

Calculated Metric Scores

Total Taxa	3
EPT Taxa	3
Ephemeroptera Taxa	1
Intolerant Urban %	5
Ephemeroptera %	1
Scraper Taxa	3
% Climbers	1
BIBI Score	**2.43**
BIBI Narrative Rating	**Poor**

Taxa	Count
Amphinemura	17
Isoperla	6
Ironoquia	3
Helichus	1
Hydroporinae	2
Corynoneura	1
Orthocladius	1
Pentaneurini	1
Pseudorthocladius	1
Rheocricotopus	5
Zalutschia	1
Ceratopogoninae	1
Stegopterna	1
Naididae	2
Tubificidae	9
Pisidium	6
Sphaeriidae	2
Crangonyctidae	14
Synurella	1
Asellidae	1
Caecidotea	11
TOTAL:	**87**

In-situ Water Quality

pH (SU)	7.74
Temperature (°C)	14.3
Dissolved Oxygen (mg/L)	9.99
Specific Conductivity (µS/cm)	211.3
Turbidity (NTU)	13.8

Physical Habitat Assessment

EPA Rapid Bioassessment Protocol

Epifaunal Substrate/Available Cover	15	Bank Stability- Left Bank	10
Pool Substrate Characterization	11	Bank Stability- Right Bank	10
Pool Variability	5	Vegetative Protection - Left Bank	10
Sediment Deposition	19	Vegetative Protection - Right Bank	9
Channel Flow Status	16	Riparian Vegetative Zone Width- Left Bank	10
Channel Alteration	19	Riparian Vegetative Zone Width- Right Bank	10
Channel Sinuosity	10		
EPA Habitat Score			**154**
EPA Narrative Rating			**Comparable to Reference**

MBSS Physical Habitat Index

	Value	Score		Value	Score
Instream Habitat	12	84.61	Shading	90	91.34
Epifaunal Substrate	15	100.00	Remoteness	10	53.85
Bank Stability	20	100.00	Woody Debris/Rootwads	18	100.00
PHI Score					**88.30**
PHI Narrative Rating					**Minimally Degraded**

Land Use/Land Cover Analysis:

Total Drainage Area (acres) 456.16

Cover	Acres	%Area
Developed Land	**58.87**	**12.91**
Commercial	0	0
Industrial	0	0
Residential 1/8-acre	0	0
Residential 1/4-acre	0.77	0.17
Residential 1/2-acre	4.55	1.00
Residential 1-Acre	0.11	0.02
Residential 2-Acre	48.41	10.61
Transportation	5.03	1.10
Utility	0	0
Forest Land	**390.77**	**85.66**
Forested Wetland	0	0
Residential Woods	0	0
Woods	390.77	85.66
Open Land	**4.59**	**1.01**
Open Space	4.25	0.93
Open Wetland	0	0
Water	0.34	0.08
Agricultural Land	**1.94**	**0.42**
Pasture/Hay	1.92	0.42
Row Crops	0.02	0.00

Impervious Surface	Acres	% Area
Impervious Land	5.75	1.26

HB-25-Dup-2013 HBQ Subwatershed

Upstream View:

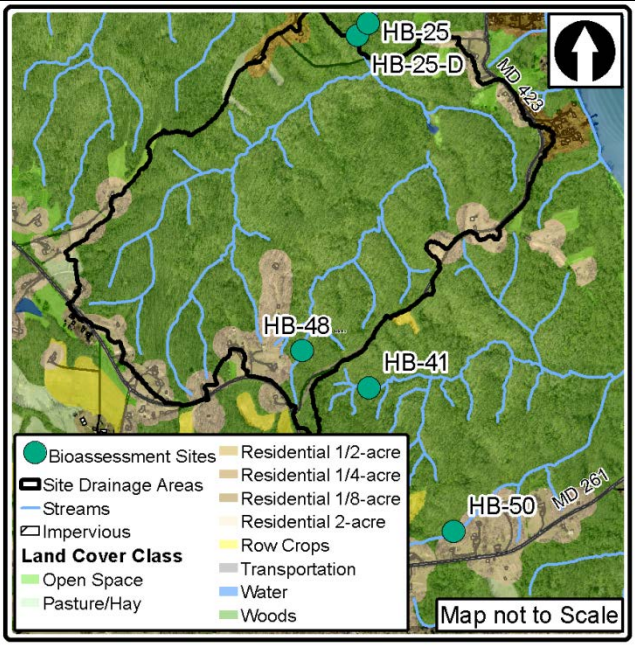
Downstream View:

Latitude: 38.743024 **Longitude:** -76.565989

Site HB-25-Dup-2013 is located immediately upstream of the sampling site HB-25-2013 in the Unnamed Tributary II subwatershed. Extensive wetlands are present in the floodplain due to historic beaver activity. Instream features consist mostly of run/glide complexes with shallow riffles. The stream substrate is dominated by mud, sand, and clay, with little gravel present. Leaf packs and instream woody debris and rootwads account for the majority of the benthic macroinvertebrate habitat. The stream has a well developed riparian buffer and banks are stable with minor erosion and optimal vegetative protection. Despite having a benthic macroinvertebrate community with a high percentage of individuals intolerant to urban stressors and moderate taxa diversity, the community was rated as Poor because Ephemeroptera taxa and climbers were absent. Of the 455 acre drainage area, over 85% is forest and just over 1% consists of impervious surfaces.

Summary Results:

- Benthic macroinvertebrate community – *"Poor"*
- Habitat scores *"Supporting"* and *"Minimally Degraded"*
- Stoneflies (*Amphinemura*), Amphipods (Crangonyctidae), and Isopods (*Caecidotea*) dominated the community.
- *In-situ* water quality values met COMAR standards.
- The stream channel is shallow and has extensive wetlands in the floodplain. Moderate amounts of instream rootwads/woody debris are present at there is very minor erosion on both banks. Leafpacks provide the majority of instream habitat for benthic macroinvertebrates.



HB-25-Dup-2013 HB Subwatershed

Biological Assessment

Raw Metric Values

Total Taxa	15
EPT Taxa	4
Ephemeroptera Taxa	0
Intolerant Urban %	54
Ephemeroptera %	0
Scraper Taxa	1
% Climbers	0

Calculated Metric Scores

Total Taxa	3
EPT Taxa	3
Ephemeroptera Taxa	1
Intolerant Urban %	5
Ephemeroptera %	1
Scraper Taxa	3
% Climbers	1
BIBI Score	**2.43**
BIBI Narrative Rating	**Poor**

Taxa	Count
Amphinemura	18
Capniidae	1
Isoperla	9
Nemouridae	1
Ironoquia	1
Anisoptera	1
Hydrobaenus	1
Orthocladius	7
Pseudorthocladius	1
Rheocricotopus	6
Ceratopogoninae	1
Tubificidae	4
Crangonyctidae	14
Gammaridae	2
Stygobromus	1
Synurella	1
Caecidotea	16
TOTAL:	**85**

In-situ Water Quality

pH (SU)	7.40
Temperature (°C)	14.4
Dissolved Oxygen (mg/L)	10.25
Specific Conductivity (µS/cm)	211.7
Turbidity (NTU)	10.47

Physical Habitat Assessment

EPA Rapid Bioassessment Protocol

Epifaunal Substrate/Available Cover	13	Bank Stability- Left Bank	9
Pool Substrate Characterization	10	Bank Stability- Right Bank	9
Pool Variability	4	Vegetative Protection - Left Bank	10
Sediment Deposition	15	Vegetative Protection - Right Bank	9
Channel Flow Status	15	Riparian Vegetative Zone Width- Left Bank	10
Channel Alteration	19	Riparian Vegetative Zone Width- Right Bank	10
Channel Sinuosity	10		
EPA Habitat Score			**143**
EPA Narrative Rating			**Supporting**

MBSS Physical Habitat Index

	Value	Score		Value	Score
Instream Habitat	10	73.53	Shading	95	99.94
Epifaunal Substrate	13	91.86	Remoteness	10	53.85
Bank Stability	18	94.87	Woody Debris/Rootwads	17	100.00
PHI Score					**85.68**
PHI Narrative Rating					**Minimally Degraded**

Land Use/Land Cover Analysis:

Total Drainage Area (acres) 455.22

Cover	Acres	%Area
Developed Land	**58.87**	**12.93**
Commercial	0	0
Industrial	0	0
Residential 1/8-acre	0	0
Residential 1/4-acre	0.77	0.17
Residential 1/2-acre	4.55	1.00
Residential 1-Acre	0.11	0.02
Residential 2-Acre	48.41	10.64
Transportation	5.03	1.10
Utility	0	0
Forest Land	**389.82**	**85.63**
Forested Wetland	0	0
Residential Woods	0	0
Woods	389.82	85.63
Open Land	**4.59**	**1.01**
Open Space	4.25	0.93
Open Wetland	0	0
Water	0.34	0.08
Agricultural Land	**1.94**	**0.43**
Pasture/Hay	1.92	0.42
Row Crops	0.02	0.01

Impervious Surface	Acres	% Area
Impervious Land	5.75	1.26

HB-31-2013 HB7 Subwatershed

Upstream View:

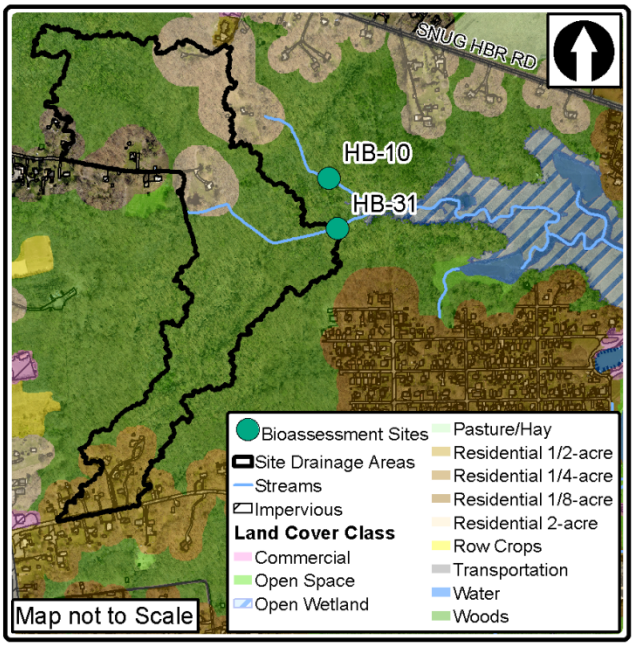
Downstream View:

(Latitude: 38.835103, **Longitude:** -76.504032**)**

Site HB-31-2013 is located southeast of Kellman Road within the Cedarhurst subwatershed. Forested and developed lands encompass the entire 67 acre drainage area, covering 70 and 30 percent, respectively. Approximately 3% of the drainage area is comprised of impervious surfaces. The stream channel at this site consists mainly of long runs and glides with a few shallow pools. A moderate amount of instream rootwads are present, but other stable substrates for benthic macroinvertebrates are lacking and the stream did not have a diversity of flows. The benthic macroinvertebrate community at this site was rated as Very Poor. Taxa diversity and the percentage of individuals intolerant to urban stressors were low. Low flow conditions and poor habitat complexity are likely affecting the biological community at this site.

Summary Results:

- Benthic macroinvertebrate community – *"Very Poor"*
- Habitat scores "Supporting" and *"Minimally Degraded"*
- Midges (*Pseudorthocladius*) heavily dominated the community.
- *In-situ* water quality values met COMAR standards.
- This is a highly straightened slow flowing stream with tannic water from standing leaves. Instream rootwads make up the majority of habitat, but overall Epifaunal substrate is poor.



HB-31-2013 HB7 Subwatershed

Biological Assessment

Raw Metric Values

Total Taxa	10
EPT Taxa	1
Ephemeroptera Taxa	0
Intolerant Urban %	7
Ephemeroptera %	0
Scraper Taxa	0
% Climbers	0

Calculated Metric Scores

Total Taxa	1
EPT Taxa	1
Ephemeroptera Taxa	1
Intolerant Urban %	1
Ephemeroptera %	1
Scraper Taxa	1
% Climbers	1
BIBI Score	**1.00**
BIBI Narrative Rating	**Very Poor**

Taxa	**Count**
Ironoquia	1
Chironomini	2
Pseudorthocladius	74
Tribelos	1
Dolichopodidae	1
Tipula	1
Tipulidae	1
Enchytraeidae	2
Tubificidae	1
Crangonyctidae	1
Crangonyx	7
Caecidotea	7
Nemata	1
TOTAL:	**100**

In-situ Water Quality

pH (SU)	7.11
Temperature (°C)	4.0
Dissolved Oxygen (mg/L)	8.71
Specific Conductivity (µS/cm)	39.0
Turbidity (NTU)	20.3

Physical Habitat Assessment

EPA Rapid Bioassessment Protocol

Epifaunal Substrate/Available Cover	4	Bank Stability- Left Bank	9
Pool Substrate Characterization	11	Bank Stability- Right Bank	9
Pool Variability	11	Vegetative Protection - Left Bank	10
Sediment Deposition	19	Vegetative Protection - Right Bank	10
Channel Flow Status	19	Riparian Vegetative Zone Width- Left Bank	10
Channel Alteration	14	Riparian Vegetative Zone Width- Right Bank	10
Channel Sinuosity	2		
EPA Habitat Score			**138**
EPA Narrative Rating			**Supporting**

MBSS Physical Habitat Index

	Value	Score		Value	Score
Instream Habitat	4	59.85	Shading	95	99.94
Epifaunal Substrate	6	63.67	Remoteness	15	80.78
Bank Stability	18	94.87	Woody Debris/Rootwads	12	100.00
PHI Score					**83.18**
PHI Narrative Rating					**Minimally Degraded**

Land Use/Land Cover Analysis:

Total Drainage Area (acres) 67.05

Cover	**Acres**	**%Area**
Developed Land	**20.12**	**30.01**
Commercial	0	0
Industrial	0	0
Residential 1/8-acre	0	0
Residential 1/4-acre	0	0
Residential 1/2-acre	6.17	9.21
Residential 1-Acre	4.25	6.34
Residential 2-Acre	9.70	14.47
Transportation	0	0
Utility	0	0
Forest Land	**46.92**	**69.99**
Forested Wetland	0	0
Residential Woods	0	0
Woods	46.92	69.99
Open Land	**0**	**0**
Open Space	0	0
Open Wetland	0	0
Water	0	0
Agricultural Land	**0**	**0**
Pasture/Hay	0	0
Row Crops	0	0

Impervious Surface	**Acres**	**% Area**
Impervious Land	1.91	2.85

HB-36-2013 HB1 Subwatershed

Upstream View:

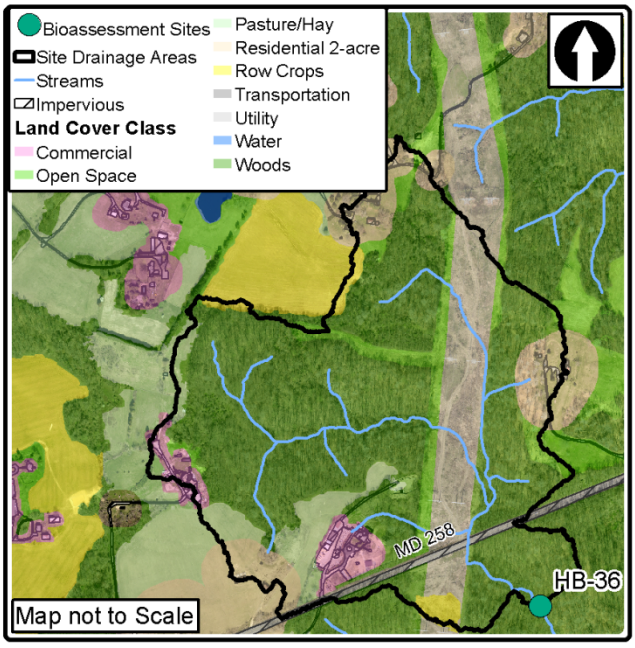
Downstream View:

(Latitude: 38.787632, **Longitude:** -76.584972**)**

Site HB-36-2013 is located in a forested valley downstream of Bayfront Road within the Tracy's Creek I subwatershed. Although the stream is in good condition with minimal disturbance, it appears have an intermittent flow regime. Instream reach features consist primarily of run/glide complexes and a few shallow riffles. Small sections of erosion are present on both banks, but they are generally stable. Despite having a benthic macroinvertebrate community with a high percentage of individuals intolerant to urban stressors and moderate taxa diversity, the community was still rated as Poor because Ephemeroptera taxa were absent. The Poor community rating may be attributed to an intermittent water regime and low habitat complexity. The majority of the 126 acre drainage area is forested with only 3% impervious surfaces.

Summary Results:

- Benthic macroinvertebrate community – *"Poor"*
- Habitat scores *"Supporting"* and *"Partially Degraded"*
- Midges (*Rheocricotopus* & *Orthocladius*) and black flies (*Stegopterna*) dominated the community.
- *In-situ* water quality values met COMAR standards.
- This shallow intermittent channel has a silty/clay bottom and no pool habitat. Instream rootwads and woody debris make up the majority of stable benthic macroinvertebrate habitat. Stream banks are relatively stable with optimal vegetative protection and riparian width.



HB-36-2013 HB1 Subwatershed

Biological Assessment

Raw Metric Values

Total Taxa	20
EPT Taxa	2
Ephemeroptera Taxa	0
Intolerant Urban %	35
Ephemeroptera %	0
Scraper Taxa	1
% Climbers	2

Calculated Metric Scores

Total Taxa	3
EPT Taxa	3
Ephemeroptera Taxa	1
Intolerant Urban %	5
Ephemeroptera %	1
Scraper Taxa	3
% Climbers	3
BIBI Score	**2.71**
BIBI Narrative Rating	**Poor**

Taxa	Count
Nemouridae	2
Nemoura	2
Ironoquia	1
Limnephilidae	2
Helichus	1
Diplocladius	9
Orthocladius	10
Parametriocnemus	4
Rheocricotopus	11
Dasyhelea	1
Dolichopodidae	1
Stegopterna	16
Tipula	1
Tipulidae	1
Enchytraeidae	1
Lumbricina	1
Naididae	1
Tubificidae	4
Pisidium	2
Sphaeriidae	3
Gammaridae	4
Gammarus	4
Stygobromus	2
Synurella	7
Caecidotea	8
TOTAL:	**99**

In-situ Water Quality

pH (SU)	6.58
Temperature (°C)	7.0
Dissolved Oxygen (mg/L)	11.23
Specific Conductivity (µS/cm)	201.7
Turbidity (NTU)	15.4

Physical Habitat Assessment

EPA Rapid Bioassessment Protocol

Epifaunal Substrate/Available Cover	11	Bank Stability- Left Bank	9
Pool Substrate Characterization	10	Bank Stability- Right Bank	9
Pool Variability	1	Vegetative Protection - Left Bank	9
Sediment Deposition	16	Vegetative Protection - Right Bank	9
Channel Flow Status	10	Riparian Vegetative Zone Width- Left Bank	10
Channel Alteration	19	Riparian Vegetative Zone Width- Right Bank	10
Channel Sinuosity	11		
EPA Habitat Score			**134**
EPA Narrative Rating			**Supporting**

MBSS Physical Habitat Index

	Value	Score		Value	Score
Instream Habitat	4	53.36	Shading	95	99.94
Epifaunal Substrate	11	88.59	Remoteness	7	37.70
Bank Stability	18	94.87	Woody Debris/Rootwads	10	96.51
PHI Score					**78.49**
PHI Narrative Rating					**Partially Degraded**

Land Use/Land Cover Analysis:

Total Drainage Area (acres) 126.41

Cover	Acres	%Area
Developed Land	**32.00**	**25.31**
Commercial	5.32	4.21
Industrial	0	0
Residential 1/8-acre	0	0
Residential 1/4-acre	0	0
Residential 1/2-acre	0	0
Residential 1-Acre	0	0
Residential 2-Acre	9.78	7.74
Transportation	2.16	1.71
Utility	14.74	11.66
Forest Land	**76.29**	**60.35**
Forested Wetland	0	0
Residential Woods	0	0
Woods	76.29	60.35
Open Land	**8.59**	**6.80**
Open Space	8.59	6.80
Open Wetland	0	0
Water	0	0
Agricultural Land	**9.53**	**7.54**
Pasture/Hay	7.36	5.82
Row Crops	2.17	1.72

Impervious Surface	Acres	% Area
Impervious Land	4.16	3.29

HB-41-2013 HBS Subwatershed

Upstream View:

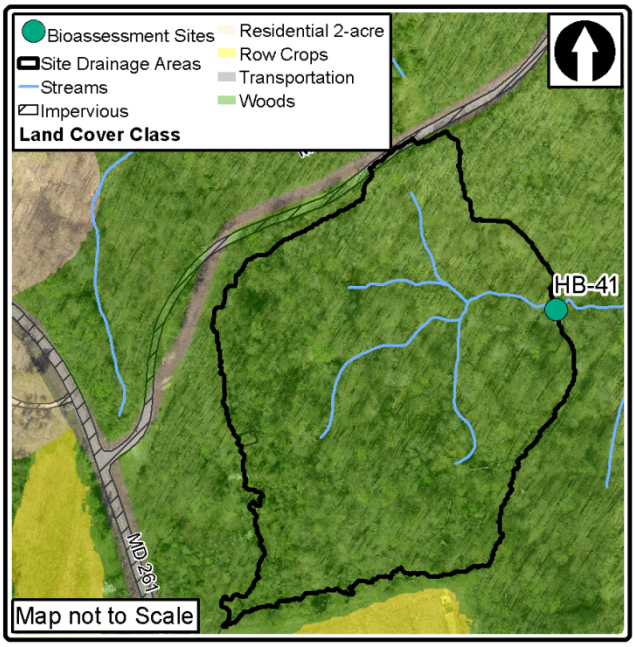
Downstream View:

(Latitude: 38.730165, **Longitude:** -76.56553**)**

Site HB-41-2013 is located in a deep forested valley with steep side slopes, northwest of Fairhaven Road, within the Unnamed Tributary III subwatershed. This headwater channel is intermittent with very low water level and poor habitat complexity. The reach consists mainly of run/glide complexes with very little pool and riffle habitat. The channel substrate is primarily comprised of sand, which is the dominate habitat. The benthic macroinvertebrate community at this site was rated as Very Poor and consisted mainly of midges (*Parametriocnemus)* and isopods (*Caecidotea)*. About 33% of the community was comprised of individuals intolerant to urban stressors, but an absence of Ephemeroptera, scrapers, and climbers resulted in a Very Poor score. Of the 13 acre drainage area, over 99% is forested land and about 4% is impervious surfaces. *In-situ* water quality parameters measured within COMAR standards, but conductivity was elevated, with a reading of 321µS/cm.

Summary Results:

- Benthic macroinvertebrate community – *"Very Poor"*
- Habitat scores *"Supporting"* and *"Minimally Degraded"*
- Midges (*Parametriocnemus*) and Isopods (*Caecidotea*) dominated the community.
- *In-situ* water quality values met COMAR standards, but conductivity was elevated.
- This very small/shallow headwater channel located in a deep valley had good sinuosity, stable stream banks, and a well developed riparian buffer.



HB-41-2013 HBS Subwatershed

Biological Assessment

Raw Metric Values

Total Taxa	17
EPT Taxa	1
Ephemeroptera Taxa	0
Intolerant Urban %	33
Ephemeroptera %	0
Scraper Taxa	0
% Climbers	0

Calculated Metric Scores

Total Taxa	3
EPT Taxa	1
Ephemeroptera Taxa	1
Intolerant Urban %	5
Ephemeroptera %	1
Scraper Taxa	1
% Climbers	1
BIBI Score	**1.86**
BIBI Narrative Rating	**Very Poor**

Taxa	**Count**
Amphinemura	4
Dytiscidae	1
Chaetocladius	10
Corynoneura	1
Diplocladius	2
Larsia	1
Limnophyes	1
Orthocladiinae	1
Parametriocnemus	16
Rheocricotopus	2
Zalutschia	2
Diptera	1
Erioptera	1
Tipula	1
Enchytraeidae	2
Lumbriculidae	2
Tubificidae	3
Gammaridae	7
Caecidotea	23
TOTAL:	**81**

In-situ Water Quality

pH (SU)	7.56
Temperature (°C)	11.0
Dissolved Oxygen (mg/L)	10.66
Specific Conductivity (µS/cm)	321.0
Turbidity (NTU)	10.9

Physical Habitat Assessment

EPA Rapid Bioassessment Protocol

Epifaunal Substrate/Available Cover	6	Bank Stability- Left Bank	9
Pool Substrate Characterization	7	Bank Stability- Right Bank	10
Pool Variability	2	Vegetative Protection - Left Bank	4
Sediment Deposition	17	Vegetative Protection - Right Bank	4
Channel Flow Status	15	Riparian Vegetative Zone Width- Left Bank	10
Channel Alteration	19	Riparian Vegetative Zone Width- Right Bank	10
Channel Sinuosity	14		
EPA Habitat Score			**127**
EPA Narrative Rating			**Supporting**

MBSS Physical Habitat Index

	Value	Score		Value	Score
Instream Habitat	6	87.69	Shading	98	100.00
Epifaunal Substrate	6	74.33	Remoteness	14	75.39
Bank Stability	19	97.47	Woody Debris/Rootwads	5	100.00
PHI Score					**89.15**
PHI Narrative Rating					**Minimally Degraded**

Land Use/Land Cover Analysis:

Total Drainage Area (acres) 13.05

Cover	**Acres**	**%Area**
Developed Land	**0.02**	**0.13**
Commercial	0	0
Industrial	0	0
Residential 1/8-acre	0	0
Residential 1/4-acre	0	0
Residential 1/2-acre	0	0
Residential 1-Acre	0	0
Residential 2-Acre	0	0
Transportation	0.02	0.13
Utility	0	0
Forest Land	**13.03**	**99.87**
Forested Wetland	0	0
Residential Woods	0	0
Woods	13.03	99.87
Open Land	**0**	**0**
Open Space	0	0
Open Wetland	0	0
Water	0	0
Agricultural Land	**0**	**0**
Pasture/Hay	0	0
Row Crops	0	0

Impervious Surface	**Acres**	**% Area**
Impervious Land	0.50	3.83

HB-47-2013 HBO Subwatershed

Upstream View:

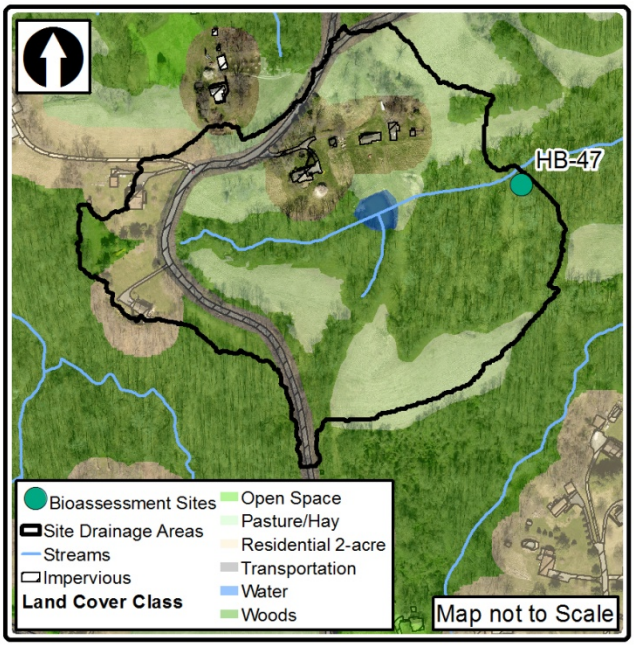
Downstream View:

(Latitude: 38.758725, **Longitude:** -76.576628**)**

Site HB-47-2013 begins just downstream of a farm field, east of Franklin Gibson Road, within the Unnamed Tributary subwatershed. The stream in this area is incised and banks are moderately unstable. Human activity has moderately impacted the riparian zone on both banks. The benthic macroinvertebrate community was rated as Very Poor due to low taxa diversity, low percentage of individuals intolerant to urban stressors, and an absence of Ephemeroptera taxa. This may be attributed to an overall lack of habitat and stable substrate. *In-situ* water quality values were within COMAR standards, but conductivity was elevated, with a reading of 359µS/cm. Land use in the drainage area to this site is diverse with 28% developed land, 42% forested land, and 28% agricultural land. Impervious surfaces account for about 5% of the drainage area.

Summary Results:

- Benthic macroinvertebrate community – *"Very Poor"*
- Habitat scores *"Partially Supporting"* and *"Partially Degraded"*
- Midges (*Diplocladius*) dominated the community.
- *In-situ* water quality values met COMAR standards, but conductivity was elevated.
- This small incised channel has low flow and very little benthic macroinvertebrate habitat. The reach consists mainly of long run/glide complexes with a moderate amount of instream woody debris present.



HB-47-2013 HBO Subwatershed

Biological Assessment

Raw Metric Values

Total Taxa	11
EPT Taxa	1
Ephemeroptera Taxa	0
Intolerant Urban %	1
Ephemeroptera %	0
Scraper Taxa	0
% Climbers	0

Calculated Metric Scores

Total Taxa	1
EPT Taxa	1
Ephemeroptera Taxa	1
Intolerant Urban %	1
Ephemeroptera %	1
Scraper Taxa	1
% Climbers	1
BIBI Score	**1.00**
BIBI Narrative Rating	**Very Poor**

Taxa	**Count**
Ironoquia	1
Chaetocladius	1
Diplocladius	49
Orthocladiinae	3
Parametriocnemus	2
Rheocricotopus	1
Erioptera	1
Naididae	4
Tubificidae	2
Pisidium	2
Crangonyctidae	10
Synurella	1
Asellidae	4
TOTAL:	**81**

In-situ Water Quality

pH (SU)	7.11
Temperature (°C)	14.5
Dissolved Oxygen (mg/L)	12.63
Specific Conductivity (µS/cm)	358.7
Turbidity (NTU)	26.7

Physical Habitat Assessment

EPA Rapid Bioassessment Protocol

Epifaunal Substrate/Available Cover	5	Bank Stability- Left Bank	6
Pool Substrate Characterization	7	Bank Stability- Right Bank	4
Pool Variability	7	Vegetative Protection - Left Bank	8
Sediment Deposition	9	Vegetative Protection - Right Bank	9
Channel Flow Status	17	Riparian Vegetative Zone Width- Left Bank	8
Channel Alteration	13	Riparian Vegetative Zone Width- Right Bank	6
Channel Sinuosity	7		
EPA Habitat Score			**106**
EPA Narrative Rating			**Partially Supporting**

MBSS Physical Habitat Index

	Value	Score		Value	Score
Instream Habitat	4	68.67	Shading	70	68.32
Epifaunal Substrate	5	63.48	Remoteness	6	32.31
Bank Stability	10	70.71	Woody Debris/Rootwads	8	100.00
PHI Score					**67.25**
PHI Narrative Rating					**Partially Degraded**

Land Use/Land Cover Analysis:

Total Drainage Area (acres) 28.30

Cover	**Acres**	**%Area**
Developed Land	**7.96**	**28.14**
Commercial	0	0
Industrial	0	0
Residential 1/8-acre	0	0
Residential 1/4-acre	0	0
Residential 1/2-acre	0	0
Residential 1-Acre	3.37	11.92
Residential 2-Acre	2.11	7.47
Transportation	2.48	8.75
Utility	0	0
Forest Land	**11.85**	**41.87**
Forested Wetland	0	0
Residential Woods	0	0
Woods	11.85	41.87
Open Land	**0.33**	**1.16**
Open Space	0	0
Open Wetland	0	0
Water	0.33	1.16
Agricultural Land	**8.16**	**28.83**
Pasture/Hay	8.16	28.83
Row Crops	0	0

Impervious Surface	**Acres**	**% Area**
Impervious Land	1.41	4.98

HB-48-2013 HBQ Subwatershed

Upstream View:

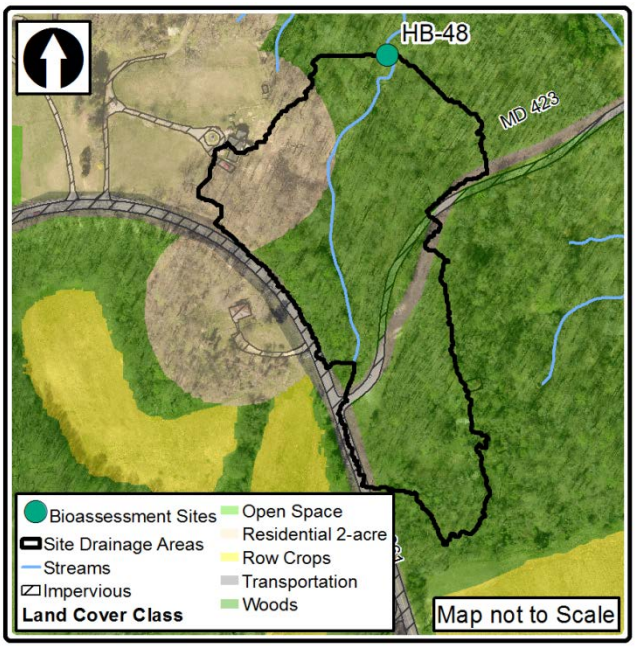
Downstream View:

(Latitude: 38.731533, **Longitude:** -76.568654**)**

Site HB-48-2013 is located in a valley north of Fairhaven Road within the Unnamed Tributary II subwatershed. Of the 9.6 acre drainage area, approximately 77% is forested, 23% is developed, and 3% consists of impervious surfaces. This is the smallest drainage area sampled within the Herring Bay Watershed. This headwater stream likely has intermittent flow indicated by very low water level. A few pieces of instream woody debris are present, but the majority of the macroinvertebrate habitat consists of leaf packs and shallow silty/clay riffles. The left bank of the stream is moderately unstable with some areas of severe erosion, but the riparian width is optimal on both banks. The benthic macroinvertebrate community at this site had low taxa diversity and a low percentage of individuals that were intolerant to urban stressors, which resulted in a Very Poor rating. This may be attributed to a lack of complex and stable habitat, and an intermittent water regime. *In-situ* water quality values were within COMAR standards, but conductivity was elevated with a reading of 527.3µS/cm.

Summary Results:

- Benthic macroinvertebrate community – *"Very Poor"*
- Habitat scores *"Partially Supporting"* and *"Partially Degraded"*
- Amphipods (Gammaridae) and midges (*Diplocladius* & *Parametriocnemus*) dominated the community.
- *In-situ* water quality values met COMAR standards, but conductivity was elevated.
- This is a shallow, intermittent channel with lots of instream leaf litter. A few pools are present throughout, but the site consists primarily of long stretches of shallow riffles, resulting in poor habitat complexity.



HB-48-2013 HBQ Subwatershed

Biological Assessment

Raw Metric Values

Total Taxa	13
EPT Taxa	1
Ephemeroptera Taxa	0
Intolerant Urban %	1
Ephemeroptera %	0
Scraper Taxa	1
% Climbers	7.2

Calculated Metric Scores

Total Taxa	1
EPT Taxa	1
Ephemeroptera Taxa	1
Intolerant Urban %	1
Ephemeroptera %	1
Scraper Taxa	3
% Climbers	3
BIBI Score	**1.57**
BIBI Narrative Rating	**Very Poor**

Taxa	**Count**
Limnephilidae	2
Corynoneura	1
Diplocladius	13
Parametriocnemus	16
Polypedilum	3
Rheocricotopus	1
Thienemanniella	6
Zavrelimyia	2
Pseudolimnophila	1
Tipula	7
Tubificidae	8
Fossaria	1
Amphipoda	1
Gammaridae	21
TOTAL:	**83**

In-situ Water Quality

pH (SU)	7.49
Temperature (°C)	17.4
Dissolved Oxygen (mg/L)	12.50
Specific Conductivity (µS/cm)	527.3
Turbidity (NTU)	13.6

Physical Habitat Assessment

EPA Rapid Bioassessment Protocol

Epifaunal Substrate/Available Cover	4	Bank Stability- Left Bank	3
Pool Substrate Characterization	6	Bank Stability- Right Bank	8
Pool Variability	3	Vegetative Protection - Left Bank	4
Sediment Deposition	8	Vegetative Protection - Right Bank	6
Channel Flow Status	14	Riparian Vegetative Zone Width- Left Bank	9
Channel Alteration	19	Riparian Vegetative Zone Width- Right Bank	9
Channel Sinuosity	11		
EPA Habitat Score			**104**
EPA Narrative Rating			**Partially Supporting**

MBSS Physical Habitat Index

	Value	Score		Value	Score
Instream Habitat	2	68.65	Shading	75	73.32
Epifaunal Substrate	4	64.72	Remoteness	12	64.62
Bank Stability	11	74.16	Woody Debris/Rootwads	4	100.00
PHI Score					**74.25**
PHI Narrative Rating					**Partially Degraded**

Land Use/Land Cover Analysis:

Total Drainage Area (acres) 9.59

Cover	**Acres**	**%Area**
Developed Land	**2.21**	**23.04**
Commercial	0	0
Industrial	0	0
Residential 1/8-acre	0	0
Residential 1/4-acre	0	0
Residential 1/2-acre	0	0
Residential 1-Acre	0	0
Residential 2-Acre	1.61	16.81
Transportation	0.60	6.23
Utility	0	0
Forest Land	**7.38**	**76.96**
Forested Wetland	0	0
Residential Woods	0	0
Woods	7.38	76.96
Open Land	**0**	**0**
Open Space	0	0
Open Wetland	0	0
Water	0	0
Agricultural Land	**0**	**0**
Pasture/Hay	0	0
Row Crops	0	0

Impervious Surface	**Acres**	**% Area**
Impervious Land	0.31	3.23

HB-49-2013 HBC Subwatershed

Upstream View:

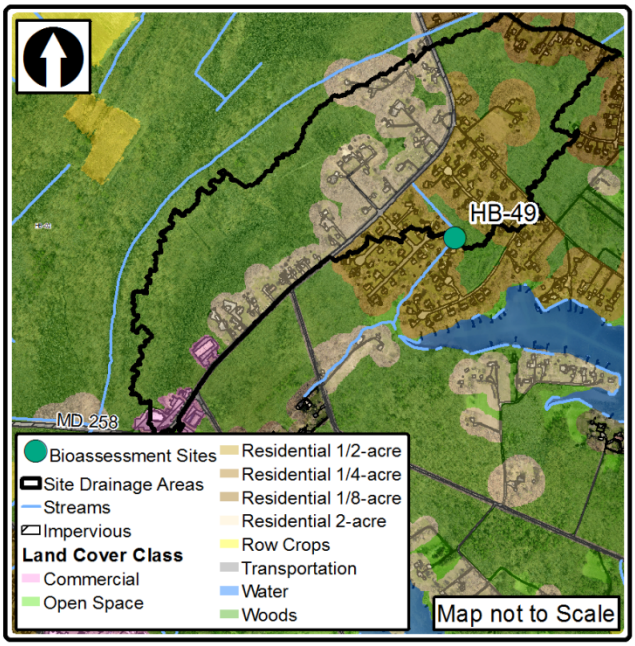
Downstream View:

(Latitude: 38.798462, **Longitude:** -76.536159**)**

Site HB-49-2013 is located behind a residential area at the end of Lee Way Court, within the Broadwater Creek subwatershed. The stream appears to have been straightened and the vegetation is mowed up to the edge on both banks. The stream has extensive amounts of trash due to its close proximity to homes. One neighbor indicated the stream has been treated with insecticides to control mosquito populations. Channel substrate consists mainly of silt and clay with little sand. Riffles are almost entirely absent and run/glides are the most dominant instream feature. Leaf packs are the primary habitat for benthic macroinvertebrates. The benthic macroinvertebrate community at this site was rated as Poor and dominated by aquatic worms. No Ephemeroptera taxa and very few specialized feeding groups or habits were collected at this site. Of the 157 acre drainage area, 52% is comprised of developed land. Impervious surfaces account for almost 12% of the drainage area, which is the second highest percentage of all Herring Bay sites. *In-situ* water quality values were within COMAR standards, but conductivity was slightly elevated with a reading of 260.3µS/cm.

Summary Results:

- Benthic macroinvertebrate community – *"Poor"*
- Habitat scores *"Non Supporting"* and *'Degraded"*
- Aquatic worms (*Tubificidae, Naididae* & *Lumbriculidae*) dominated the community.
- *In-situ* water quality values met COMAR standards, but conductivity was elevated.
- This straightened stream had abundant human refuse. Banks are moderately unstable with marginal vegetative protection. This site has poor habitat complexity for aquatic biota.



HB-49-2013 HBC Subwatershed

Biological Assessment

Raw Metric Values

Total Taxa	14
EPT Taxa	0
Ephemeroptera Taxa	0
Intolerant Urban %	10
Ephemeroptera %	0
Scraper Taxa	1
% Climbers	3

Calculated Metric Scores

Total Taxa	3
EPT Taxa	1
Ephemeroptera Taxa	1
Intolerant Urban %	3
Ephemeroptera %	1
Scraper Taxa	3
% Climbers	3
BIBI Score	**2.14**
BIBI Narrative Rating	**Poor**

Taxa	Count
Diplocladius	2
Orthocladiinae	5
Orthocladius	2
Chrysops	1
Tipula	2
Crambidae	1
Lumbriculidae	8
Naididae	13
Tubificidae	24
Pisidium	12
Sphaeriidae	8
Physa	2
Crangonyx	5
Gammaridae	4
Gammarus	1
Synurella	3
Caecidotea	6
TOTAL:	**99**

In-situ Water Quality

pH (SU)	7.58
Temperature (°C)	12.7
Dissolved Oxygen (mg/L)	7.26
Specific Conductivity (µS/cm)	260.3
Turbidity (NTU)	17.5

Physical Habitat Assessment

EPA Rapid Bioassessment Protocol

Epifaunal Substrate/Available Cover	5	Bank Stability- Left Bank	2
Pool Substrate Characterization	11	Bank Stability- Right Bank	3
Pool Variability	5	Vegetative Protection - Left Bank	5
Sediment Deposition	19	Vegetative Protection - Right Bank	4
Channel Flow Status	16	Riparian Vegetative Zone Width- Left Bank	9
Channel Alteration	10	Riparian Vegetative Zone Width- Right Bank	4
Channel Sinuosity	5		
EPA Habitat Score			**98**
EPA Narrative Rating			**Non Supporting**

MBSS Physical Habitat Index

	Value	Score		Value	Score
Instream Habitat	5	56.70	Shading	70	68.32
Epifaunal Substrate	5	52.33	Remoteness	7	37.70
Bank Stability	5	50.00	Woody Debris/Rootwads	7	85.19
PHI Score					**58.37**
PHI Narrative Rating					**Degraded**

Land Use/Land Cover Analysis:

Total Drainage Area (acres) 156.81

Cover	Acres	%Area
Developed Land	**82.22**	**52.43**
Commercial	3.37	2.15
Industrial	0	0
Residential 1/8-acre	7.47	4.76
Residential 1/4-acre	0	0
Residential 1/2-acre	30.33	19.34
Residential 1-Acre	0	0
Residential 2-Acre	35.71	22.78
Transportation	5.33	3.40
Utility	0	0
Forest Land	**74.60**	**47.57**
Forested Wetland	0	0
Residential Woods	0	0
Woods	74.60	47.57
Open Land	**0**	**0**
Open Space	0	0
Open Wetland	0	0
Water	0	0
Agricultural Land	**0**	**0**
Pasture/Hay	0	0
Row Crops	0	0

Impervious Surface	Acres	% Area
Impervious Land	18.19	11.60

HB-50-2013 HBS Subwatershed

Upstream View:

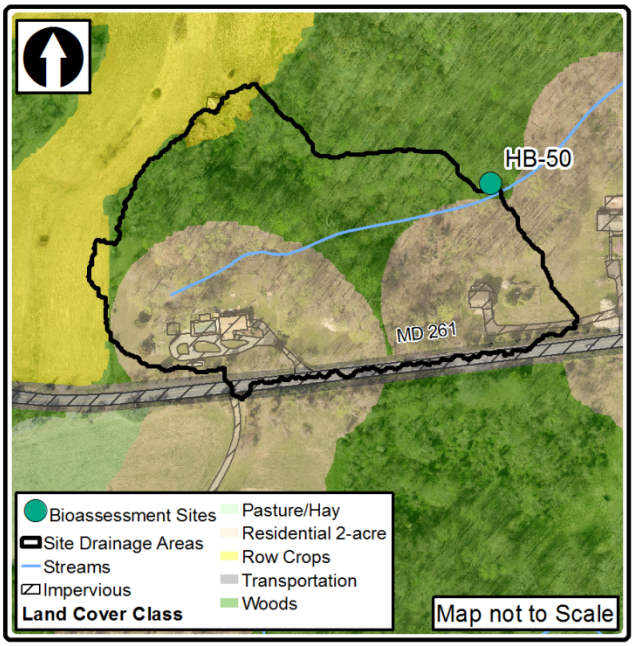
Downstream View:

(Latitude: 38.724922, **Longitude:** -76.561613**)**

Site HB-50-2013 is located north of Friendship Road, behind a residential area, within the Unnamed Tributary III subwatershed. A dirt trail leads up to the stream and there is a small culvert directly in the middle of the reach. The stream is very shallow and dissipates into wetland swales both at the upstream and downstream end. Long run/glide complexes make up the majority of the reach. A few shallow sandy riffles are present, but pools are essentially absent. Instream rootwads and woody debris are present, but in small amounts. The benthic macroinvertebrate community at this site had a high percentage of individuals intolerant to urban stressors and moderate taxa richness, but Ephemeroptera taxa and climbers were absent, resulting in the Poor score. Developed and forested land made up more than 96% of this 10.6 acre drainage area, with about 6% of the total area consisting of impervious surfaces. *In-situ* water quality measurements were within COMAR standards. However, conductivity was elevated with a reading of 289.5µS/cm and the water level was too low to record an accurate turbidity measurement.

Summary Results:

- Benthic macroinvertebrate community – "Poor"
- Habitat scores "Supporting" and "Minimally Degraded"
- Isopods (*Caecidotea*) and Amphipods (Crangonyctidae) dominated the community.
- *In-situ* water quality values met COMAR standards, but conductivity was elevated.
- This is likely an intermittent or ephemeral stream which dissipates into wetlands both at the upstream and downstream ends. Marginal instream habitat consists mainly of leaf packs and shallow riffles. This site has good bank stability with minimal erosion.



HB-50-2013 HBS Subwatershed

Biological Assessment

Raw Metric Values

Total Taxa	14
EPT Taxa	1
Ephemeroptera Taxa	0
Intolerant Urban %	43
Ephemeroptera %	0
Scraper Taxa	1
% Climbers	0

Calculated Metric Scores

Total Taxa	3
EPT Taxa	1
Ephemeroptera Taxa	1
Intolerant Urban %	5
Ephemeroptera %	1
Scraper Taxa	3
% Climbers	1
BIBI Score	**2.14**
BIBI Narrative Rating	**Poor**

Taxa	Count
Amphinemura	7
Nemouridae	1
Chaetocladius	10
Diplocladius	2
Hydrobaenus	2
Orthocladiinae	2
Parametriocnemus	4
Rheocricotopus	1
Tanytarsini	1
Zavrelimyia	1
Tipulidae	1
Enchytraeidae	1
Tubificidae	1
Sphaeriidae	1
Crangonyctidae	16
Asellidae	8
Caecidotea	30
TOTAL:	**89**

In-situ Water Quality

pH (SU)	6.99
Temperature (°C)	13.0
Dissolved Oxygen (mg/L)	9.12
Specific Conductivity (µS/cm)	289.5
Turbidity (NTU)	N/A

Physical Habitat Assessment

EPA Rapid Bioassessment Protocol

Epifaunal Substrate/Available Cover	7	Bank Stability- Left Bank	10
Pool Substrate Characterization	7	Bank Stability- Right Bank	9
Pool Variability	2	Vegetative Protection - Left Bank	8
Sediment Deposition	18	Vegetative Protection - Right Bank	8
Channel Flow Status	17	Riparian Vegetative Zone Width- Left Bank	9
Channel Alteration	15	Riparian Vegetative Zone Width- Right Bank	8
Channel Sinuosity	13		
EPA Habitat Score			**131**
EPA Narrative Rating			**Supporting**

MBSS Physical Habitat Index

	Value	Score		Value	Score
Instream Habitat	6	89.82	Shading	95	99.94
Epifaunal Substrate	7	81.50	Remoteness	7	37.70
Bank Stability	19	97.47	Woody Debris/Rootwads	5	100.00
PHI Score					**84.40**
PHI Narrative Rating					**Minimally Degraded**

Land Use/Land Cover Analysis:

Total Drainage Area (acres) 10.60

Cover	Acres	%Area
Developed Land	**6.38**	**60.21**
Commercial	0	0
Industrial	0	0
Residential 1/8-acre	0	0
Residential 1/4-acre	0	0
Residential 1/2-acre	0	0
Residential 1-Acre	0	0
Residential 2-Acre	5.95	56.11
Transportation	0.43	4.09
Utility	0	0
Forest Land	**3.87**	**36.49**
Forested Wetland	0	0
Residential Woods	0	0
Woods	3.87	36.49
Open Land	**0**	**0**
Open Space	0	0
Open Wetland	0	0
Water	0	0
Agricultural Land	**0.35**	**3.31**
Pasture/Hay	0	0
Row Crops	0.35	3.31

Impervious Surface	Acres	% Area
Impervious Land	0.66	6.22

Appendix B:

Quality Assurance/Quality Control Summary

Introduction

The purpose of this summary is to document the Quality Assurance/Quality Control (QA/QC) activities associated with the Herring Bay Targeted Biological Stream Assessments. The purpose of the monitoring was to collect and analyze physical and biological data that will be used to report on the condition of streams within the Herring Bay watershed, as required by Anne Arundel County's MS4 permit. The assessment included *in-situ* water quality, benthic macroinvertebrates, and physical habitat at 24 targeted sites pre-determined by the Anne Arundel County Department of Public Works (DPW). The DPW will incorporate data from this study into their Watershed Management Tool (WMT). In combination with other watershed data, these data will also be used to assist in the completion of a comprehensive watershed assessment and management plan to prioritize restoration within the Herring Bay watershed. The QA/QC procedures were developed in order to ensure that the data are of known and sufficient quality to meet the Measured Quality Objectives (MQO), and to provide estimates of the sources of variances associated with the individual variables measured. The QA/QC analysis was completed using methods described by Hill and Pieper (2011), including measures of precision, accuracy, bias, sensitivity, and completeness.

Training

Initial QA/QC procedures for benthic macroinvertebrate field sampling included formal training for field crew leaders in Maryland Biological Stream Survey (MBSS) Sampling Protocols. All field crew leaders and crew members attended MBSS Spring Index Period Training in 2013. In addition, all field crew leaders received current (2013) MBSS certifications for benthic macroinvertebrate sampling.

Laboratory supervisors overseeing staff processing benthic macroinvertebrate samples held current (2012) MBSS certifications for benthic macroinvertebrate processing and subsampling. Laboratory supervisors provided training, oversight, and QA/QC procedures to all laboratory staff working on this project, as required by MBSS.

Sample taxonomy was conducted by EcoAnalysts, Inc. in Moscow, Idaho. All taxonomists held current Society of Freshwater Scientists (SFS) taxonomic certifications for Ephemeroptera, Plecoptera, and Trichoptera; Other Arthropoda; Chironomidae; and Oligochaeta. Sample taxonomy QA/QC was conducted by Coastal Resources, Inc. (CRI), who also held current SFS taxonomic certifications.

Field Sampling

The 24 biological monitoring sites within the Herring Bay watershed were assessed using Standard Operating Procedures (SOP) described in the County's Quality Assurance Project Plan (QAPP) for the Anne Arundel County Biological Monitoring and Assessment Program (Anne Arundel County 2011). These methods are consistent with methods used by the Maryland Department of Natural Resources Maryland Biological Stream Survey (MBSS; DNR, 2010). The sites included 24 targeted sites and three duplicate sites assessed as a quality control measure. Prior to the sampling fieldwork, all field crew leaders received training and certification in MBSS Spring Index Period sampling protocols. Stream monitoring included assessments of *in-situ* water quality, benthic macroinvertebrates, and physical habitat. All fieldwork was conducted between March 15 and April 26, 2013, which is within the approved MBSS Spring Index Period for benthic macroinvertebatate sampling.

A Quanta Hydrolab multi-probe meter was used to obtain *in-situ* water quality measurements. The Hydrolab unit was calibrated prior to every field day during the sampling season. During calibration, all applicable calibration standards were added and membranes were replaced if needed. In addition, values of each parameter before and after calibration were recorded to note any possible malfunction in the meter or individual probes.

Both the U.S. Environmental Protection Agency's Rapid Bioassessment Protocol (RBP) for low gradient streams and the MBSS aquatic habitat assessment methodology for coastal plain streams were used to assess the condition and availability of the stream habitat for aquatic biota at each site (Barbour et al. 1999; Paul et al. 2002). A minimum of a two person team was used to determine these scores. This method results in a more holistic viewpoint towards the surrounding habitat and reduces individual scoring bias.

All equipment was thoroughly inspected and determined to be in good repair before field use. Benthic macroinvertebrate D-nets were inspected for holes, and repairs were made before each field sampling day. During sampling, benthic macroinvertebrate were collected in areas most likely to support the greatest taxonomic diversity. Habitat types sampled included cobble/gravel, snags/leafpacks, under-cut banks, root-wads, and submerged vegetation. Collected samples were stored in buckets using both internal and external labels. All samples were logged onto a chain-of-custody form upon completion of field collection, delivery to the laboratory for processing, and delivery to the taxonomist for identification.

As required by the QAPP, duplicate samples were taken at 10 percent of the sites sampled, which consisted of three sites. Duplicate samples were collected immediately upstream of the sampling location to determine repeatability and consistency of the field sampling protocols. Duplicate sites were selected in the field at stream reaches with similar habitat conditions to the original site and sampling included an assessment of the benthic macroinvertebrate community, aquatic habitat, *in-situ* water quality, and land use/land cover. These data were then directly compared to the data collected at the original site. Using data from the duplicate samples, the consistency of field sampling was determined using three measures, including Relative Percent Difference (RPD), Root Mean Square Error (RMSE), and Coefficient of Variability (CV). Acceptable MQOs for metric and index scores derived from Hill and Pieper (2011) are included below in ***Table 1***. In addition, the sensitivity of the BIBI scores was determined by calculating the 90% confidence interval (CI). The MQO for the 90% CI is ≤0.96.

Table 1 – Measured Quality Objectives for BIBI and metric scores.

Metric/Index	Measured Quality Objective (MQO)		
	Median RPD	**RMSE**	**CV**
Total Number of Taxa	<20	<4.3	<20
Number of EPT Taxa	<30	<1.7	<50
Number of Ephemeroptera Taxa	<30	<2.8	<100
Percent Intolerant to Urban	<80	<15.9	<80
Percent Ephemeroptera	<30	<0.5	<100
Number of Scraper Taxa	<30	<0.9	<100
Percent Climbers	<30	<6.9	<70
BIBI	<20	<0.6	<22

All data from duplicate sites were similar for Land Use/Land Cover and *in-situ* water quality. A comparison of duplicate benthic samples and the original samples is presented below in ***Table 2***. Among the three pairs of samples, values were generally consistent and acceptable by DPW's QA/QC standards. However, two metrics, Total Taxa and EPT Taxa, did not meet the MQO criteria for Mean RPD. The BIBI was also slighly outside of the acceptable range for the RMSE. In addition, several parameters, including Total Taxa, EPT Taxa, Scraper Taxa, Percent Climbers, and the BIBI did not meet the MQO criteria for CV. Values outside of the MQO criteria tended to be influenced by either low values or by variation observed in individual sites. The 90% CI for the three duplicates was 0.64, which was below the MQO criteria of ≤0.96 and is acceptable by DPW's QA/QC standards.

Table 2 – Results of duplicate sample analysis, including measures of precision. Note that values in bold exceeded MQOs. Also, N/A is shown when results could not be determined due to division of measure by zero.

Site	Total Taxa	EPT Taxa	Ephem Taxa	% Intol	% Ephem	Scraper Taxa	% Climbers	BIBI	Rating
HB-02	9	2	0	92.45	0.00	0	0.00	1.86	Very Poor
HB-02-DUP	7	1	0	93.46	0.00	0	0.00	1.57	Very Poor
HB-13	15	1	0	29.29	0.00	1	2.02	2.43	Poor
HB-13-DUP	10	0	0	11.11	0.00	0	0.00	1.29	Very Poor
HB-25	18	3	0	43.02	0.00	1	0.00	2.43	Poor
HB-25-DUP	15	4	0	54.12	0.00	1	0.00	2.43	Poor
Median RPD	**25.00**	**66.67**	N/A	22.84	N/A	N/A	N/A	16.91	-
RMSE	3.56	1.00	0.00	12.31	0.00	0.58	1.17	**0.68**	-
CV	**28.86**	**54.55**	N/A	22.84	N/A	**115.47**	**346.41**	**33.93**	-

A comparison of aquatic habitat data between the duplicate and original assessments is presented below in ***Table 3***. Field duplicate sites scored the same RBP rating as their corresponding pair at all but one site (HB-25). However, the narrative ranking only differed by one assessment category. All duplicate sites scored the same PHI rating as their corresponding pair.

Table 3 – Comparison of aquatic habitat assessments for original and duplicate sites.

Site	Total RBP	Percent Reference	RBP Classification	PHI Score	PHI Narrative Rating
HB-02-2013	120	71.43	Partially Supporting	71.27	Partially Degraded
HB-02-DUP-2013	124	73.81	Partially Supporting	79.84	Partially Degraded
HB-13-2013	112	66.67	Partially Supporting	73.97	Partially Degraded
HB-13-DUP-2013	116	69.05	Partially Supporting	74.18	Partially Degraded
HB-25-2013	154	91.67	Comparable to Reference	88.30	Minimally Degraded
HB-25-DUP-2013	143	85.12	Supporting	85.68	Minimally Degraded

Benthic Laboratory Processing and Subsampling

Benthic macroinvertebrate samples were processed, subsampled, and identified using protocols detailed in the QAPP and in *Laboratory Methods for Benthic Macroinvertebrate Processing and Taxonomy* (Boward 2000). Percent sorting efficiency (PSE) was used to evaluate the effectiveness of laboratory personnel in finding and removing specimens from a particular sample. The MQO for sorting efficiency is >90%. All personnel in training were required to achieve >90% sorting efficiency for 10 consecutive samples before they were deemed "Experienced". Ten percent of samples sorted by experienced laboratory personnel were also checked. The average sorting efficiency for this project was 98.6%, which exceeded the MQO of >90% and is acceptable by DPW's QA/QC standards.

Benthic Macroinvertebrate Taxonomy

Sample taxonomy was conducted by EcoAnalysts, Inc. in Moscow, Idaho. A synoptic voucher collection was retained, consisting of at least one good specimen of each taxon encountered within the project. Upon completion, this collection was reviewed by CRI, as well as the data. Upon receiving the taxonomy results, several sites had total counts less than the threshold (80 individuals) for calculating the BIBI. As a result, additional cells were picked from these samples and identified by CRI to obtain the remaining organisms required to calculate the BIBI.

Ten percent of the samples identified by EcoAnalysts were re-identified by CRI in-house for taxonomic agreement. Both Percent Difference in Enumeration (PDE) and Percent Taxonomic Disagreement (PTD) were calculated between the randomly selected samples. The MQO for PDE is ≤5%, and the MQO for PTD ≤15%. The results of the analysis of taxonomic agreement for the three samples are presented below in ***Tables 4 through 6***. The results indicate that the average PDE and PTD for the three duplicates was 3.70 and 13.38, respectively. These averages are within the MQO for these measures. Individually, HB-06 and HB-25 had PDE and PTD values that were within the MQO criteria; however, HB-13-Dup was outside of the MQO criteria for both PDE and PTD. This was mostly due to the difference in the enumerations of Asellidae between the primary and secondary taxonomist. The primary taxonomist identified 44 Asellidae

and the secondary taxonomist identified 64 Asellidae. However, it was noted by the secondary taxonomist that one of the Asellidae in the sample was a gravid female. Thus, young individuals that were not initially counted may have been dislodged from the female before the secondary taxonomist processed the sample. This observation would explain the difference in PDE and PTD in HB-13-Dup.

Table 4 – Taxonomic identification and enumeration results from primary and secondary taxonomists at HB-06, including PDE and PTD.

Final ID	Primary Taxonomist	Secondary Taxonomist	# of agreements
Amphinemura	3	3	3
Isoperla	3	3	3
Nemouridae	1	1	1
Ironoquia	3	3	3
Diplocladius	5	5	5
Hydrobaenus	3	1	1
Orthocladius	32	32	32
Pseudorthocladius	1	0	0
Rheocricotopus	3	3	3
Chrysops	1	1	1
Erioptera	1	1	1
Stegopterna	26	27	26
Tipula	1	1	1
Enchytraeidae	3	0	0
Tubificidae	3	6	3
Stygobromus	1	1	1
Caecidotea	3	3	3
Nemata	2	2	2
Chaetocladius	0	1	0
Total	95	94	89
PDE			0.53
PTD			6.32

Table 5 – Taxonomic identification and enumeration results from primary and secondary taxonomists at HB-13-DUP, including PDE and PTD.

Final ID	Primary Taxonomist	Secondary Taxonomist	# of agreements
Hydroporinae	1	1	1
Tribelos	1	1	1
Dasyhelea	1	0	0
Erioptera	1	0	0
Enchytraeidae	3	3	3
Naididae	10	6	6
Tubificidae	8	5	5
Crangonyx	3	3	3
Synurella	4	4	4
Asellidae	44	64	44
Caecidotea	5	5	5
Oligochaeta	0	1	0
Total	81	93	72
PDE			6.90
PTD			22.58

Table 6 – Taxonomic identification and enumeration results from primary and secondary taxonomists at HB-23, including PDE and PTD.

Final ID	Primary Taxonomist	Secondary Taxonomist	# of agreements
Siphlonurus	2	2	2
Amphinemura	22	22	22
Nemouridae	1	0	0
Diplocladius	5	5	5
Hydrobaenus	1	1	1
Orthocladius	8	6	6
Parametriocnemus	1	1	1
Rheocricotopus	2	0	0
Stegopterna	1	1	1
Naididae	1	1	1
Crangonyctidae	50	54	50
Synurella	3	3	3
Caecidotea	11	11	11
Tubificidae	0	1	0
Asellidae	0	6	0
Nemoura	0	1	0
Chironomidae	0	1	0
Total	108	116	103
PDE			3.57
PTD			11.21

Data Entry

The accuracy of data entry was checked by direct comparison of original datasheets with printouts from the database. An individual other than the primary data entry technician checked all data entries. All data entry errors were corrected prior to any analyses taking place.

Summary of QA/QC Results

A summary of the QA/QC results are presented below in ***Table 7***. With the exception of the RMSE for the BIBI (which was slightly outside of the acceptable MQO), all MQOs were met for this project.

Table 7 - Summary of QC results from 2013 Herring Bay biological stream assessments.

Activity	Performance Indicator	Measure	MQO	2013 Results
Field Sampling	Precision	Median RPD for BIBI	<20	16.91
		RMSE for BIBI	<0.6	0.68
Taxonomic Identification	Precision	Mean PDE	<5	3.70
		Mean PTD	<15	13.38
Lab Sorting and Processing	Bias	PSE	>90	98.60
Site Assessment	Sensitivity	90% CI for BIBI	≤0.96	0.64

Appendix C:

Statistical Data

Correlation matrix (Kendall):

Variables	pH	Temp	Do	Cond	Turb	Drainage Area (acres)	Impervious Percent	RBP Score	PHI Score	Instream Habitat	Epifaunal Substrate	Bank Stability	% Shading	Remoteness	# Woody Debris/ Rootwads	% Developed	% Forest	% Open	% Agricultural	Epifaunal Substrate/Available Cover	Pool Substrate Characterization	Pool Variability	Sediment Deposition	Channel Flow Status	Channel Alteration	Channel Sinuosity	Bank Stability- Left Bank	Bank Stability- Right Bank	Vegetative Protection - Left Bank	Vegetative Protection - Right Bank	Riparian Vegetative Zone Width- Left Bank	Riparian Vegetative Zone Width- Right Bank	BIBI Score	Total Taxa	# EPT Taxa	# Ephemeroptera Taxa	% Intolerant Urban	% Ephemeroptera	# Scraper Taxa	%Climbers
pH	**1**	0.270	0.115	0.099	-0.099	0.044	-0.004	0.116	0.202	0.164	0.230	-0.109	0.017	0.261	0.089	-0.067	0.044	-0.004	-0.080	0.216	-0.059	-0.016	0.060	-0.234	0.109	0.163	-0.151	-0.077	0.176	0.089	0.320	0.311	0.255	0.191	0.136	0.244	0.151	0.247	0.253	-0.009
Temp	0.270	**1**	**0.277**	**0.539**	-0.063	-0.119	0.095	0.080	0.079	0.122	0.034	-0.038	-0.201	-0.066	-0.092	0.071	0.087	-0.162	-0.210	0.087	-0.029	0.004	-0.064	**-0.331**	0.250	**0.393**	-0.077	0.013	-0.044	-0.035	0.102	-0.005	0.267	0.236	0.118	0.244	-0.020	0.230	0.348	0.273
Do	0.115	**0.277**	**1**	0.146	**-0.423**	0.257	**-0.296**	0.187	0.059	**0.452**	**0.344**	-0.268	-0.230	0.152	0.096	-0.209	0.036	0.246	**0.331**	**0.423**	**0.311**	**0.352**	-0.263	-0.148	0.290	**0.321**	-0.236	-0.307	-0.105	-0.071	-0.023	0.225	**0.368**	0.272	**0.484**	**0.390**	0.143	**0.388**	0.347	0.249
Cond	0.099	**0.539**	0.146	**1**	-0.138	-0.091	0.162	-0.107	-0.020	0.008	-0.030	-0.067	-0.096	-0.144	-0.064	0.028	0.067	-0.206	-0.163	0.099	-0.176	-0.164	0.059	-0.266	**0.381**	**0.430**	-0.090	0.000	-0.245	-0.150	0.088	-0.066	0.114	0.206	0.140	-0.016	0.063	-0.040	0.269	0.065
Turb	-0.099	-0.063	**-0.423**	-0.138	**1**	**-0.455**	**0.383**	-0.123	-0.099	**-0.477**	**-0.370**	0.301	0.038	**-0.342**	-0.080	**0.312**	-0.154	-0.149	-0.222	**-0.423**	-0.294	-0.156	0.059	0.156	**-0.363**	**-0.438**	0.304	0.307	**0.324**	**0.380**	-0.079	-0.234	-0.283	-0.182	**-0.602**	-0.227	-0.293	-0.230	-0.123	-0.148
Drainage Area (acres)	0.044	-0.119	0.257	-0.091	**-0.455**	**1**	**-0.312**	**0.321**	-0.067	**0.661**	**0.514**	-0.151	-0.230	0.128	**0.377**	-0.162	0.051	0.262	**0.331**	**0.506**	**0.487**	**0.434**	0.102	0.190	0.200	0.054	-0.073	-0.255	0.018	-0.071	-0.014	0.169	0.300	0.215	**0.439**	0.227	0.293	0.230	0.269	0.083
Impervious Percent	-0.004	0.095	**-0.296**	0.162	**0.383**	**-0.312**	**1**	**-0.313**	-0.209	**-0.351**	**-0.446**	0.050	0.071	-0.268	-0.224	**0.549**	-0.249	-0.069	**-0.339**	**-0.464**	-0.302	**-0.327**	-0.042	-0.089	-0.145	-0.221	0.064	0.102	0.044	0.018	0.005	-0.281	-0.080	-0.099	**-0.448**	-0.114	-0.087	-0.135	0.000	0.009
RBP Score	0.116	0.080	0.187	-0.107	-0.123	**0.321**	**-0.313**	**1**	**0.472**	**0.428**	**0.721**	**0.365**	0.013	0.277	**0.394**	-0.139	**0.337**	0.020	-0.080	**0.499**	**0.346**	0.247	0.285	0.132	**0.401**	0.189	**0.387**	0.286	**0.435**	**0.346**	**0.436**	**0.588**	**0.318**	**0.315**	**0.345**	0.277	**0.310**	0.294	0.242	0.028
PHI Score	0.202	0.079	0.059	-0.020	-0.099	-0.067	-0.209	**0.472**	**1**	0.125	**0.404**	**0.343**	**0.321**	**0.424**	0.216	-0.202	**0.470**	-0.157	**-0.331**	0.240	-0.008	-0.057	0.068	-0.173	0.281	0.296	0.270	**0.375**	**0.385**	0.274	**0.596**	**0.609**	0.173	0.190	0.204	0.227	0.119	0.230	0.078	0.055
Instream Habitat	0.164	0.122	**0.452**	0.008	**-0.477**	**0.661**	**-0.351**	**0.428**	0.125	**1**	**0.584**	-0.080	-0.181	0.227	**0.369**	-0.268	0.217	0.085	0.217	**0.605**	**0.538**	**0.537**	0.054	0.045	0.307	0.291	-0.077	-0.162	0.014	-0.094	0.108	0.297	**0.452**	**0.384**	**0.551**	0.344	**0.344**	0.360	0.296	0.141
Epifaunal Substrate	0.230	0.034	**0.344**	-0.030	**-0.370**	**0.514**	**-0.446**	**0.721**	**0.404**	**0.584**	**1**	0.121	-0.004	**0.363**	**0.409**	-0.242	0.183	0.169	0.117	**0.784**	**0.384**	0.211	0.128	0.000	**0.366**	0.305	0.152	0.059	0.292	0.185	**0.427**	**0.630**	**0.450**	**0.355**	**0.555**	0.366	**0.421**	**0.383**	0.313	0.059
Bank Stability	-0.109	-0.038	-0.268	-0.067	0.301	-0.151	0.050	**0.365**	**0.343**	-0.080	0.121	**1**	0.075	-0.017	0.068	0.059	0.125	-0.043	**-0.390**	-0.026	-0.107	-0.199	0.287	0.081	0.221	-0.062	**0.930**	**0.910**	**0.334**	**0.365**	**0.372**	0.228	-0.094	-0.009	-0.235	-0.129	-0.004	-0.134	-0.119	-0.273
% Shading	0.017	-0.201	-0.230	-0.096	0.038	-0.230	0.071	0.013	**0.321**	-0.181	-0.004	0.075	**1**	0.070	0.114	-0.079	0.121	-0.162	-0.168	-0.048	-0.155	-0.264	-0.054	-0.277	0.000	0.093	0.032	0.108	0.222	0.103	0.239	0.134	0.018	0.048	-0.014	-0.120	0.151	-0.109	-0.053	-0.127
Remoteness	0.261	-0.066	0.152	-0.144	**-0.342**	0.128	-0.268	0.277	**0.424**	0.227	**0.363**	-0.017	0.070	**1**	0.050	-0.194	0.259	0.029	-0.135	0.168	0.035	0.060	0.035	-0.018	0.161	0.178	-0.054	0.031	0.123	0.083	**0.520**	**0.703**	0.110	-0.017	0.264	0.220	0.190	0.206	-0.064	-0.010
# Woody Debris/ Rootwads	0.089	-0.092	0.096	-0.064	-0.080	**0.377**	-0.224	**0.394**	0.216	**0.369**	**0.409**	0.068	0.114	0.050	**1**	-0.176	0.216	-0.123	0.123	**0.483**	0.166	**0.336**	0.150	0.073	0.110	0.017	0.087	0.026	0.284	0.126	0.206	0.166	0.244	0.272	0.234	0.296	0.116	0.313	0.358	0.070
% Developed	-0.067	0.071	-0.209	0.028	**0.312**	-0.162	**0.549**	-0.139	-0.202	-0.268	-0.242	0.059	-0.079	-0.194	-0.176	**1**	**-0.383**	-0.020	**-0.323**	**-0.373**	-0.025	-0.098	0.110	0.004	-0.127	-0.246	0.116	0.085	0.201	0.301	0.079	-0.159	-0.123	-0.157	**-0.367**	-0.081	-0.206	-0.071	0.011	0.083
% Forest	0.044	0.087	0.036	0.067	-0.154	0.051	-0.249	**0.337**	**0.470**	0.217	0.183	0.125	0.121	0.259	0.216	**-0.383**	**1**	**-0.488**	-0.264	0.133	0.034	0.131	0.034	0.055	0.263	0.188	0.039	0.187	0.114	-0.027	0.226	0.309	0.182	**0.347**	0.213	0.049	0.111	0.055	0.224	0.129
% Open	-0.004	-0.162	0.246	-0.206	-0.149	0.262	-0.069	0.020	-0.157	0.085	0.169	-0.043	-0.162	0.029	-0.123	-0.020	**-0.488**	**1**	**0.321**	0.178	0.081	-0.088	-0.074	-0.035	0.134	0.094	0.052	-0.113	-0.076	-0.050	-0.090	0.062	0.125	-0.202	0.152	0.248	0.162	0.218	-0.114	-0.014
% Agricultural	-0.080	-0.210	**0.331**	-0.163	-0.222	**0.331**	**-0.339**	-0.080	**-0.331**	0.217	0.117	**-0.390**	-0.168	-0.135	0.123	**-0.323**	-0.264	**0.321**	**1**	0.264	0.254	0.269	-0.234	0.152	-0.125	-0.009	**-0.332**	**-0.456**	-0.190	-0.108	**-0.407**	-0.139	0.036	0.048	0.288	0.009	0.097	0.017	-0.012	-0.059
Epifaunal Substrate/Available Cover	0.216	0.087	**0.423**	0.099	**-0.423**	**0.506**	**-0.464**	**0.499**	0.240	**0.605**	**0.784**	-0.026	-0.048	0.168	**0.483**	**-0.373**	0.133	0.178	0.264	**1**	0.300	0.193	0.053	-0.124	0.324	**0.381**	0.004	-0.080	0.069	-0.028	0.242	**0.354**	**0.461**	**0.416**	**0.555**	0.358	**0.336**	**0.374**	**0.382**	0.126
Pool Substrate Characterization	-0.059	-0.029	**0.311**	-0.176	-0.294	**0.487**	-0.302	**0.346**	-0.008	**0.538**	**0.384**	-0.107	-0.155	0.035	0.166	-0.025	0.034	0.081	0.254	0.300	**1**	**0.483**	0.158	0.180	0.111	0.120	-0.077	-0.176	0.056	0.024	-0.093	0.139	0.270	0.202	0.265	0.190	0.173	0.194	0.161	0.211
Pool Variability	-0.016	0.004	**0.352**	-0.164	-0.156	**0.434**	**-0.327**	0.247	-0.057	**0.537**	0.211	-0.199	-0.264	0.060	**0.336**	-0.098	0.131	-0.088	0.269	0.193	**0.483**	**1**	-0.026	0.280	-0.061	-0.108	-0.178	-0.300	0.100	0.087	-0.168	0.053	0.201	0.222	0.272	0.185	-0.012	0.205	0.203	0.153
Sediment Deposition	0.060	-0.064	-0.263	0.059	0.059	0.102	-0.042	0.285	0.068	0.054	0.128	0.287	-0.054	0.035	0.150	0.110	0.034	-0.074	-0.234	0.053	0.158	-0.026	**1**	0.290	0.156	-0.121	**0.368**	0.237	0.160	0.057	0.208	0.080	-0.063	-0.146	-0.044	0.017	0.115	0.000	-0.042	-0.292
Channel Flow Status	-0.234	**-0.331**	-0.148	-0.266	0.156	0.190	-0.089	0.132	-0.173	0.045	0.000	0.081	-0.277	-0.018	0.073	0.004	0.055	-0.035	0.152	-0.124	0.180	0.280	0.290	**1**	-0.121	**-0.420**	0.142	0.027	0.028	0.038	-0.223	-0.090	-0.317	-0.256	-0.034	-0.174	-0.025	-0.178	-0.270	-0.311
Channel Alteration	0.109	0.250	0.290	**0.381**	**-0.363**	0.200	-0.145	**0.401**	0.281	0.307	**0.366**	0.221	0.000	0.161	0.110	-0.127	0.263	0.134	-0.125	0.324	0.111	-0.061	0.156	-0.121	**1**	**0.599**	0.221	0.210	0.020	-0.030	0.324	**0.366**	0.330	0.251	**0.483**	0.186	**0.400**	0.164	0.219	-0.005
Channel Sinuosity	0.163	**0.393**	**0.321**	**0.430**	**-0.438**	0.054	-0.221	0.189	0.296	0.291	0.305	-0.062	0.093	0.178	0.017	-0.246	0.188	0.094	-0.009	**0.381**	0.120	-0.108	-0.121	**-0.420**	**0.599**	**1**	-0.109	-0.027	-0.171	-0.173	0.224	0.302	**0.402**	0.309	**0.454**	0.266	**0.318**	0.268	0.195	0.190
Bank Stability- Left Bank	-0.151	-0.077	-0.236	-0.090	0.304	-0.073	0.064	**0.387**	0.270	-0.077	0.152	**0.930**	0.032	-0.054	0.087	0.116	0.039	0.052	**-0.332**	0.004	-0.077	-0.178	**0.368**	0.142	0.221	-0.109	**1**	**0.827**	**0.371**	**0.389**	0.321	0.203	-0.106	-0.040	-0.201	-0.097	0.026	-0.103	-0.146	-0.310
Bank Stability- Right Bank	-0.077	0.013	-0.307	0.000	0.307	-0.255	0.102	0.286	**0.375**	-0.162	0.059	**0.910**	0.108	0.031	0.026	0.085	0.187	-0.113	**-0.456**	-0.080	-0.176	-0.300	0.237	0.027	0.210	-0.027	**0.827**	**1**	0.288	**0.338**	**0.418**	0.247	-0.146	-0.027	-0.312	-0.175	-0.043	-0.179	-0.121	-0.219
Vegetative Protection - Left Bank	0.176	-0.044	-0.105	-0.245	**0.324**	0.018	0.044	**0.435**	**0.385**	0.014	0.292	**0.334**	0.222	0.123	0.284	0.201	0.114	-0.076	-0.190	0.069	0.056	0.100	0.160	0.028	0.020	-0.171	**0.371**	0.288	**1**	**0.784**	**0.374**	**0.405**	0.122	0.151	0.040	0.099	0.180	0.097	0.174	-0.128
Vegetative Protection - Right Bank	0.089	-0.035	-0.071	-0.150	**0.380**	-0.071	0.018	**0.346**	0.274	-0.094	0.185	**0.365**	0.103	0.083	0.126	0.301	-0.027	-0.050	-0.108	-0.028	0.024	0.087	0.057	0.038	-0.030	-0.173	**0.389**	**0.338**	**0.784**	**1**	**0.393**	**0.357**	-0.099	0.051	-0.071	-0.109	-0.004	-0.098	0.006	-0.212
Riparian Vegetative Zone Width- Left Bank	0.320	0.102	-0.023	0.088	-0.079	-0.014	0.005	**0.436**	**0.596**	0.108	**0.427**	**0.372**	0.239	**0.520**	0.206	0.079	0.226	-0.090	**-0.407**	0.242	-0.093	-0.168	0.208	-0.223	0.324	0.224	0.321	**0.418**	**0.374**	**0.393**	**1**	**0.685**	0.114	0.140	0.095	0.057	0.134	0.056	0.144	-0.108
Riparian Vegetative Zone Width- Right Bank	0.311	-0.005	0.225	-0.066	-0.234	0.169	-0.281	**0.588**	**0.609**	0.297	**0.630**	0.228	0.134	**0.703**	0.166	-0.159	0.309	0.062	-0.139	**0.354**	0.139	0.053	0.080	-0.090	**0.366**	0.302	0.203	0.247	**0.405**	**0.357**	**0.685**	**1**	0.301	0.308	**0.376**	0.164	**0.347**	0.160	0.126	-0.044
BIBI Score	0.255	0.267	**0.368**	0.114	-0.283	0.300	-0.080	**0.318**	0.173	**0.452**	**0.450**	-0.094	0.018	0.110	0.244	-0.123	0.182	0.125	0.036	**0.461**	0.270	0.201	-0.063	-0.317	0.330	**0.402**	-0.106	-0.146	0.122	-0.099	0.114	0.301	**1**	**0.574**	**0.479**	**0.460**	**0.542**	**0.441**	**0.635**	**0.400**
Total Taxa	0.191	0.236	0.272	0.206	-0.182	0.215	-0.099	**0.315**	0.190	**0.384**	**0.355**	-0.009	0.048	-0.017	0.272	-0.157	**0.347**	-0.202	0.048	**0.416**	0.202	0.222	-0.146	-0.256	0.251	0.309	-0.040	-0.027	0.151	0.051	0.140	0.308	**0.574**	**1**	0.326	0.093	0.294	0.116	**0.544**	0.260
# EPT Taxa	0.136	0.118	**0.484**	0.140	**-0.602**	**0.439**	**-0.448**	**0.345**	0.204	**0.551**	**0.555**	-0.235	-0.014	0.264	0.234	**-0.367**	0.213	0.152	0.288	**0.555**	0.265	0.272	-0.044	-0.034	**0.483**	**0.454**	-0.201	-0.312	0.040	-0.071	0.095	**0.376**	**0.479**	0.326	**1**	0.288	**0.485**	0.272	0.237	0.069
# Ephemeroptera Taxa	0.244	0.244	**0.390**	-0.016	-0.227	0.227	-0.114	0.277	0.227	0.344	0.366	-0.129	-0.120	0.220	0.296	-0.081	0.049	0.248	0.009	0.358	0.190	0.185	0.017	-0.174	0.186	0.266	-0.097	-0.175	0.099	-0.109	0.057	0.164	**0.460**	0.093	0.288	**1**	0.146	**0.976**	0.311	**0.398**
% Intolerant Urban	0.151	-0.020	0.143	0.063	-0.293	0.293	-0.087	**0.310**	0.119	**0.344**	**0.421**	-0.004	0.151	0.190	0.116	-0.206	0.111	0.162	0.097	**0.336**	0.173	-0.012	0.115	-0.025	**0.400**	**0.318**	0.026	-0.043	0.180	-0.004	0.134	**0.347**	**0.542**	0.294	**0.485**	0.146	**1**	0.135	0.236	-0.111
% Ephemeroptera	0.247	0.230	**0.388**	-0.040	-0.230	0.230	-0.135	0.294	0.230	0.360	**0.383**	-0.134	-0.109	0.206	0.313	-0.071	0.055	0.218	0.017	**0.374**	0.194	0.205	0.000	-0.178	0.164	0.268	-0.103	-0.179	0.097	-0.098	0.056	0.160	**0.441**	0.116	0.272	**0.976**	0.135	**1**	0.303	**0.416**
# Scraper Taxa	0.253	0.348	0.347	0.269	-0.123	0.269	0.000	0.242	0.078	0.296	0.313	-0.119	-0.053	-0.064	0.358	0.011	0.224	-0.114	-0.012	**0.382**	0.161	0.203	-0.042	-0.270	0.219	0.195	-0.146	-0.121	0.174	0.006	0.144	0.126	**0.635**	**0.544**	0.237	0.311	0.236	0.303	**1**	**0.523**
%Climbers	-0.009	0.273	0.249	0.065	-0.148	0.083	0.009	0.028	0.055	0.141	0.059	-0.273	-0.127	-0.010	0.070	0.083	0.129	-0.014	-0.059	0.126	0.211	0.153	-0.292	-0.311	-0.005	0.190	-0.310	-0.219	-0.128	-0.212	-0.108	-0.044	**0.400**	0.260	0.069	**0.398**	-0.111	**0.416**	**0.523**	**1**

Values in bold are different from 0 with a significance level alpha=0.05

p-values:

Variables	pH	Temp	Do	Cond	Turb	Drainage Area (acres)	Impervious Percent	RBP Score	PHI Score	Instream Habitat	Epifaunal Substrate	Bank Stability	% Shading	Remoteness	# Woody Debris/ Rootwads	% Developed	% Forest	% Open	% Agricultural	Epifaunal Substrate/Available Cover	Pool Substrate Characterization	Pool Variability	Sediment Deposition	Channel Flow Status	Channel Alteration	Channel Sinuosity	Bank Stability- Left Bank	Bank Stability- Right Bank	Vegetative Protection - Left Bank	Vegetative Protection - Right Bank	Riparian Vegetative Zone Width- Left Bank	Riparian Vegetative Zone Width- Right Bank	BIBI Score	Total Taxa	# EPT Taxa	# Ephemeroptera Taxa	% Intolerant Urban	% Ephemeroptera	# Scraper Taxa	%Climbers
pH	**0**	0.077	0.459	0.526	0.526	0.791	1.000	0.459	0.186	0.308	0.152	0.502	0.936	0.098	0.578	0.672	0.791	1.000	0.626	0.172	0.727	0.936	0.725	0.146	0.517	0.308	0.357	0.646	0.284	0.601	0.054	0.062	0.112	0.229	0.421	0.185	0.328	0.172	0.166	0.977
Temp	0.077	**0**	**0.048**	**0.000**	0.668	0.406	0.510	0.615	0.615	0.453	0.850	0.830	0.208	0.689	0.560	0.652	0.578	0.300	0.185	0.592	0.872	1.000	0.705	**0.038**	0.128	**0.013**	0.645	0.957	0.805	0.847	0.552	1.000	0.095	0.135	0.488	0.186	0.916	0.203	0.055	0.097
Do	0.459	**0.048**	**0**	0.303	**0.002**	0.067	**0.034**	0.224	0.711	**0.004**	**0.031**	0.091	0.148	0.337	0.542	0.168	0.832	0.111	**0.035**	**0.007**	**0.050**	**0.024**	0.099	0.360	0.076	**0.042**	0.143	0.055	0.528	0.680	0.910	0.177	**0.021**	0.083	**0.003**	**0.032**	0.355	**0.029**	0.055	0.129
Cond	0.526	**0.000**	0.303	**0**	0.330	0.529	0.252	0.492	0.916	0.979	0.871	0.687	0.556	0.364	0.691	0.874	0.672	0.184	0.304	0.538	0.271	0.299	0.726	0.095	**0.019**	**0.006**	0.588	1.000	0.131	0.364	0.610	0.709	0.484	0.191	0.405	0.964	0.692	0.856	0.139	0.710
Turb	0.526	0.668	**0.002**	0.330	**0**	**0.001**	**0.006**	0.428	0.526	**0.002**	**0.020**	0.056	0.830	**0.029**	0.615	**0.039**	0.314	0.339	0.160	**0.007**	0.064	0.325	0.726	0.333	**0.026**	**0.005**	0.058	0.055	**0.045**	**0.019**	0.651	0.159	0.076	0.251	**0.000**	0.218	0.054	0.203	0.508	0.375
Drainage Area (acres)	0.791	0.406	0.067	0.529	**0.001**	**0**	**0.025**	**0.034**	0.672	**< 0.0001**	**0.001**	0.347	0.148	0.423	**0.014**	0.289	0.751	0.089	**0.035**	**0.001**	**0.002**	**0.005**	0.535	0.236	0.226	0.748	0.665	0.111	0.934	0.680	0.955	0.314	0.059	0.173	**0.008**	0.218	0.054	0.203	0.139	0.626
Impervious Percent	1.000	0.510	**0.034**	0.252	**0.006**	**0.025**	**0**	**0.039**	0.169	**0.026**	**0.005**	0.768	0.668	0.088	0.145	**0.000**	0.101	0.671	**0.031**	**0.003**	0.057	**0.036**	0.808	0.591	0.383	0.164	0.704	0.534	0.805	0.934	1.000	0.090	0.628	0.539	**0.007**	0.553	0.579	0.467	1.000	0.977
RBP Score	0.459	0.615	0.224	0.492	0.428	**0.034**	**0.039**	**0**	**0.001**	**0.007**	**< 0.0001**	**0.021**	0.957	0.078	**0.010**	0.368	**0.026**	0.915	0.626	**0.001**	**0.030**	0.116	0.075	0.419	**0.014**	0.238	**0.016**	0.075	**0.007**	**0.034**	**0.008**	**0.000**	**0.046**	**0.045**	**0.037**	0.132	**0.042**	0.101	0.186	0.886
PHI Score	0.186	0.615	0.711	0.916	0.526	0.672	0.169	**0.001**	**0**	0.436	**0.011**	**0.030**	**0.042**	**0.006**	0.160	0.185	**0.002**	0.312	**0.035**	0.127	0.979	0.729	0.685	0.282	0.086	0.061	0.093	**0.019**	**0.017**	0.093	**0.000**	**0.000**	0.281	0.229	0.222	0.218	0.443	0.203	0.682	0.753
Instream Habitat	0.308	0.453	**0.004**	0.979	**0.002**	**< 0.0001**	**0.026**	**0.007**	0.436	**0**	**0.000**	0.643	0.277	0.167	**0.021**	0.090	0.170	0.608	0.188	**0.000**	**0.001**	**0.001**	0.763	0.806	0.072	0.077	0.660	0.338	0.956	0.596	0.547	0.086	**0.006**	**0.018**	**0.001**	0.071	**0.030**	0.053	0.118	0.416
Epifaunal Substrate	0.152	0.850	**0.031**	0.871	**0.020**	**0.001**	**0.005**	**< 0.0001**	**0.011**	**0.000**	**0**	0.475	1.000	**0.027**	**0.011**	0.129	0.255	0.302	0.489	**< 0.0001**	**0.021**	0.201	0.456	1.000	**0.033**	0.066	0.376	0.740	0.087	0.285	**0.014**	**0.000**	**0.007**	**0.031**	**0.001**	0.056	**0.008**	**0.041**	0.101	0.748
Bank Stability	0.502	0.830	0.091	0.687	0.056	0.347	0.768	**0.021**	**0.030**	0.643	0.475	**0**	0.663	0.935	0.686	0.726	0.435	0.808	**0.017**	0.892	0.530	0.224	0.084	0.642	0.198	0.723	**< 0.0001**	**< 0.0001**	**0.048**	**0.031**	**0.031**	0.189	0.584	0.978	0.177	0.517	1.000	0.489	0.544	0.110
% Shading	0.936	0.208	0.148	0.556	0.830	0.148	0.668	0.957	**0.042**	0.277	1.000	0.663	**0**	0.685	0.485	0.629	0.452	0.319	0.311	0.786	0.355	0.106	0.764	0.097	1.000	0.587	0.869	0.529	0.191	0.559	0.169	0.449	0.935	0.787	0.955	0.548	0.349	0.581	0.799	0.469
Remoteness	0.098	0.689	0.337	0.364	**0.029**	0.423	0.088	0.078	**0.006**	0.167	**0.027**	0.935	0.685	**0**	0.769	0.219	0.097	0.872	0.413	0.305	0.850	0.727	0.849	0.935	0.349	0.279	0.764	0.870	0.471	0.637	**0.002**	**< 0.0001**	0.514	0.936	0.124	0.250	0.230	0.271	0.751	0.977
# Woody Debris/ Rootwads	0.578	0.560	0.542	0.691	0.615	**0.014**	0.145	**0.010**	0.160	**0.021**	**0.011**	0.686	0.485	0.769	**0**	0.217	0.128	0.440	0.448	**0.002**	0.307	**0.033**	0.357	0.666	0.516	0.936	0.606	0.892	0.083	0.457	0.223	0.328	0.131	0.087	0.165	0.109	0.458	0.083	0.050	0.688
% Developed	0.672	0.652	0.168	0.874	**0.039**	0.289	**0.000**	0.368	0.185	0.090	0.129	0.726	0.629	0.219	0.217	**0**	**0.006**	0.915	**0.039**	**0.017**	0.893	0.540	0.499	1.000	0.446	0.119	0.480	0.607	0.216	0.065	0.650	0.342	0.450	0.322	**0.026**	0.681	0.177	0.715	0.975	0.626
% Forest	0.791	0.578	0.832	0.672	0.314	0.751	0.101	**0.026**	**0.002**	0.170	0.255	0.435	0.452	0.097	0.128	**0.006**	**0**	**0.001**	0.093	0.406	0.851	0.408	0.850	0.746	0.108	0.237	0.828	0.244	0.492	0.890	0.173	0.061	0.257	**0.026**	0.201	0.819	0.474	0.785	0.218	0.438
% Open	1.000	0.300	0.111	0.184	0.339	0.089	0.671	0.915	0.312	0.608	0.302	0.808	0.319	0.872	0.440	0.915	**0.001**	**0**	**0.044**	0.270	0.627	0.593	0.664	0.850	0.428	0.572	0.764	0.497	0.659	0.782	0.609	0.729	0.449	0.207	0.372	0.183	0.300	0.235	0.548	0.954
% Agricultural	0.626	0.185	**0.035**	0.304	0.160	**0.035**	**0.031**	0.626	**0.035**	0.188	0.489	**0.017**	0.311	0.413	0.448	**0.039**	0.093	**0.044**	**0**	0.106	0.124	0.097	0.159	0.364	0.472	0.978	**0.046**	**0.006**	0.262	0.536	**0.018**	0.428	0.847	0.785	0.094	1.000	0.552	0.963	0.974	0.747
Epifaunal Substrate/Available Cover	0.172	0.592	**0.007**	0.538	**0.007**	**0.001**	**0.003**	**0.001**	0.127	**0.000**	**< 0.0001**	0.892	0.786	0.305	**0.002**	**0.017**	0.406	0.270	0.106	**0**	0.069	0.236	0.764	0.462	0.056	**0.020**	1.000	0.642	0.697	0.889	0.160	**0.039**	**0.005**	**0.010**	**0.001**	0.058	**0.032**	**0.043**	**0.041**	0.469
Pool Substrate Characterization	0.727	0.872	**0.050**	0.271	0.064	**0.002**	0.057	**0.030**	0.979	**0.001**	**0.021**	0.530	0.355	0.850	0.307	0.893	0.851	0.627	0.124	0.069	**0**	**0.003**	0.351	0.287	0.530	0.479	0.660	0.297	0.759	0.911	0.605	0.431	0.107	0.222	0.129	0.331	0.283	0.310	0.406	0.222
Pool Variability	0.936	1.000	**0.024**	0.299	0.325	**0.005**	**0.036**	0.116	0.729	**0.001**	0.201	0.224	0.106	0.727	**0.033**	0.540	0.408	0.593	0.097	0.236	**0.003**	**0**	0.892	0.088	0.734	0.517	0.288	0.069	0.562	0.618	0.333	0.772	0.223	0.170	0.112	0.335	0.958	0.272	0.281	0.372
Sediment Deposition	0.725	0.705	0.099	0.726	0.726	0.535	0.808	0.075	0.685	0.763	0.456	0.084	0.764	0.849	0.357	0.499	0.850	0.664	0.159	0.764	0.351	0.892	**0**	0.084	0.373	0.477	**0.029**	0.160	0.355	0.757	0.236	0.660	0.721	0.383	0.821	0.963	0.483	1.000	0.847	0.090
Channel Flow Status	0.146	**0.038**	0.360	0.095	0.333	0.236	0.591	0.419	0.282	0.806	1.000	0.642	0.097	0.935	0.666	1.000	0.746	0.850	0.364	0.462	0.287	0.088	0.084	**0**	0.492	**0.011**	0.408	0.891	0.889	0.845	0.205	0.619	0.059	0.121	0.866	0.379	0.893	0.356	0.159	0.071
Channel Alteration	0.517	0.128	0.076	**0.019**	**0.026**	0.226	0.383	**0.014**	0.086	0.072	**0.033**	0.198	1.000	0.349	0.516	0.446	0.108	0.428	0.472	0.056	0.530	0.734	0.373	0.492	**0**	**0.000**	0.205	0.227	0.930	0.884	0.071	**0.041**	0.055	0.139	**0.007**	0.357	**0.014**	0.412	0.270	1.000
Channel Sinuosity	0.308	**0.013**	**0.042**	**0.006**	**0.005**	0.748	0.164	0.238	0.061	0.077	0.066	0.723	0.587	0.279	0.936	0.119	0.237	0.572	0.978	**0.020**	0.479	0.517	0.477	**0.011**	**0.000**	**0**	0.528	0.891	0.317	0.316	0.197	0.081	**0.015**	0.058	**0.008**	0.166	**0.044**	0.154	0.308	0.270
Bank Stability- Left Bank	0.357	0.645	0.143	0.588	0.058	0.665	0.704	**0.016**	0.093	0.660	0.376	**< 0.0001**	0.869	0.764	0.606	0.480	0.828	0.764	**0.046**	1.000	0.660	0.288	**0.029**	0.408	0.205	0.528	**0**	**< 0.0001**	**0.030**	**0.024**	0.068	0.251	0.544	0.827	0.256	0.641	0.892	0.609	0.459	0.074
Bank Stability- Right Bank	0.646	0.957	0.055	1.000	0.055	0.111	0.534	0.075	**0.019**	0.338	0.740	**< 0.0001**	0.529	0.870	0.892	0.607	0.244	0.497	**0.006**	0.642	0.297	0.069	0.160	0.891	0.227	0.891	**< 0.0001**	**0**	0.093	**0.049**	**0.016**	0.159	0.394	0.891	0.075	0.377	0.808	0.354	0.542	0.209
Vegetative Protection - Left Bank	0.284	0.805	0.528	0.131	**0.045**	0.934	0.805	**0.007**	**0.017**	0.956	0.087	**0.048**	0.191	0.471	0.083	0.216	0.492	0.659	0.262	0.697	0.759	0.562	0.355	0.889	0.930	0.317	**0.030**	0.093	**0**	**< 0.0001**	**0.035**	**0.022**	0.485	0.375	0.840	0.637	0.272	0.638	0.379	0.476
Vegetative Protection - Right Bank	0.601	0.847	0.680	0.364	**0.019**	0.680	0.934	**0.034**	0.093	0.596	0.285	**0.031**	0.559	0.637	0.457	0.065	0.890	0.782	0.536	0.889	0.911	0.618	0.757	0.845	0.884	0.316	**0.024**	**0.049**	**< 0.0001**	**0**	**0.027**	**0.045**	0.575	0.781	0.708	0.602	1.000	0.637	1.000	0.234
Riparian Vegetative Zone Width- Left Bank	0.054	0.552	0.910	0.610	0.651	0.955	1.000	**0.008**	**0.000**	0.547	**0.014**	**0.031**	0.169	**0.002**	0.223	0.650	0.173	0.609	**0.018**	0.160	0.605	0.333	0.236	0.205	0.071	0.197	0.068	**0.016**	**0.035**	**0.027**	**0**	**0.000**	0.526	0.424	0.614	0.808	0.428	0.808	0.481	0.561
Riparian Vegetative Zone Width- Right Bank	0.062	1.000	0.177	0.709	0.159	0.314	0.090	**0.000**	**0.000**	0.086	**0.000**	0.189	0.449	**< 0.0001**	0.328	0.342	0.061	0.729	0.428	**0.039**	0.431	0.772	0.660	0.619	**0.041**	0.081	0.251	0.159	**0.022**	**0.045**	**0.000**	**0**	0.085	0.072	**0.038**	0.429	**0.036**	0.431	0.539	0.828
BIBI Score	0.112	0.095	**0.021**	0.484	0.076	0.059	0.628	**0.046**	0.281	**0.006**	**0.007**	0.584	0.935	0.514	0.131	0.450	0.257	0.449	0.847	**0.005**	0.107	0.223	0.721	0.059	0.055	**0.015**	0.544	0.394	0.485	0.575	0.526	0.085	**0**	**0.000**	**0.006**	**0.016**	**0.001**	**0.018**	**0.001**	**0.020**
Total Taxa	0.229	0.135	0.083	0.191	0.251	0.173	0.539	**0.045**	0.229	**0.018**	**0.031**	0.978	0.787	0.936	0.087	0.322	**0.026**	0.207	0.785	**0.010**	0.222	0.170	0.383	0.121	0.139	0.058	0.827	0.891	0.375	0.781	0.424	0.072	**0.000**	**0**	0.057	0.645	0.062	0.551	**0.003**	0.125
# EPT Taxa	0.421	0.488	**0.003**	0.405	**0.000**	**0.008**	**0.007**	**0.037**	0.222	**0.001**	**0.001**	0.177	0.955	0.124	0.165	**0.026**	0.201	0.372	0.094	**0.001**	0.129	0.112	0.821	0.866	**0.007**	**0.008**	0.256	0.075	0.840	0.708	0.614	**0.038**	**0.006**	0.057	**0**	0.153	**0.003**	0.168	0.236	0.719
# Ephemeroptera Taxa	0.185	0.186	**0.032**	0.964	0.218	0.218	0.553	0.132	0.218	0.071	0.056	0.517	0.548	0.250	0.109	0.681	0.819	0.183	1.000	0.058	0.331	0.335	0.963	0.379	0.357	0.166	0.641	0.377	0.637	0.602	0.808	0.429	**0.016**	0.645	0.153	**0**	0.438	**< 0.0001**	0.161	**0.043**
% Intolerant Urban	0.328	0.916	0.355	0.692	0.054	0.054	0.579	**0.042**	0.443	**0.030**	**0.008**	1.000	0.349	0.230	0.458	0.177	0.474	0.300	0.552	**0.032**	0.283	0.958	0.483	0.893	**0.014**	**0.044**	0.892	0.808	0.272	1.000	0.428	**0.036**	**0.001**	0.062	**0.003**	0.438	**0**	0.467	0.196	0.510
% Ephemeroptera	0.172	0.203	**0.029**	0.856	0.203	0.203	0.467	0.101	0.203	0.053	**0.041**	0.489	0.581	0.271	0.083	0.715	0.785	0.235	0.963	**0.043**	0.310	0.272	1.000	0.356	0.412	0.154	0.609	0.354	0.638	0.637	0.808	0.431	**0.018**	0.551	0.168	**< 0.0001**	0.467	**0**	0.162	**0.031**
# Scraper Taxa	0.166	0.055	0.055	0.139	0.508	0.139	1.000	0.186	0.682	0.118	0.101	0.544	0.799	0.751	0.050	0.975	0.218	0.548	0.974	**0.041**	0.406	0.281	0.847	0.159	0.270	0.308	0.459	0.542	0.379	1.000	0.481	0.539	**0.001**	**0.003**	0.236	0.161	0.196	0.162	**0**	**0.007**
%Climbers	0.977	0.097	0.129	0.710	0.375	0.626	0.977	0.886	0.753	0.416	0.748	0.110	0.469	0.977	0.688	0.626	0.438	0.954	0.747	0.469	0.222	0.372	0.090	0.071	1.000	0.270	0.074	0.209	0.476	0.234	0.561	0.828	**0.020**	0.125	0.719	**0.043**	0.510	**0.031**	**0.007**	**0**

Values in bold are different from 0 with a significance level alpha=0.05

Coefficients of determination (Kendall):

Variables	pH	Temp	Do	Cond	Turb	Drainage Area (acres)	Impervious Percent	RBP Score	PHI Score	Instream Habitat	Epifaunal Substrate	Bank Stability	% Shading	Remoteness	# Woody Debris/ Rootwads	% Developed	% Forest	% Open	% Agricultural	Epifaunal Substrate/Available Cover	Pool Substrate Characterization	Pool Variability	Sediment Deposition	Channel Flow Status	Channel Alteration	Channel Sinuosity	Bank Stability- Left Bank	Bank Stability- Right Bank	Vegetative Protection - Left Bank	Vegetative Protection - Right Bank	Riparian Vegetative Zone Width- Left Bank	Riparian Vegetative Zone Width- Right Bank	BIBI Score	Total Taxa	# EPT Taxa	# Ephemeroptera Taxa	% Intolerant Urban	% Ephemeroptera	# Scraper Taxa	%Climbers
pH	**1**	0.073	0.013	0.010	0.010	0.002	0.000	0.013	0.041	0.027	0.053	0.012	0.000	0.068	0.008	0.005	0.002	0.000	0.006	0.047	0.003	0.000	0.004	0.055	0.012	0.027	0.023	0.006	0.031	0.008	0.103	0.096	0.065	0.036	0.019	0.060	0.023	0.061	0.064	0.000
Temp	0.073	**1**	0.077	0.290	0.004	0.014	0.009	0.006	0.006	0.015	0.001	0.001	0.040	0.004	0.009	0.005	0.008	0.026	0.044	0.008	0.001	0.000	0.004	0.109	0.063	0.154	0.006	0.000	0.002	0.001	0.010	0.000	0.071	0.056	0.014	0.060	0.000	0.053	0.121	0.074
Do	0.013	0.077	**1**	0.021	0.179	0.066	0.088	0.035	0.004	0.204	0.118	0.072	0.053	0.023	0.009	0.044	0.001	0.061	0.110	0.179	0.097	0.124	0.069	0.022	0.084	0.103	0.056	0.094	0.011	0.005	0.001	0.051	0.135	0.074	0.234	0.152	0.020	0.151	0.121	0.062
Cond	0.010	0.290	0.021	**1**	0.019	0.008	0.026	0.011	0.000	0.000	0.001	0.004	0.009	0.021	0.004	0.001	0.005	0.042	0.027	0.010	0.031	0.027	0.004	0.071	0.145	0.185	0.008	0.000	0.060	0.023	0.008	0.004	0.013	0.043	0.020	0.000	0.004	0.002	0.072	0.004
Turb	0.010	0.004	0.179	0.019	**1**	0.207	0.147	0.015	0.010	0.227	0.137	0.091	0.001	0.117	0.006	0.098	0.024	0.022	0.049	0.179	0.086	0.024	0.004	0.024	0.132	0.192	0.093	0.094	0.105	0.145	0.006	0.055	0.080	0.033	0.362	0.052	0.086	0.053	0.015	0.022
Drainage Area (acres)	0.002	0.014	0.066	0.008	0.207	**1**	0.098	0.103	0.005	0.437	0.264	0.023	0.053	0.016	0.142	0.026	0.003	0.069	0.110	0.256	0.237	0.188	0.010	0.036	0.040	0.003	0.005	0.065	0.000	0.005	0.000	0.028	0.090	0.046	0.193	0.052	0.086	0.053	0.072	0.007
Impervious Percent	0.000	0.009	0.088	0.026	0.147	0.098	**1**	0.098	0.044	0.123	0.199	0.003	0.005	0.072	0.050	0.302	0.062	0.005	0.115	0.216	0.091	0.107	0.002	0.008	0.021	0.049	0.004	0.010	0.002	0.000	0.000	0.079	0.006	0.010	0.201	0.013	0.008	0.018	0.000	0.000
RBP Score	0.013	0.006	0.035	0.011	0.015	0.103	0.098	**1**	0.223	0.183	0.520	0.133	0.000	0.077	0.156	0.019	0.114	0.000	0.006	0.249	0.120	0.061	0.081	0.017	0.161	0.036	0.150	0.082	0.190	0.120	0.190	0.346	0.101	0.099	0.119	0.077	0.096	0.087	0.058	0.001
PHI Score	0.041	0.006	0.004	0.000	0.010	0.005	0.044	0.223	**1**	0.016	0.163	0.118	0.103	0.180	0.047	0.041	0.221	0.025	0.110	0.058	0.000	0.003	0.005	0.030	0.079	0.088	0.073	0.140	0.149	0.075	0.356	0.371	0.030	0.036	0.041	0.052	0.014	0.053	0.006	0.003
Instream Habitat	0.027	0.015	0.204	0.000	0.227	0.437	0.123	0.183	0.016	**1**	0.341	0.006	0.033	0.051	0.136	0.072	0.047	0.007	0.047	0.366	0.289	0.288	0.003	0.002	0.094	0.085	0.006	0.026	0.000	0.009	0.012	0.088	0.204	0.148	0.303	0.118	0.118	0.130	0.088	0.020
Epifaunal Substrate	0.053	0.001	0.118	0.001	0.137	0.264	0.199	0.520	0.163	0.341	**1**	0.015	0.000	0.132	0.168	0.059	0.033	0.029	0.014	0.615	0.147	0.045	0.016	0.000	0.134	0.093	0.023	0.004	0.085	0.034	0.183	0.396	0.203	0.126	0.307	0.134	0.178	0.147	0.098	0.004
Bank Stability	0.012	0.001	0.072	0.004	0.091	0.023	0.003	0.133	0.118	0.006	0.015	**1**	0.006	0.000	0.005	0.003	0.016	0.002	0.152	0.001	0.011	0.040	0.082	0.006	0.049	0.004	0.865	0.828	0.111	0.133	0.138	0.052	0.009	0.000	0.055	0.017	0.000	0.018	0.014	0.075
% Shading	0.000	0.040	0.053	0.009	0.001	0.053	0.005	0.000	0.103	0.033	0.000	0.006	**1**	0.005	0.013	0.006	0.015	0.026	0.028	0.002	0.024	0.069	0.003	0.077	0.000	0.009	0.001	0.012	0.049	0.011	0.057	0.018	0.000	0.002	0.000	0.014	0.023	0.012	0.003	0.016
Remoteness	0.068	0.004	0.023	0.021	0.117	0.016	0.072	0.077	0.180	0.051	0.132	0.000	0.005	**1**	0.003	0.037	0.067	0.001	0.018	0.028	0.001	0.004	0.001	0.000	0.026	0.032	0.003	0.001	0.015	0.007	0.271	0.494	0.012	0.000	0.070	0.048	0.036	0.043	0.004	0.000
# Woody Debris/ Rootwads	0.008	0.009	0.009	0.004	0.006	0.142	0.050	0.156	0.047	0.136	0.168	0.005	0.013	0.003	**1**	0.031	0.047	0.015	0.015	0.234	0.028	0.113	0.023	0.005	0.012	0.000	0.008	0.001	0.081	0.016	0.043	0.028	0.060	0.074	0.055	0.088	0.014	0.098	0.128	0.005
% Developed	0.005	0.005	0.044	0.001	0.098	0.026	0.302	0.019	0.041	0.072	0.059	0.003	0.006	0.037	0.031	**1**	0.147	0.000	0.104	0.139	0.001	0.010	0.012	0.000	0.016	0.061	0.013	0.007	0.041	0.090	0.006	0.025	0.015	0.025	0.134	0.007	0.042	0.005	0.000	0.007
% Forest	0.002	0.008	0.001	0.005	0.024	0.003	0.062	0.114	0.221	0.047	0.033	0.016	0.015	0.067	0.047	0.147	**1**	0.238	0.070	0.018	0.001	0.017	0.001	0.003	0.069	0.035	0.001	0.035	0.013	0.001	0.051	0.096	0.033	0.120	0.045	0.002	0.012	0.003	0.050	0.017
% Open	0.000	0.026	0.061	0.042	0.022	0.069	0.005	0.000	0.025	0.007	0.029	0.002	0.026	0.001	0.015	0.000	0.238	**1**	0.103	0.032	0.007	0.008	0.005	0.001	0.018	0.009	0.003	0.013	0.006	0.002	0.008	0.004	0.016	0.041	0.023	0.062	0.026	0.048	0.013	0.000
% Agricultural	0.006	0.044	0.110	0.027	0.049	0.110	0.115	0.006	0.110	0.047	0.014	0.152	0.028	0.018	0.015	0.104	0.070	0.103	**1**	0.070	0.064	0.072	0.055	0.023	0.016	0.000	0.110	0.208	0.036	0.012	0.166	0.019	0.001	0.002	0.083	0.000	0.009	0.000	0.000	0.003
Epifaunal Substrate/Available Cover	0.047	0.008	0.179	0.010	0.179	0.256	0.216	0.249	0.058	0.366	0.615	0.001	0.002	0.028	0.234	0.139	0.018	0.032	0.070	**1**	0.090	0.037	0.003	0.015	0.105	0.145	0.000	0.006	0.005	0.001	0.059	0.125	0.213	0.173	0.308	0.128	0.113	0.140	0.146	0.016
Pool Substrate Characterization	0.003	0.001	0.097	0.031	0.086	0.237	0.091	0.120	0.000	0.289	0.147	0.011	0.024	0.001	0.028	0.001	0.001	0.007	0.064	0.090	**1**	0.233	0.025	0.032	0.012	0.014	0.006	0.031	0.003	0.001	0.009	0.019	0.073	0.041	0.070	0.036	0.030	0.037	0.026	0.044
Pool Variability	0.000	0.000	0.124	0.027	0.024	0.188	0.107	0.061	0.003	0.288	0.045	0.040	0.069	0.004	0.113	0.010	0.017	0.008	0.072	0.037	0.233	**1**	0.001	0.079	0.004	0.012	0.032	0.090	0.010	0.008	0.028	0.003	0.041	0.049	0.074	0.034	0.000	0.042	0.041	0.023
Sediment Deposition	0.004	0.004	0.069	0.004	0.004	0.010	0.002	0.081	0.005	0.003	0.016	0.082	0.003	0.001	0.023	0.012	0.001	0.005	0.055	0.003	0.025	0.001	**1**	0.084	0.024	0.015	0.135	0.056	0.026	0.003	0.043	0.006	0.004	0.021	0.002	0.000	0.013	0.000	0.002	0.085
Channel Flow Status	0.055	0.109	0.022	0.071	0.024	0.036	0.008	0.017	0.030	0.002	0.000	0.006	0.077	0.000	0.005	0.000	0.003	0.001	0.023	0.015	0.032	0.079	0.084	**1**	0.015	0.176	0.020	0.001	0.001	0.001	0.050	0.008	0.100	0.066	0.001	0.030	0.001	0.032	0.073	0.097
Channel Alteration	0.012	0.063	0.084	0.145	0.132	0.040	0.021	0.161	0.079	0.094	0.134	0.049	0.000	0.026	0.012	0.016	0.069	0.018	0.016	0.105	0.012	0.004	0.024	0.015	**1**	0.359	0.049	0.044	0.000	0.001	0.105	0.134	0.109	0.063	0.233	0.035	0.160	0.027	0.048	0.000
Channel Sinuosity	0.027	0.154	0.103	0.185	0.192	0.003	0.049	0.036	0.088	0.085	0.093	0.004	0.009	0.032	0.000	0.061	0.035	0.009	0.000	0.145	0.014	0.012	0.015	0.176	0.359	**1**	0.012	0.001	0.029	0.030	0.050	0.091	0.161	0.096	0.206	0.071	0.101	0.072	0.038	0.036
Bank Stability- Left Bank	0.023	0.006	0.056	0.008	0.093	0.005	0.004	0.150	0.073	0.006	0.023	0.865	0.001	0.003	0.008	0.013	0.001	0.003	0.110	0.000	0.006	0.032	0.135	0.020	0.049	0.012	**1**	0.684	0.137	0.151	0.103	0.041	0.011	0.002	0.041	0.009	0.001	0.011	0.021	0.096
Bank Stability- Right Bank	0.006	0.000	0.094	0.000	0.094	0.065	0.010	0.082	0.140	0.026	0.004	0.828	0.012	0.001	0.001	0.007	0.035	0.013	0.208	0.006	0.031	0.090	0.056	0.001	0.044	0.001	0.684	**1**	0.083	0.114	0.175	0.061	0.021	0.001	0.097	0.031	0.002	0.032	0.015	0.048
Vegetative Protection - Left Bank	0.031	0.002	0.011	0.060	0.105	0.000	0.002	0.190	0.149	0.000	0.085	0.111	0.049	0.015	0.081	0.041	0.013	0.006	0.036	0.005	0.003	0.010	0.026	0.001	0.000	0.029	0.137	0.083	**1**	0.615	0.140	0.164	0.015	0.023	0.002	0.010	0.032	0.009	0.030	0.016
Vegetative Protection - Right Bank	0.008	0.001	0.005	0.023	0.145	0.005	0.000	0.120	0.075	0.009	0.034	0.133	0.011	0.007	0.016	0.090	0.001	0.002	0.012	0.001	0.001	0.008	0.003	0.001	0.001	0.030	0.151	0.114	0.615	**1**	0.155	0.127	0.010	0.003	0.005	0.012	0.000	0.010	0.000	0.045
Riparian Vegetative Zone Width- Left Bank	0.103	0.010	0.001	0.008	0.006	0.000	0.000	0.190	0.356	0.012	0.183	0.138	0.057	0.271	0.043	0.006	0.051	0.008	0.166	0.059	0.009	0.028	0.043	0.050	0.105	0.050	0.103	0.175	0.140	0.155	**1**	0.469	0.013	0.020	0.009	0.003	0.018	0.003	0.021	0.012
Riparian Vegetative Zone Width- Right Bank	0.096	0.000	0.051	0.004	0.055	0.028	0.079	0.346	0.371	0.088	0.396	0.052	0.018	0.494	0.028	0.025	0.096	0.004	0.019	0.125	0.019	0.003	0.006	0.008	0.134	0.091	0.041	0.061	0.164	0.127	0.469	**1**	0.090	0.095	0.141	0.027	0.121	0.025	0.016	0.002
BIBI Score	0.065	0.071	0.135	0.013	0.080	0.090	0.006	0.101	0.030	0.204	0.203	0.009	0.000	0.012	0.060	0.015	0.033	0.016	0.001	0.213	0.073	0.041	0.004	0.100	0.109	0.161	0.011	0.021	0.015	0.010	0.013	0.090	**1**	0.330	0.230	0.212	0.294	0.194	0.404	0.160
Total Taxa	0.036	0.056	0.074	0.043	0.033	0.046	0.010	0.099	0.036	0.148	0.126	0.000	0.002	0.000	0.074	0.025	0.120	0.041	0.002	0.173	0.041	0.049	0.021	0.066	0.063	0.096	0.002	0.001	0.023	0.003	0.020	0.095	0.330	**1**	0.106	0.009	0.086	0.013	0.296	0.068
# EPT Taxa	0.019	0.014	0.234	0.020	0.362	0.193	0.201	0.119	0.041	0.303	0.307	0.055	0.000	0.070	0.055	0.134	0.045	0.023	0.083	0.308	0.070	0.074	0.002	0.001	0.233	0.206	0.041	0.097	0.002	0.005	0.009	0.141	0.230	0.106	**1**	0.083	0.235	0.074	0.056	0.005
# Ephemeroptera Taxa	0.060	0.060	0.152	0.000	0.052	0.052	0.013	0.077	0.052	0.118	0.134	0.017	0.014	0.048	0.088	0.007	0.002	0.062	0.000	0.128	0.036	0.034	0.000	0.030	0.035	0.071	0.009	0.031	0.010	0.012	0.003	0.027	0.212	0.009	0.083	**1**	0.021	0.952	0.096	0.158
% Intolerant Urban	0.023	0.000	0.020	0.004	0.086	0.086	0.008	0.096	0.014	0.118	0.178	0.000	0.023	0.036	0.014	0.042	0.012	0.026	0.009	0.113	0.030	0.000	0.013	0.001	0.160	0.101	0.001	0.002	0.032	0.000	0.018	0.121	0.294	0.086	0.235	0.021	**1**	0.018	0.056	0.012
% Ephemeroptera	0.061	0.053	0.151	0.002	0.053	0.053	0.018	0.087	0.053	0.130	0.147	0.018	0.012	0.043	0.098	0.005	0.003	0.048	0.000	0.140	0.037	0.042	0.000	0.032	0.027	0.072	0.011	0.032	0.009	0.010	0.003	0.025	0.194	0.013	0.074	0.952	0.018	**1**	0.092	0.173
# Scraper Taxa	0.064	0.121	0.121	0.072	0.015	0.072	0.000	0.058	0.006	0.088	0.098	0.014	0.003	0.004	0.128	0.000	0.050	0.013	0.000	0.146	0.026	0.041	0.002	0.073	0.048	0.038	0.021	0.015	0.030	0.000	0.021	0.016	0.404	0.296	0.056	0.096	0.056	0.092	**1**	0.273
%Climbers	0.000	0.074	0.062	0.004	0.022	0.007	0.000	0.001	0.003	0.020	0.004	0.075	0.016	0.000	0.005	0.007	0.017	0.000	0.003	0.016	0.044	0.023	0.085	0.097	0.000	0.036	0.096	0.048	0.016	0.045	0.012	0.002	0.160	0.068	0.005	0.158	0.012	0.173	0.273	**1**

Middle and Lower Patuxent Watershed Sites

Anne Arundel County, Maryland

Biological Monitoring Summary
2016 Spring Index Period

April 2017

Middle and Lower Patuxent Watershed Sites
Anne Arundel County, Maryland

Biological Monitoring Summary
Spring 2016 Index Period

April 2017

Prepared For:

Anne Arundel County DPW
Heritage Office Complex
2662 Riva Road, Third Floor
Annapolis, MD 21401

Prepared By:

Century Engineering, Inc.
10710 Gilroy Rd
Hunt Valley, MD 21031
&
Biohabitats, Inc.
The Stables Building
2081 Clipper Park Road
Baltimore, Maryland 21211

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APPENDICES

1 INTRODUCTION

The Anne Arundel County National Pollutant Discharge Elimination Systems (NPDES) Municipal Separate Storm Sewer System (MS-4) permit, issued by the Maryland Department of the Environment (MDE), includes a requirement for the systematic assessment of current water quality conditions within all of the County's watershed. The overall goal of this requirement is to ensure that County watersheds have been thoroughly assessed and an action plan developed to maximize water quality improvements. In order to help achieve this goal, Anne Arundel County is undertaking the assessment of the riparian physical habitat and the benthic macroinvertebrate community condition in the Middle Patuxent (MP) and Lower Patuxent (LP) watersheds. The data developed under this work will be incorporated into the County's Watershed Management Tool (WMT) and will be coupled with other watershed data, compiled as part of Middle and Lower Patuxent assessment efforts, to complete a comprehensive watershed assessment.

To support this effort, Century Engineering, Inc. and Biohabitats, Inc., a joint venture team (JV Team), took on the assessment of 74 first year monitoring sites within the Middle and Lower Patuxent Watersheds. The 25,596-acre Middle and Lower Patuxent watersheds (22,416 AC MP/ 3,180 AC LP) contain approximately 242 miles of planimetric stream segments and are subdivided into 36 sub-basins within Anne Arundel County. Targeted and alternative sites within these watersheds have been pre-selected by the County. The JV team selected two (2) sites per subbasin to acquire data within the 36 subbasins. Following the protocols outlined in the County's Quality Assurance Project Plan for Anne Arundel County Biological Monitoring and Assessment Program (QAPP), a total of 74 sites (67 sites and 5 quality control sites) were sampled during the Spring Index Period (March 1 – April 30) for benthic macroinvertebrates. Two (2) additional quality control sites, MP64-REP and MP139-REP, were sampled following Maryland Department of Natural Resources (DNR) protocols. The 74 sites are a combination of sites within the Lower and Middle Patuxent Watersheds. Appendix A shows the Anne Arundel County watersheds and subwatersheds provides an overview of the sampled locations for each subwatershed within the Lower and Middle Patuxent watersheds.

Specific field tasks performed during the Spring 2016 Index Period included:

- Sampling benthic macroinvertebrates and physiochemical data within sample reaches during the 2016 Spring Index Period
- Assessment of habitat using MPHI and the US EPA's RBP methods
- MBSS Spring Habitat Assessment Sheet
- Photography
- GPS of sampling locations

Specific data and results are summarized in the body of the report but complete data reporting is included in the appendices and the associated geodatabase. Data found in the appendices includes field data sheets and spreadsheets as follows:

- Spring 2016 Monitoring Site Location Overview Mapping
- Individual Site Sampling Data Forms
- Summary spreadsheets of data and calculated BIBI, RBP, IBI, PHI scores and their underlying metric values for all stations
- Spreadsheet that lists all the benthic taxa collected at each station
- Spreadsheet that contains the averaged water quality parameters collected concurrently at each station: pH (SU), Dissolved Oxygen (mg/L), Temperature (deg. C), Specific Conductivity (µS/cm), Turbidity (NTU) and Total Dissolved Solids (mg/L)

2 METHODS

2.1 SITE SELECTION

The Anne Arundel County Watershed Assessment and Planning Program selected two (2) sites within the 36 sub-basins within two (2) of the 12 Digit DNR Watersheds, Middle and Lower Patuxent, within Anne Arundel County. Areas in need of benthic macroinvertebrate (BMI) sampling and water quality data were selected and property owner letters were sent to all parcels that could be used to access any potential sampling stream reaches. Multiple sites were selected per subwatershed. Two (2) sites were attempted to be sampled within the 36 subwatersheds within the Middle and Lower Patuxent Watersheds, with the objective of one (1) site within the upper limits (lower order streams) of the sub-watershed and one (1) site within the lower limits (higher order streams) within the subwatershed.

2.2 FIELD AND LABORATORY METHODS

Both Anne Arundel County field sampling and data analysis methods were developed to be comparable to DNR's Maryland Biological Stream Survey (MBSS), and complementary to those in place in Prince George's, Montgomery, and Howard Counties in Maryland (Hill and Stribling, 2004). Primary data collected at the selected watershed sampling sites included site location (latitude and longitude), pH, dissolved oxygen, water temperature, specific conductivity, turbidity, total dissolved solids, and benthic macroinvertebrates. The physical habitat index (PHI) following MBSS methodologies was executed at each station (Kazyak, 2001; Kazyak, et al., 2005; Maryland DNR, 2007; Stranko et al., 2014). Physical habitat assessment using USEPA's Rapid Bioassessment Protocols (RBP) (Barbour and Stribling 1994; Barbour et al. 1999) for Low Gradient streams was also performed. Biological data were analyzed using the 2005 revised version of the MBSS Coastal Plain Benthic Index of Biotic Integrity (BIBI) (Southerland et al., 2005).

A more detailed description of the sampling and analysis methods can be found in the Anne Arundel County Biological Monitoring and Assessment Program Annual Reports (Crunkleton, et al., 2013; Crunkleton, et al., 2012; Crunkleton, et al., 2011; Crunkleton, et al., 2010). Specific information regarding the sampling and analysis methods, including the standard operating procedures (SOPs), can be found in the *Documentation of Method Performance Characteristics for the Anne Arundel County Biological Monitoring Program* (Hill et al., 2010) and the *Quality Assurance Project Plan for Anne Arundel County Biological Monitoring and Assessment Program* (Hill et al., 2011).

2.3 BENTHIC MACROINVERTEBRATE SAMPLING AND PROCESSING

2.3.1 Benthic Macroinvertebrate Assessment Procedures

All sampling was conducted as required within the MBSS Spring index period, which begins on March 1 and concludes at the end of April. At each site, benthic macroinvertebrates were collected from a 75 meter reach by sampling approximately 20 ft^2 of surface area with a D-frame net (595 µm mesh), with an emphasis on the most productive habitat types (e.g., riffles, snags, vegetated banks, sandy bottom) found within the reach. The most productive habitat types, in order of sampling preference include riffles, snags/logs that create a partial dam or are in a run area, undercut banks and associated root mats in moving water, gravel/broken peat and/or clay lumps in a run area, and detrital/sand areas in moving water. Kazyak (2001) also states that it is appropriate to move outside of the 75-meter reach, if necessary, to obtain the required 20 ft^2 of habitat surface area for sampling. Samples were primarily collected by jabbing the net into a habitat type (snags, root wads) to dislodge organisms or by disturbing the bottom substrate just upstream of the net allowing organisms to wash into the net. Larger surfaces such as logs or cobbles were scrubbed by hand to further dislodge organisms. All sampled material (including leaf litter, small woody debris, and sediment) was composited in a 500 µm sieve bucket, placed in one or more one-liter sample containers and preserved in 95% ethanol. Internal and external labels

were completed for each container. Samples were tracked on chain-of-custody forms and transported to the laboratory for sorting. A visual inspection of the sites for salamanders and vernal pools as well as other anecdotal herpetofauna encounters were conducted as part of the general habitat assessments.

2.3.2 Benthic Macroinvertebrate Taxonomy

Primary taxonomy on each sample (Boward and Friedman 2000) was performed by the contract laboratory (EcoAnalysts and Maryland DNR) and individual organisms were identified primarily to genus level. In some cases, (e.g., when individuals were early instars or had damaged or missing diagnostic morphological features), identification was left at genus-group, subfamily, or family level. Taxonomic data were received in Excel spreadsheets. Functional feeding group, habit, and tolerance value designations were assigned to each taxon according to Merritt and Cummins (1996), Barbour et al. (1999) and Stribling et al. (1999). The tolerance value assigned to each taxon is based on its ability to survive and reproduce in the presence of chemical pollution, hydrologic alteration, or habitat degradation (Stribling et al. 1999; Bressler et al. 2005, 2006; Flotemersch et al. 2006).

2.4 STREAM PHYSICAL HABITAT ASSESSMENT METHODS

The protocol for the Anne Arundel County Targeted Watershed Sites Biological Monitoring required the use of two types of habitat assessment protocols, the USEPA Rapid Bioassessment Protocol (RBP) for Low Gradient Streams (Barbour and Stribling 1994; Barbour et al. 1999) and the MBSS Physical Habitat Index (PHI) (Kazyak, 2001; Paul et al., 2003; Maryland DNR, 2007; Stranko et al. 2014). Physical habitat quality for the RBP and MBSS protocols were visually assessed at each site.

2.4.1 EPA Rapid Bioassessment Protocols

The RBP evaluates 10 parameters that describe instream physical characteristics, channel morphology, riparian vegetation and stream bank structure. Each parameter was given a score based on a 20-point scale (20=best, 0=worst), or 10-point scale for individual bank parameters and rated as either optimal, suboptimal, marginal, or poor according to their scoring range. The following 10 parameters were evaluated:

- Epifaunal substrate / available cover
- Pool substrate characterization
- Pool variability
- Sediment deposition
- Channel flow status
- Channel alteration
- Channel sinuosity
- Bank stability
- Vegetative protection
- Riparian vegetative zone width

2.4.2 Maryland Biological Stream Survey Physical Habitat Index

The MBSS PHI evaluated 10 parameters that also describe instream physical characteristics, channel morphology, riparian vegetation cover (shading) but also include scores for how remote a site is and its aesthetics due to impacts from trash. Each parameter was given a score based on a 20-point scale (20=best, 0=worst), as a % for embeddedness and shading, or as a number for woody debris and rootwads, and rated as either optimal, suboptimal, marginal, or poor according to their scoring range. The following 10 parameters were evaluated:

- Instream habitat
- Epifaunal substrate
- Velocity / depth diversity
- Pool / glide / eddy quality
- Bank stability
- Embeddedness
- Shading
- Remoteness score
- Aesthetic rating (trash)
- Number of woody debris & rootwads

2.5 WATER QUALITY

Temperature, dissolved oxygen, pH, specific conductivity, turbidity and total dissolved solids (TDS) were measured at the downstream limits, mid-point, and upstream limits at each site during the biological assessments using water quality meters calibrated according to the specifications provided by the manufacturer.

2.6 QUALITY ASSURANCE/QUALITY CONTROL

A primary goal of the County is to produce biological assessments of its water resources with objective and defensible data. As a result, a comprehensive Quality Assurance Project Plan (QAPP) for ensuring the collection of such data was developed simultaneously with the Countywide Biological Monitoring and Assessment Program initially by Tetra Tech in 2004 (Hill and Stribling), and was updated by KCI in 2011 (Hill and Pieper). The QAPP followed U. S. Environmental Protection Agency requirements for developing project plans (USEPA, 1995) and describes the biological stream assessment protocol including data collection methods (SOPs), the technical rationale behind the procedures, and the series of activities and reporting procedures that are used to document and communicate data quality.

To provide a guideline for ongoing data quality assessments associated with the County's Biological Monitoring Program and to help enhance defensibility of data and assessments, a method performance characteristic framework was developed and outlined in *Documentation of Method Performance Characteristics for the Anne Arundel County Biological Monitoring Program* (Hill et al., 2005, Hill and Pieper, 2011). In this guidance document, five performance quality characteristics (precision, accuracy, bias, representativeness, and completeness) were evaluated, either quantitatively or qualitatively, for each of six methods making up the biological assessment protocol for Anne Arundel County: field sampling, laboratory sorting and subsampling, taxonomic identification and enumeration, data entry, metric calculation, and site assessment. From the results of the performance characteristic evaluation, quantitative measurement quality objectives (MQOs) were developed for each of the six biological assessment components, which help to define criteria for acceptable data quality. A brief quality control summary of quality control measures from these sampling periods is included in below.

Field Sampling – Accuracy and Precision

Field water quality measurements were collected in situ at the targeted monitoring sites according to methods in the County QAPP. Water quality equipment was inspected and calibrated to ensure proper usage and accuracy of the measurements.

Chain of custody procedures were followed for transfer of the samples between the field and the identification lab (Appendix I).

All field crew leaders were recently trained in MBSS Spring sampling protocols prior to the start of the sampling.

Field Sampling – Bias

All subjective scoring of physical habitat parameters was completed with the input of all team members at the sampling site to reduce individual sampler bias.

Laboratory Sorting and Subsampling & Taxonomic Identification – Bias and Precision

All sorting was completed following the SOPs described in the QAPP.

Seventy-one (71) sites had taxonomic identifications completed by EcoAnalysts, Inc., an outside expert laboratory. Three (3) sites (MP16, MP16-REP, and MP02) had taxonomic identifications completed by the Maryland DNR due to the necessary certification auditing per MBSS protocols. Prior to identification, the sample was subsampled down to the target needed for a 100 insect assessment (80-120 insects, total). Subsampling of the original sample involved spreading the entire sample on a Caton gridded tray (Caton 1991; Flotemersch et al. 2006) with 30 square grids (6-cm each), which allows isolation of physically defined amounts of sample material (leaf litter, detritus, sticks, substrate particles) from the total sample and the separation/removal of the organisms from that material. A minimum of four grids were selected at random and sorted to completion until the target number of organisms (100$\pm$ 20%) was reached. If more than 40 organisms are found in the first grid, the original four grids are re-spread on a separate Caton tray and another four grids are then randomly selected for sorting, and consecutive grids are selected until the target number is reached.

3 DATA ANALYSIS

3.1 PHYSICAL HABITAT

The 10 metric scores each for physical habitat from the EPA Rapid Bioassessment Protocols (RBP) and the Maryland Biological Stream Survey Physical Habitat Index (PHI) (Stribling et al. 1999) were summed to obtain a final habitat score for 2016 which was compared to a reference condition score and included as part of a qualitative comparative assessment of habitat and biological results. The values were compared to the maximum possible score for overall percent comparability for each site. Since adequate habitat reference condition scores have not been determined for Anne Arundel County streams, the categories used for RBP scoring were adapted from Plafkin et al. (1989) and are based on Western Coastal Plain reference conditions obtained from Prince George's County streams (Stribling et al. 1999).

Table 3-1 provides narrative ratings that correspond to physical habitat quality scores. These scores express the potential of a stream or watershed to support a healthy biological community.

Table 3-1: Physical Habitat Scoring and Rating Criteria for EPA RBP and MBSS PHI Protocols			
EPA RBP Scoring		**MBSS PHI Scoring**	
Score	**Narrative Rating**	**Score**	**Narrative Rating**
151+	Comparable to Ref.	81-100	Minimally Degraded
126-150	Supporting	66.0-80.9	Partially Degraded
100 -125*	Partially Supporting	51-65.9	Degraded
< 100*	Non-Supporting	0-50.9	Severely Degraded

*Modified as per Stribling et al. 1999

3.2 BENTHIC INDEX OF BIOTIC INTEGRITY

The biological condition indicator used for the assessment of benthic macroinvertebrates is the BIBI (Karr et al., 1986), which uses characteristics of the benthic macroinvertebrate assemblage structure and function to assess the overall water resource condition. The BIBI was developed by the MBSS and calibrated for different physiogeographic areas of Maryland. In 2005, MBSS revised the BIBI (Southerland et al. 2005) and the revised benthic metrics calculated in this report were those selected and calibrated specifically for Maryland Coastal Plain streams (Table 3-2.1). The seven metrics calculated for each of the benthic macroinvertebrate samples were:

- Number of taxa
- Number of EPT
- Number of Ephemeroptera
- % Intolerant urban
- % Ephemeroptera
- Number of scraper taxa
- % Climbers

Table 3-2.1: MBSS BIBI Metrics and Threshold Scoring for Coastal Plain Streams			
Metric	**Threshold**		
	5	**3**	**1**
Number of Taxa	≥ 22	14 - 21	< 14
Number of EPT Taxa	≥ 5	2 - 4	< 2
Number of Ephemeroptera Taxa	≥ 2	1 - 1	< 1
Percent Intolerant to Urban	≥ 28	10 - 27	< 10
Percent Ephemeroptera	≥ 11	0.8 - 10.9	< 0.8
Number of Scraper Taxa	≥ 2	1 - 1	< 1
Percent Climbers	≥ 8	0.9 - 7.9	< 0.9

Source: Southerland et al. (2005)

Each metric was scored on a 5, 3, 1 basis (5 being best, 1 the worst) according to stream health. BIBI metric scoring criteria are listed in Table 3-2.1. Overall biological index scores are obtained by summing the seven

metric scores for each site and dividing by the number of metrics (7). Using the format established by MBSS, the resulting value is then compared to the index scoring criteria for translation into narrative categories (Table 3-2.2).

Table 3-2.2: MBSS BIBI Scoring, Narrative Ranking and Characteristics

BIBI Score	Narrative Ranking	Characteristics
4.0 - 5.0	Good	Comparable to reference streams considered to be minimally impacted, biological metrics fall within the upper 50% 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.

3.3 WATER QUALITY

Water quality data were collected during biological sampling at each site and compared to Maryland water quality standards for Use I streams (COMAR 2010). Use I streams have designated uses for water contact recreation and protection of non-tidal warm water aquatic life. Table 3-3 lists the water quality standards for these streams.

Table 3-3: Maryland COMAR Standards for Water Quality

Parameter	Standard
pH	6.5 to 8.5
Dissolved Oxygen (mg/L)	Minimum of 5.0 mg/L
Specific Conductivity (µS/cm)	No state standard
Turbidity (NTU)	Maximum of 150 NTU and maximum monthly average of 50 NTU
Temperature (ºC)	Maximum of 32ºC (90ºF) or ambient temperature, whichever is greater

Source: COMAR 26.08.02.03-3 (COMAR 2010)

4 RESULTS

4.1 PHYSICAL HABITAT

A total of 67 sites were sampled with 7 quality control samples within the Middle and Lower Patuxent watersheds, representing each of the 36 subwatersheds with two (2) sites from each subwatershed. Within the subwatersheds of Hall Creek 2, Lyons Creek 1, and Lyons Creek 6; only one sample site was assessed and sampled due to property access constraints and/or lack of sampleability. Table 4-1 provides a direct comparison of the results of two physical habitat assessments using the metrics and scoring methodologies from the EPA RBP, MBSS PHI, and BIBI scores for 2016. Appendix C directly compares the RBP and PHI scores graphically. Individual site data regarding PHI, RBP, and BIBI scores can found in Appendices D, E, and the associated geodatabase respectively. Figures 4-1 through 4-3 show a graphical depiction of the RBP, PHI, and BIBI scores

respectively. A map of the RBP and PHI scores for each site are shown on Figure 4-4. A map of the BIBI scores for each site is shown on Figure 4-5.

Table 4-1: Direct Comparison of BIBI, RBP, and PHI Qualitative and Quantitative Scores

Site	Subwatershed	RBP Score & Narrative	BIBI Score & Narrative	PHI Score & Narrative
LP02	Hall Creek 1	134 Supporting	3.6 Fair	65.46 Degraded
LP04	Hall Creek 2	109 Partially Supporting	1 Very Poor	65.80 Degraded
LP06	Hall Creek 3	95 Non-Supporting	2.1 Poor	51.77 Degraded
LP09A	Hall Creek 1	103 Partially Supporting	2.4 Poor	47.27 Severely Degraded
LP11A	Hall Creek 3	98 Non-Supporting	1.9 Very Poor	53.09 Degraded
MP01	Unnamed Tributary 2	162 Comparable to Ref.	4.1 Good	83.84 Minimally Degraded
MP02	Unnamed Tributary 2	122 Partially Supporting	3.57 Fair	66.07 Partially Degraded
MP03	Rock Branch 1	136 Supporting	3 Fair	61.39 Degraded
MP04	Rock Branch 1	134 Supporting	3.9 Fair	73.62 Partially Degraded
MP05	Unnamed Tributary 3	115 Partially Supporting	3.3 Fair	62.81 Degraded
MP06	Unnamed Tributary 3	99 Non-Supporting	2.7 Poor	63.20 Degraded
MP07	Rock Branch 2	125 Partially Supporting	3.9 Fair	56.11 Degraded
MP08	Rock Branch 2	140 Supporting	2.1 Poor	62.05 Degraded
MP09	Rock Branch 3	94 Non-Supporting	3 Fair	42.43 Severely Degraded
MP103A	Two Run Branch 1	83 Not Supporting	2.4 Poor	66.95 Partially Degraded
MP109A	Cabin Branch 5	134 Supporting	3 Fair	82.68 Minimally Degraded
MP11	Ferry Branch 1	121 Partially Supporting	3.9 Fair	78.44 Partially Degraded
MP112A	Lyons Creek 1	120 Partially Supporting	2.1 Poor	69.60 Partially Degraded

Table 4-1: Direct Comparison of BIBI, RBP, and PHI Qualitative and Quantitative Scores				
Site	**Subwatershed**	**RBP Score & Narrative**	**BIBI Score & Narrative**	**PHI Score & Narrative**
MP113A	Lyons Creek 4	121 Partially Supporting	3 Fair	66.823 Partially Degraded
MP117A	Lyons Creek 3	72 Non-Supporting	1.9 Very Poor	48.92 Severely Degraded
MP117A-REP	Lyons Creek 3	68 Non-Supporting	2.7 Poor	49.13 Severely Degraded
MP118A	Lyons Creek 3	132 Supporting	3.9 Fair	75.77 Partially Degraded
MP119A	Lyons Creek 7	92 Non-Supporting	2.1 Poor	49.40 Severely Degraded
MP121A	Lyons Creek 8	79 Non-Supporting	1.3 Very Poor	46.02 Severely Degraded
MP124A	Lyons Creek 2	157 Comparable to Ref.	5 Good	68.02 Partially Degraded
MP126A	Lyons Creek 10	99 Non-Supporting	3 Fair	63.43 Degraded
MP128	Cabin Branch 2	149 Supporting	3.6 Fair	85.11 Minimally Degraded
MP129A	Cabin Branch 2	102 Partially Supporting	3.9 Fair	73.75 Partially Degraded
MP13	Wilson Owens Branch 3	134 Supporting	4.4 Good	82.34 Minimally Degraded
MP132A	Cabin Branch 1	95 Not Supporting	4.4 Good	55.67 Degraded
MP134A	Deep Creek	108 Partially Supporting	1.6 Very Poor	78.42 Partially Degraded
MP139A	Wilson Owens Branch	122 Partially Supporting	4.4 Good	64.79 Degraded
MP139A-REP	Wilson Owens Branch	122 Partially Supporting	4.4 Good	64.79 Degraded
MP15	Ferry Branch 2	93 Non-Supporting	2.4 Poor	45.88 Severely Degraded
MP16	Ferry Branch 2	106 Partially Supporting	2.14 Poor	49.25 Severely Degraded
MP16-REP	Ferry Branch 2	113 Partially Supporting	2.14 Poor	50.84 Severely Degraded
MP19	Wilson Owens Branch 3	10 Partially Supporting	2.1 Poor	65.08 Degraded

Table 4-1: Direct Comparison of BIBI, RBP, and PHI Qualitative and Quantitative Scores				
Site	**Subwatershed**	**RBP Score & Narrative**	**BIBI Score & Narrative**	**PHI Score & Narrative**
MP22	Wilson Owens Branch 2	117 Partially Supporting	3 Fair	84.19 Minimally Degraded
MP23	Wilson Owens Branch 1	92 Non-Supporting	3 Fair	61.69 Degraded
MP24	Wilson Owens Branch 1	117 Partially Supporting	2.4 Poor	61.99 Degraded
MP25	Lyons Creek 5	92 Non-Supporting	2.7 Poor	56.41 Degraded
MP26	Lyons Creek 5	116 Partially Supporting	2.4 Poor	58.84 Degraded
MP31	Cabin Branch 4	82 Non-Supporting	3.3 Fair	58.71 Severely Degraded
MP31-REP	Cabin Branch 4	79 Non-Supporting	3.6 Fair	51.75 Degraded
MP33	Galloway Creek	122 Partially Supporting	3.3 Fair	58.02 Degraded
MP34	Galloway Creek	99 Partially Supporting	2.4 Poor	64.01 Degraded
MP35	Two Run Branch 2	106 Partially Supporting	3 Fair	69.16 Partially Degraded
MP36	Two Run Branch 2	137 Supporting	3.9 Fair	73.79 Partially Degraded
MP37	Cabin Branch 3	81 Non-Supporting	1.9 Very Poor	58.13 Degraded
MP38	Cabin Branch 3	87 Not Supporting	2.4 Poor	49.92 Severely Degraded
MP39	Cabin Branch 5	150 Supporting	3.9 Fair	84.55 Minimally Degraded
MP39-REP	Cabin Branch 5	149 Supporting	3.9 Fair	75.63 Partially Degraded
MP42	Lyons Creek 4	100 Partially Supporting	2.7 Poor	61.85 Degraded
MP43	Lyons Creek 9	140 Supporting	3.6 Fair	84.33 Minimally Degraded
MP44	Lyons Creek 9	126 Supporting	2.7 Poor	72.86 Partially Degraded
MP48	Lyons Creek 7	114 Partially Supporting	3 Fair	56.78 Degraded

Table 4-1: Direct Comparison of BIBI, RBP, and PHI Qualitative and Quantitative Scores				
Site	**Subwatershed**	**RBP Score & Narrative**	**BIBI Score & Narrative**	**PHI Score & Narrative**
MP50	Lyons Creek 8	120 Partially Supporting	1.3 Very Poor	58.49 Degraded
MP51	Lyons Creek 2	133 Supporting	4.7 Good	67.87 Partially Degraded
MP53	Lyons Creek 10	105 Partially Supporting	3.6 Fair	66.37 Partially Degraded
MP57	Cabin Branch 1	112 Partially Supporting	3 Fair	83.86 Minimally Degraded
MP60	Deep Creek	84 Not Supporting	3.3 Fair	45.62 Severely Degraded
MP61	Pindell Branch	114 Partially Supporting	4.1 Good	81.14 Partially Degraded
MP62	Pindell Branch	120 Partially Supporting	4.1 Good	83.59 Partially Degraded
MP64	Two Run Branch 1	116 Partially Supporting	4.4 Good	71.57 Partially Degraded
MP64-REP	Two Run Branch 1	116 Partially Supporting	4.4 Good	71.57 Partially Degraded
MP71	Rock Branch 3	121 Partially Supporting	2.4 Poor	54.67 Degraded
MP71A-REP	Rock Branch 3	102 Partially Supporting	3.3 Fair	59.74 Degraded
MP79A	Ferry Branch 1	116 Partially Supporting	3.6 Fair	59.27 Degraded
MP80A	Wilson Owens Branch 3	113 Partially Supporting	4.4 Good	64.09 Degraded
MP86A	Ferry Branch 3	106 Partially Supporting	2.1 Poor	57.84 Degraded
MP88A	Ferry Branch 3	51 Non-Supporting	1.9 Very Poor	41.97 Severely Degraded
MP92A	Lyons Creek 6	115 Partially Supporting	1.9 Very Poor	61.40 Degraded
MP97A	Cabin Branch 4	90 Not Supporting	2.1 Poor	66.90 Partially Degraded
MP98A	Wilson Owens Branch 2	82 Not Supporting	2.4 Poor	62.12 Degraded

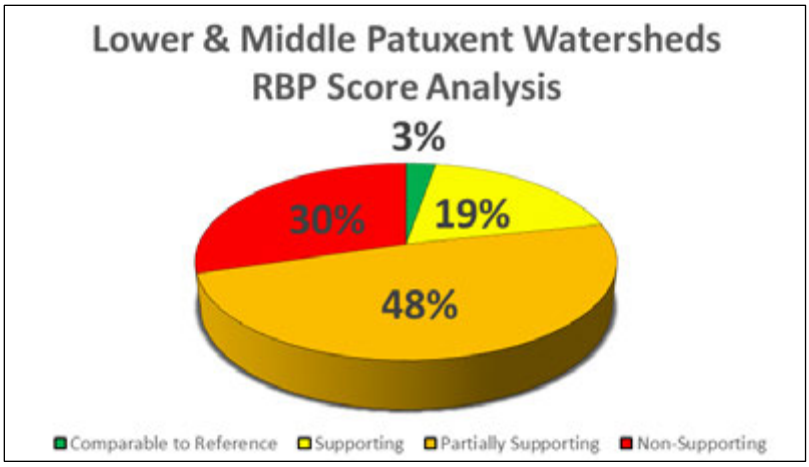


Figure 4-1: RBP Score Analysis

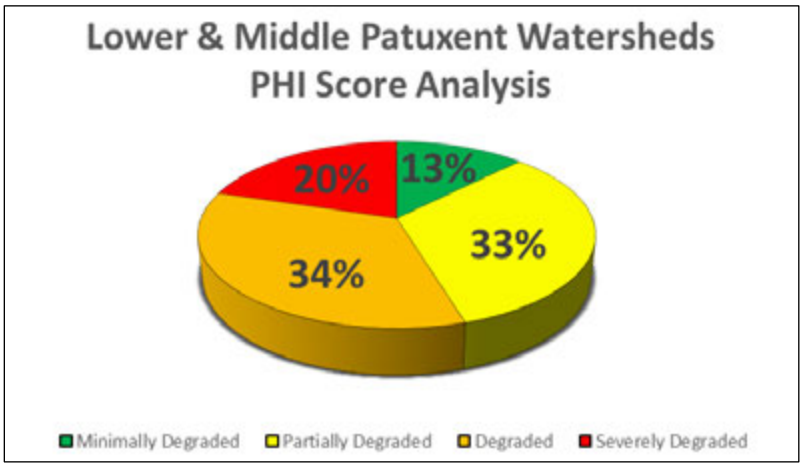


Figure 4-2: PHI Score Analysis

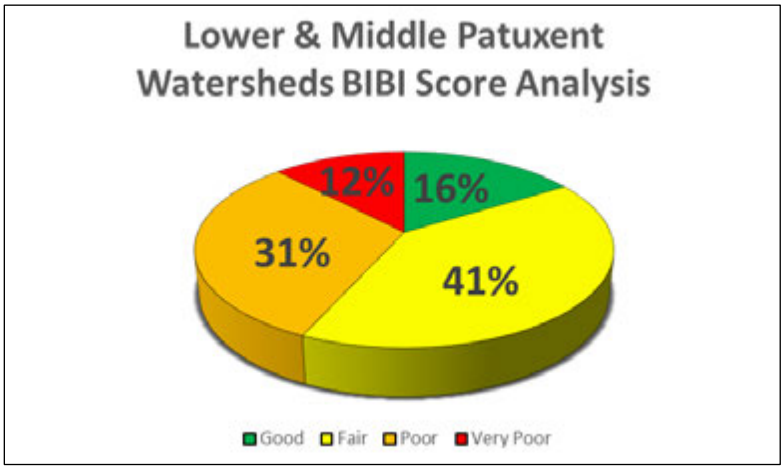
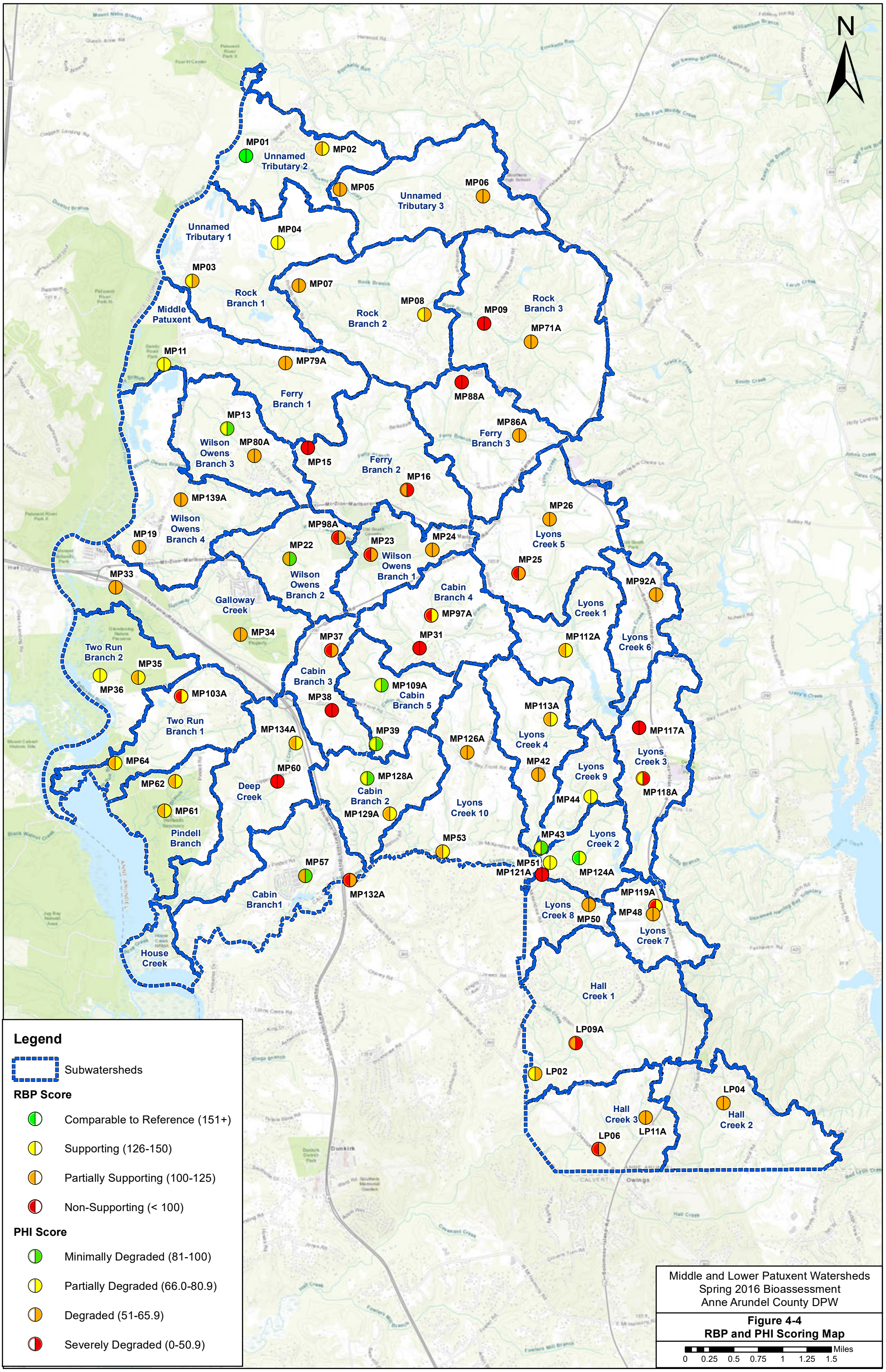


Figure 4-3: BIBI Score Analysis


N
MP01
MP02
Unnamed Tributary 2
MP05
MP06
Unnamed Tributary 3
Unnamed Tributary 1
MP04
MP03
MP07
Rock Branch 1
Middle Patuxent
Rock Branch 2
MP08
MP09
Rock Branch 3
MP71A
MP11
MP79A
MP88A
Ferry Branch 1
MP13
Wilson Owens Branch 3
MP80A
MP15
Ferry Branch 2
MP16
MP86A
Ferry Branch 3
MP139A
Wilson Owens Branch 4
MP98A
MP19
MP22
MP23
MP24
MP26
Lyons Creek 5
Wilson Owens Branch 1
MP25
MP33
Wilson Owens Branch 2
Cabin Branch 4
MP92A
Galloway Creek
MP97A
Lyons Creek 1
MP34
MP37
MP31
MP112A
Lyons Creek 6
Two Run Branch 2
MP35
MP36
Cabin Branch 3
MP109A
Cabin Branch 5
MP103A
MP38
MP113A
Two Run Branch 1
MP134A
MP39
MP126A
MP117A
Lyons Creek 4
MP64
MP42
Lyons Creek 3
MP60
Lyons Creek 9
MP62
Deep Creek
MP128A
MP118A
Cabin Branch 2
MP44
MP61
MP129A
Lyons Creek 10
Pindell Branch
MP53
MP43
Lyons Creek 2
MP57
MP51
MP121A
MP124A
MP132A
Cabin Branch1
MP119A
Lyons Creek 8
MP48
MP50
Lyons Creek 7
House Creek
Hall Creek 1
LP09A
LP02
LP04
Hall Creek 3
Hall Creek 2
LP11A
LP06
Legend
Subwatersheds
RBP Score
Comparable to Reference (151+)
Supporting (126-150)
Partially Supporting (100-125)
Non-Supporting (< 100)
PHI Score
Minimally Degraded (81-100)
Partially Degraded (66.0-80.9)
Degraded (51-65.9)
Severely Degraded (0-50.9)
Middle and Lower Patuxent Watersheds
Spring 2016 Bioassessment
Anne Arundel County DPW
Figure 4-4
RBP and PHI Scoring Map
Miles
0 0.25 0.5 0.75 1 1.25 1.5

N

MP01
MP02
MP03
MP04
MP05
MP06
MP07
MP08
MP09
MP11
MP13
MP15
MP16
MP19
MP22
MP23
MP24
MP25
MP26
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MP51
MP53
MP57
MP60
MP61
MP62
MP64
MP71A
MP79A
MP80A
MP86A
MP88A
MP92A
MP97A
MP98A
MP103A
MP109A
MP112A
MP113A
MP117A
MP118A
MP119A
MP121A
MP124A
MP126A
MP128A
MP129A
MP132A
MP134A
MP139A
LP02
LP04
LP06
LP09A
LP11A

Unnamed Tributary 2
Unnamed Tributary 3
Rock Branch 1
Rock Branch 2
Rock Branch 3
Wilson Owens Branch 4
Wilson Owens Branch 3
Ferry Branch 1
Ferry Branch 2
Ferry Branch 3
Wilson Owens Branch 1
Wilson Owens Branch 2
Lyons Creek 5
Lyons Creek 6
Lyons Creek 1
Lyons Creek 4
Lyons Creek 3
Lyons Creek 9
Lyons Creek 2
Lyons Creek 10
Lyons Creek 8
Lyons Creek 7
Cabin Branch 4
Cabin Branch 3
Cabin Branch 5
Cabin Branch 2
Cabin Branch1
Two Run Branch 2
Two Run Branch 1
Galloway Creek
Deep Creek
Pindell Branch
House Creek
Hall Creek 1
Hall Creek 3
Hall Creek 2

Legend

BIBI Scores

- Good (4.0-5.0)
- Fair (3.0-3.9)
- Poor (2.0-2.9)
- Very Poor (1.0-1.9)
- Subwatersheds

Middle and Lower Patuxent Watersheds
Spring 2016 Bioassessment
Anne Arundel County DPW

Figure 4-5
BIBI Scoring Map

Miles
0 0.25 0.5 0.75 1 1.25 1.5

4.2 WATER QUALITY

"Point in time" water quality measurements were made at each site at their respective downstream limits, midpoint, and upstream limits and then averaged to create the site data summary table included as Appendix F. The data collected from the Spring Index Period in 2016 was compared to COMAR Water Quality standards.

4.3 DISCUSSION

A statistical correlation analysis between physical habitat, and indices, and water quality variables was not completed for this effort. However, a descriptive comparison has been made for physical habitat, and benthic macroinvertebrate through an analysis of the metric scoring and narrative rating of the sites assessed.

4.4 PHYSICAL HABITAT COMPARISONS BETWEEN RBP AND PHI AND BIBI CORRELATION

The Targeted Watershed Site Assessments required the use of two individualized habitat assessment suites of metrics at each site. Each assessment had its own scoring and narrative rating system (Table 4-1) which can be directly compared as both were broken into four categories, albeit with different narrative vocabulary. The scoring ranges for the RBP come from Stribling et al. (1999).

The choice of narrative vocabulary can be confusing when the two are compared particularly with the middle two categories tiers. A RBP rating of Supporting for its second tier category is rated as Partially Degraded under the MBSS PHI rating terminology while the third tier category of Partially Supporting under RBP is rated as Degraded with PHI. A graphed comparison of these scores for the 67 sampled sites can be found in Appendix C. Figures 4-6 through 4-8 compare the correlation between the three different metrics.

Benthic macroinvertebrates were sampled in the Spring Index Period in 2016 and were accompanied by RBP and PHI habitat evaluations. Table 4-1 provides a direct comparison of the benthic macroinvertebrate and habitat assessment results using the metrics and scoring methodologies from the BIBI, RBP and PHI scores for Spring 2016. This table reveals that these assessment outcomes did not always agree for each site.

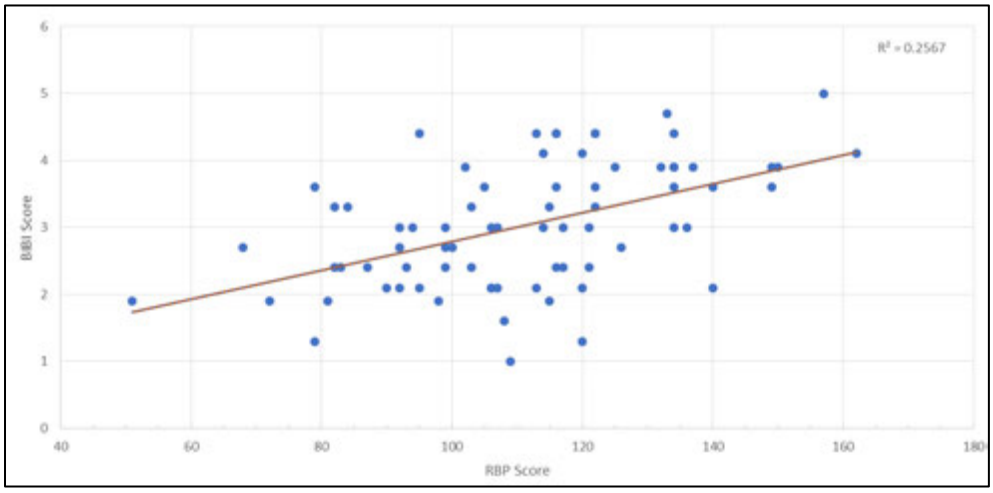

Figure 4-6: Correlation between RBP Habitat Score and BIBI Score

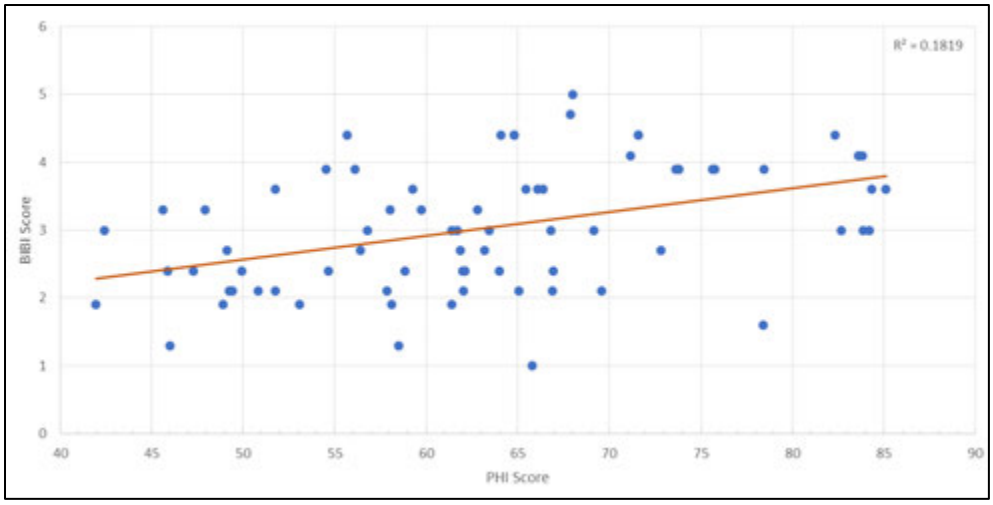

Figure 4-7: Correlation between PHI Habitat Score and BIBI Score

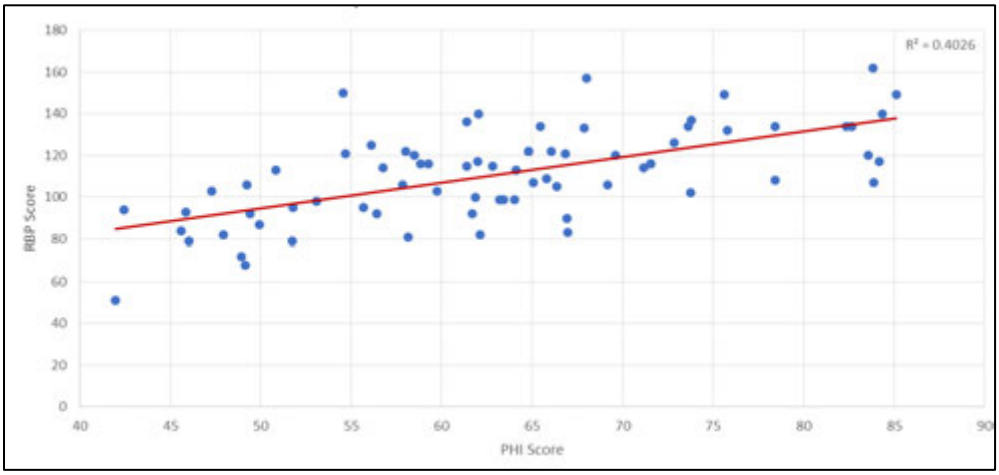

Figure 4-8: Correlation between PHI Habitat Score and RBP Score

4.5 SUBWATERSHED RESULT OVERVIEW

4.5.1 Cabin Branch

Cabin Branch was subdivided into five (5) subbasins, Cabin Branch 1 through Cabin Branch 5. Sampling was conducted at 10 sites; two (2) per subbasin, and two (2) rep sites to fulfill the quality control requirement. Analysis of the MBSS PHI scores resulted in an approximately equal distribution of narrative scores, with the average score calculated to be 68.89 and a narrative score of "Partially Degraded". Four (4) sites fall within the "Minimally Degraded" narrative score, three (3) sites fall within the "Partially Degraded" narrative score, three (3) sites fall within the "Degraded" narrative score, and two (2) sites fall within the "Severely Degraded" narrative score.

Analysis of the EPA RBP score resulted in a skewed distribution of data toward stream conditions that do not express supporting a healthy biological community, based on Western Coastal Plain reference conditions obtained from Prince George's County streams (Stribling et al. 1999). The average quantitative EPA RBP score is 109 and the average narrative score is "Partially Supporting". Four (4) sites fall within the "Supporting"

narrative score, two (2) site fall within the "Partially Supporting" narrative score, and six (6) sites fall within the "Non-supporting" narrative score. No sites had a narrative score of "Comparable to Reference". When comparing the PHI and RBP scores, the averaged RBP score is a category below the averaged PHI score.

Analysis of the Water Quality data within the Cabin Branch subshed display slightly acidic waters as three (3) of 12 sites displayed pHs that fall below the Maryland water quality standards for Use 1 streams (6.5-8.5), The average pH of this watershed was calculated to be 6.56, meeting Maryland water quality standards. All Cabin Branch Sampling sites met the State requirements for dissolved oxygen, turbidity, and temperature. While no COMAR standard for specific conductivity currently exists, a threshold for biological impairment in Maryland streams has been established at 247 µS/cm (Morgan et al., 2007). Under this impairment threshold, none of the 12 sampled sites are considered to have an impaired specific conductivity.

4.5.2 Ferry Branch

Ferry Branch was subdivided into three (3) subbasins, Ferry Branch 1 through Ferry Branch 3. Sampling was conducted at seven (7) sites; two (2) per subbasin, and one (1) rep site to fulfill the quality control requirement. Analysis of the MBSS PHI scores resulted in a skewed distribution of narrative scores toward stream conditions that do not express supporting a healthy biological community, with the average score calculated to be 54.78 and a narrative score of "Degraded". One (1) site falls within the "Partially Degraded" narrative score, two (2) sites fall within the "Degraded" narrative score, and four (4) sites fall within the "Severely Degraded" narrative score. No sites fall within the "Minimally Degraded" narrative score.

Analysis of the EPA RBP score resulted in a skewed distribution of data toward stream conditions that do not express supporting a healthy biological community, based on Western Coastal Plain reference conditions obtained from Prince George's County streams (Stribling et al. 1999). The average quantitative EPA RBP score is 101 and the average narrative score is "Partially Supporting". Five (5) sites fall within the "Partially Supporting" narrative score and two (2) sites fall within the "Non-Supporting" narrative score. No sites had a narrative score of "Comparable to Reference" or "Supporting". When comparing the PHI and RBP scores, the averaged narrative RBP score is the same level rating as the averaged narrative PHI score.

Analysis of the Water Quality data within the Ferry Branch subshed display slightly acidic waters as three (3) of the seven (7) sites have recorded average pHs that fall below the Maryland water quality standards for Use 1 streams (6.5-8.5), The average pH of this watershed was calculated to be 6.48, which fails to meet the Maryland water quality standards. All Ferry Branch Sampling sites met the State requirements for dissolved oxygen, turbidity, and temperature. While no COMAR standard for specific conductivity currently exists, a threshold for biological impairment in Maryland streams has been established at 247 µS/cm (Morgan et al., 2007). Under this impairment threshold, two (2) of the seven (7) sampled sites are considered to have an impaired specific conductivity.

4.5.3 Hall Creek

Hall Creek was subdivided into three (3) subbasins, Hall Creek 1 through Hall Creek 3. Sampling was conducted at five (5) sites; in which all subbasins were represented by two (2) sampling sites with the exception of Hall Creek 2, which was only represented by one (1) site (LP04) due to lack of property owner access approval. Analysis of the MBSS PHI scores resulted in a skewed distribution of narrative scores toward stream conditions that do not express supporting a healthy biological community, with the average score calculated to be 56.68 and a narrative score of "Degraded". Four (4) sites fall within the "Degraded" narrative score and one (1) site falls within the "Severely Degraded" narrative score. No sites fall within the "Minimally Degraded" or "Partially Degraded" narrative scores.

Analysis of the EPA RBP score resulted in a skewed distribution of data toward stream conditions that do not express supporting a healthy biological community, based on Western Coastal Plain reference conditions obtained from Prince George's County streams (Stribling et al. 1999). The average quantitative EPA RBP score is 108 and the average narrative score is "Partially Supporting". Five (5) sites fall within the "Partially Supporting" narrative score and two (2) sites fall within the "Non-Supporting" narrative score. No sites had a narrative score of "Comparable to Reference" or "Supporting". When comparing the PHI and RBP scores, the averaged narrative RBP score is the same level rating as the averaged narrative PHI score.

Analysis of the Water Quality data within the Hall Creek subshed displays all five (5) sites had recorded average pHs that fall within the Maryland water quality standards for Use 1 streams (6.5-8.5). The average pH of this watershed was calculated to be 7.20, which meets the Maryland water quality standards. All Hall Creek Sampling sites met the State requirements for dissolved oxygen, turbidity, and temperature. While no COMAR standard for specific conductivity currently exists, a threshold for biological impairment in Maryland streams has been established at 247 µS/cm (Morgan et al., 2007). Under this impairment threshold, none of the five (5) sites are considered to have an impaired specific conductivity.

4.5.4 Lyons Creek

Lyons Creek was subdivided into 10 subbasins, Lyons Creek 1 through Lyons Creek 10. Sampling was conducted at 19 sites; in which all subbasins were represented by two (2) sampling sites with the exception of Lyons Creek 1 and Lyons Creek 6, which were only represented by one (1) site due to lack of property owner access approval and/or lack of sampleability at the accessed approved site location. MP117A was conducted to fulfill the Quality Control ratio requirement. Analysis of the MBSS PHI scores resulted in a skewed distribution of narrative scores toward stream conditions that do not express supporting a healthy biological community, with the average score calculated to be 62.23 and a narrative score of "Degraded". One (1) sites falls within the "Minimally Degraded" narrative score, seven (7) sites fall within the "Partially Degraded" narrative score, seven (7) sites fall within the "Degraded" narrative score, and four (4) sites fall within the "Severely Degraded" narrative score.

Analysis of the EPA RBP score resulted in a skewed distribution of data toward stream conditions that do not express supporting a healthy biological community, based on Western Coastal Plain reference conditions obtained from Prince George's County streams (Stribling et al. 1999). The average quantitative EPA RBP score is 111 and the average narrative score is "Partially Supporting". One (1) site falls within the "Comparable to Reference" narrative score, four (4) sites fall within the "Supporting" narrative score, eight (8) sites fall within the "Partially Supporting" narrative score, and six (6) sites fall within the "Non-Supporting" narrative score. When comparing the PHI and RBP scores, the averaged narrative RBP score is the same level rating as the averaged narrative PHI score.

Analysis of the Water Quality data within the Lyons Creek subshed displays six (6) of the 19 sites have a recorded average pH that falls below the Maryland water quality standards for Use 1 streams (6.5-8.5). The average pH of this watershed was calculated to be 6.71, which meets the Maryland water quality standards. All Lyons Creek Sampling sites met the State requirements for dissolved oxygen, turbidity, and temperature. While no COMAR standard for specific conductivity currently exists, a threshold for biological impairment in Maryland streams has been established at 247 µS/cm (Morgan et al., 2007). Under this impairment threshold, three (3) of the 19 sites are considered to have an impaired specific conductivity.

4.5.5 Rock Branch

Rock Branch was subdivided into three (3) subbasins, Rock Branch 1 through Rock Branch 3. Sampling was conducted at seven (7) sites; two (2) sampling sites per subbasin and one (1) to fulfill the quality control ratio requirement. Analysis of the MBSS PHI scores resulted in a skewed distribution of narrative scores toward

stream conditions that do not express supporting a healthy biological community, with the average score calculated to be 58.57 and a narrative score of "Degraded". One (1) site falls within the "Partially Degraded" narrative score, five (5) sites fall within the "Degraded" narrative score, and one (1) site falls within the "Severely Degraded" narrative score. No sites fall within the "Minimally Degraded" narrative score.

Analysis of the EPA RBP score resulted in a skewed distribution of data toward stream conditions that do not express supporting a healthy biological community, based on Western Coastal Plain reference conditions obtained from Prince George's County streams (Stribling et al. 1999). The average quantitative EPA RBP score is 122 and the average narrative score is "Partially Supporting". Three (3) fall within the "Supporting" narrative score, three (3) sites fall within the "Partially Supporting" narrative score, and one (1) site falls within the "Non-Supporting" narrative score. No sites had a narrative score of "Comparable to Reference". When comparing the PHI and RBP scores, the averaged narrative RBP score is the same level rating as the averaged narrative PHI score.

Analysis of the Water Quality data within the Rock Branch subshed displays two (2) of the seven (7) sites have a recorded average pH that falls below the Maryland water quality standards for Use 1 streams (6.5-8.5). The average pH of this watershed was calculated to be 6.65, which meets the Maryland water quality standards. All Rock Branch sampling sites met the State requirements for dissolved oxygen, turbidity, and temperature. While no COMAR standard for specific conductivity currently exists, a threshold for biological impairment in Maryland streams has been established at 247 µS/cm (Morgan et al., 2007). Under this impairment threshold, none of the seven (7) sites have an impaired specific conductivity.

4.5.6 Wilson Owens Branch

Wilson Owens Branch was subdivided into four (4) subbasins, Wilson Owens Branch 1 through Wilson Owens Branch 4. Sampling was conducted at nine (9) sites; two (2) sampling sites per subbasin and one (1) to fulfill the quality control ratio requirement. Analysis of the MBSS PHI scores resulted in a skewed distribution of narrative scores toward stream conditions that do not express supporting a healthy biological community, with the average score calculated to be 67.90 and a narrative score of "Partially Degraded". Two (2) sites fall within the "Minimally Degraded" narrative score and seven (7) sites falls within the "Degraded" narrative score. No sites fall within the "Partially Degraded" or "Severely Degraded" narrative scores.

Analysis of the EPA RBP score resulted in a skewed distribution of data toward stream conditions that do not express supporting a healthy biological community, based on Western Coastal Plain reference conditions obtained from Prince George's County streams (Stribling et al. 1999). The average quantitative EPA RBP score is 112 and the average narrative score is "Partially Supporting". One (1) site falls within the "Supporting" narrative score, six (6) sites fall within the "Partially Supporting" narrative score, and one (1) site falls within the "Non-Supporting" narrative score. No sites had a narrative score of "Comparable to Reference". When comparing the PHI and RBP scores, the averaged narrative RBP score is one (1) level rating higher than the averaged narrative PHI score.

Analysis of the Water Quality data within the Wilson Owens Branch subshed displays all sites meet the Maryland water quality standards for Use 1 streams (6.5-8.5). Two (2) of the ten sites (MP22 and MP98) have a recorded dissolved oxygen that falls below the state water quality standards (5 mg/L). All Wilson Owens Branch sampling sites met the State requirements for turbidity and temperature. While no COMAR standard for specific conductivity currently exists, a threshold for biological impairment in Maryland streams has been established at 247 µS/cm (Morgan et al., 2007). Under this impairment threshold, two (2) of the ten sites (MP19) has an impaired specific conductivity. This measurement is thought to be due to the high concentrations of iron found within the bed and bank of this stream.

4.5.7 Unnamed Tributary

The Unnamed Tributary subwatershed was subdivided into two (2) subbasins, Unnamed Tributary 2 and Unnamed Tributary 3. Sampling was conducted at four (4) sampling sites. Analysis of the MBSS PHI scores resulted in an average score calculated to be 68.98 and a narrative score of "Partially Degraded". One (1) site falls within the "Minimally Degraded" narrative score, one (1) site falls within the "Partially Degraded" narrative score, and two (2) sites fall within the "Degraded" score. No sites fall within the "Severely Degraded" narrative score.

Analysis of the EPA RBP score resulted in a skewed distribution of data toward stream conditions that do not express supporting a healthy biological community, based on Western Coastal Plain reference conditions obtained from Prince George's County streams (Stribling et al. 1999). The average quantitative EPA RBP score is 125 and the average narrative score is "Partially Supporting". One (1) site falls within the "Comparable to Reference" narrative score, two (2) sites fall within the "Partially Supporting" narrative score, and one (1) site falls within the "Non-Supporting" narrative score. No sites had a narrative score of "Comparable to Reference". When comparing the PHI and RBP scores, the averaged narrative RBP score is one (1) level rating lower than the averaged narrative PHI score.

Analysis of the Water Quality data within the Unnamed Tributary subshed displays two (2) of the four (4) sites have a recorded average pH that does not meet the Maryland water quality standards for Use 1 streams (6.5-8.5). The average pH of this watershed was calculated to be 6.91, which meets the Maryland water quality standards. All Unnamed Tributary sampling sites met the State requirements for dissolved oxygen, turbidity, and temperature. While no COMAR standard for specific conductivity currently exists, a threshold for biological impairment in Maryland streams has been established at 247 µS/cm (Morgan et al., 2007). Under this impairment threshold, none of the four (4) sites have an impaired specific conductivity.

4.5.8 Deep Creek

Sampling was conducted at two (2) sites within the Deep Creek subwatershed. Analysis of the MBSS PHI scores resulted in a skewed distribution of narrative scores toward stream conditions that do not express supporting a healthy biological community, with the average score calculated to be 62.02 and a narrative score of "Degraded". One (1) site scored a "Severely Degraded" narrative score and the other site a "Partially Degraded" narrative score.

Analysis of the EPA RBP score resulted in a skewed distribution of data toward stream conditions that do not express supporting a healthy biological community, based on Western Coastal Plain reference conditions obtained from Prince George's County streams (Stribling et al. 1999). The average quantitative EPA RBP score is 96 and the average narrative score is "Not Supporting". One (1) site falls within the "Partially Supporting" narrative score, and the other site a "Non- Supporting" narrative score. No sites had a narrative score of "Comparable to Reference". When comparing the PHI and RBP scores, the averaged narrative RBP score is one (1) level rating higher than the averaged narrative PHI score.

In-situ water quality samples from both of the Deep Creek sites failed to meet Maryland Water Quality Criteria for pH of 6.5 to 8.5. And site MP134A failed to meet the dissolved oxygen criteria of 5 mg/L. Each of the Deep Creek sampling sites met the State requirements for turbidity and temperature. While no COMAR standard for specific conductivity currently exists, a threshold for biological impairment in Maryland streams has been established at 247 µS/cm (Morgan et al., 2007). Under this impairment threshold, both sites are impaired for specific conductivity. Iron floc was observed at site MP134A. Iron oxidation is the likely cause of reduced dissolved oxygen, low pH, and elevated conductivity. Other potential causes that may need to be examined are presence of road salt within the groundwater table or a leaking septic system or sanitary sewer line.

4.5.9 Galloway Creek

Sampling was conducted at two (2) sites within the Galloway Creek subwatershed. Analysis of the MBSS PHI scores resulted in a consistent distribution of narrative scores toward stream conditions that do not express supporting a healthy biological community, with the average score calculated to be 61.02 and a narrative score of "Degraded". Both sites scored a "Degraded" narrative score individually.

Analysis of the EPA RBP score resulted in a consistent distribution of data toward stream conditions that do not express supporting a healthy biological community, based on Western Coastal Plain reference conditions obtained from Prince George's County streams (Stribling et al. 1999). The average quantitative EPA RBP score is 110.5 and the average narrative score is "Partially Supporting". Both sites fall within the "Partially Supporting" narrative score. No sites had a narrative score of "Comparable to Reference". When comparing the PHI and RBP scores, the averaged narrative RBP score is one (1) level rating higher than the averaged narrative PHI score.

In-situ water quality samples from one (1) of the Galloway Creek sites failed to meet Maryland Water Quality Criteria for pH of 6.5 to 8.5, and both sites met the criteria for dissolved oxygen (5mg/L). Each of the Galloway Creek sampling sites met the State requirements for turbidity and temperature. While no COMAR standard for specific conductivity currently exists, a threshold for biological impairment in Maryland streams has been established at 247 µS/cm (Morgan et al., 2007). Under this impairment threshold, one (1) site is impaired for specific conductivity.

4.5.10 Pindell Branch

Sampling was conducted at two (2) sites within the Pindell Branch subwatershed. Analysis of the MBSS PHI scores resulted in a consistent distribution of narrative scores toward stream conditions that do not express supporting a healthy biological community, with the average score calculated to be 82.37 and a narrative score of "Partially Degraded". Both sites scored a "Partially Degraded" narrative score individually.

Analysis of the EPA RBP score resulted in a consistent distribution of data toward stream conditions that do not express supporting a healthy biological community, based on Western Coastal Plain reference conditions obtained from Prince George's County streams (Stribling et al. 1999). The average quantitative EPA RBP score is 117 and the average narrative score is "Partially Supporting". Both sites fall within the "Partially Supporting" narrative score. No sites had a narrative score of "Comparable to Reference". Scores for both sites are comparable for PHI and RBP.

In-situ water quality samples from both of the Pindell Branch sites failed to meet Maryland Water Quality Criteria for pH of 6.5 to 8.5, and both sites met the criteria for dissolved oxygen (5mg/L). Each of the Pindell Branch sampling sites met the State requirements for turbidity and temperature. While no COMAR standard for specific conductivity currently exists, a threshold for biological impairment in Maryland streams has been established at 247 µS/cm (Morgan et al., 2007). Under this impairment threshold, neither of the two sites are impaired for specific conductivity.

4.5.11 Two Run Branch

Two Run Branch was subdivide into two (2) sub-basins, Two Run Branch 1 and Two Run Branch 2. Sampling was conducted at five (5) sites; two (2) per sub-basin, and one (1) rep site to fulfill the Quality Control requirement. Analysis of the MBSS PHI scores resulted in a skewed distribution of narrative scores toward stream conditions that do not express supporting a healthy biological community, with the average score calculated to be 86.25 and a narrative score of "Partially Degraded". All sample sites are within the "Partially Degraded" narrative score individually.

Analysis of the EPA RBP score resulted in a skewed distribution of data toward stream conditions that do not express supporting a healthy biological community, based on Western Coastal Plain reference conditions obtained from Prince George's County streams (Stribling et al. 1999). The average quantitative EPA RBP score is 111.6 and the average narrative score is "Partially Supporting". Three (3) sites fall within the "Partially Supporting" narrative score, one (1) site within the "Non-Supporting" narrative score, and one (1) site within the "Supporting" narrative score. No sites had a narrative score of "Comparable to Reference". When comparing the PHI and RBP scores, the averaged narrative RBP score is one rating below the averaged narrative PHI score.

Analysis of the Water Quality data for the Two Run Branch sub-sheds displays three (3) of the five (5) sites have recorded average pH that falls below the Maryland water quality standards for Use 1 streams (6.5-8.5). The average pH of this watershed was calculated to be 6.40, which fails to meet the Maryland water quality standards. All Two Run Branch sampling sites met the State requirements for dissolved oxygen, turbidity, and temperature. While no COMAR standard for specific conductivity currently exists, a threshold for biological impairment in Maryland streams has been established at 247 µS/cm (Morgan et al., 2007). Under this impairment threshold, none of the five (5) sites are conductivity impaired.

4.6 WATER CHEMISTRY VARIABLES

The water quality analysis performed is limited in scope. The sampling conducted (Appendix F) represents only a snapshot of conditions in time and is not fully representative of the mean or range of conditions that the biota are subjected to. Additionally, several parameters (i.e., dissolved oxygen and temperature) are influenced by daily cycles of ambient temperature and stream metabolism so a point in time measurement is of marginal use unless found to be extreme.

Of all water quality parameters collected, pH was the most frequent parameter found to be out of Code of Maryland (COMAR) standards. For the 2016 Spring Index Period, 24 of the 74 sites for which water quality samples were collected were below the pH standard, with MP16-REP being the lowest at 5.66, and MP05 being the highest at 8.40. Twenty-three (23) of the 24 out of code sites are below (acidic) the COMAR standards; while one (1) site was above (basic) the COMAR standard. The low pH values are of concern, as they exist at 31% of the sites. Acidic mineral soils from the watershed and the existence of wetlands which are acidic may be the cause of the acidic waters.

Sites MP08 and MP09 had recorded temperatures of 6.71 and 5.77, respectively. These sites are headwater sites fed by multiple ground water seeps contributing to the abnormally cold water temperatures.

While no COMAR standard for specific conductivity currently exists, a threshold for biological impairment in Maryland streams has been established at 247 µS/cm (Morgan et al., 2007). Under this impairment threshold, the 2016 data results indicate nine (9) of the 74 sampled sites (12%) would be considered impaired for specific conductivity, likely due to the inputs of stormwater road runoff increasing these values, and increased levels of chlorides in baseflow. One (1) outlier, site MP134A, has a recorded average specific conductivity of 931 µS/cm. Observed iron floc at this site is the probable cause of high conductivity.

The dissolved oxygen parameter has a State minimum is 5.0 mg/L. Using this quantity, three (3) sites (4%) failed to meet the standard. The lowest recorded average was at site MP134A, averaging 2.36 mg/L, also the likely result of iron oxidation.

4.7 IMPERVIOUS COVER RESULTS

The watersheds that were assessed encompass an area of 55,435.25 acres (86.62 sq. mi). Of this area, 2,515.95 acres (3.93 sq. mi), or 4.54%, were identified as impervious within the 2014 Anne Arundel County GIS data.

Upon review of the impervious cover within the study area it was determined that the overall impervious surfaces within each watershed averages 4.97%. As displayed in Table 4-2 below, the minimum and maximum impervious coverage within a watershed were 0.57% at MP02 to 17.42% at MP134A, respectively. In general, the impervious cover within these watersheds is relatively low, as one might expect within this rural portion of the county. The total amount of forested cover within the targeted watersheds is 19,909.47 acres (31.11 sq. mi) and accounts for 35.91% of the total land area.

Table 4-2: Impervious Cover Results

Site ID	Drainage Area (acres)	Impervious Area (acres)	Impervious Percentage
LP02	1471.38	76.59	5.21%
LP04	144.58	9.64	6.67%
LP06	412.63	12.33	2.99%
LP09A	1093.61	65.31	5.97%
LP11A	80.53	3.72	4.62%
MP01	1262.52	50.93	4.03%
MP02	114.28	0.65	0.57%
MP03	3846.78	135.04	3.51%
MP04	168.25	3.42	2.04%
MP05	1024.36	44.10	4.30%
MP06	150.66	12.73	8.45%
MP07	2530.53	92.19	3.64%
MP08	115.00	6.49	5.64%
MP09	996.01	41.84	4.20%
MP103A	136.75	9.16	6.70%
MP109A	157.30	1.98	1.26%
MP11	2738.55	103.93	3.80%
MP112A	106.30	4.61	4.34%
MP113A	123.53	6.04	4.89%
MP117A	2473.53	107.59	4.35%
MP117A-REP	2456.06	105.52	4.30%
MP118A	2750.22	131.48	4.78%
MP119A	226.54	14.39	6.35%
MP121A	245.18	22.27	9.08%
MP124A	3678.68	187.81	5.11%
MP126A	289.68	8.19	2.83%
MP128A	1975.08	68.66	3.48%
MP129A	194.80	9.42	4.84%
MP13	214.17	19.12	8.93%
MP132A	9462.08	409.37	4.33%
MP134A	72.06	12.55	17.42%

Table 4-2: Impervious Cover Results			
Site ID	**Drainage Area (acres)**	**Impervious Area (acres)**	**Impervious Percentage**
MP139A	1433.46	63.10	4.40%
MP139A-REP	1433.46	63.10	4.40%
MP15	1897.75	78.24	4.12%
MP16	88.31	5.42	6.14%
MP16-REP	83.77	4.67	5.57%
MP19	187.99	25.72	13.68%
MP22	184.15	3.41	1.85%
MP23	273.52	10.46	3.83%
MP24	85.49	5.05	5.91%
MP25	128.91	7.09	5.50%
MP26	394.88	22.23	5.63%
MP31	633.21	30.42	4.80%
MP31-REP	609.96	28.57	4.68%
MP33	974.70	86.88	8.91%
MP34	112.07	1.41	1.26%
MP35	90.04	3.40	3.78%
MP36	155.19	3.63	2.34%
MP37	47.49	0.38	0.80%
MP38	331.85	8.69	2.62%
MP39	1352.98	51.85	3.83%
MP39-REP	1360.67	52.33	3.85%
MP42	431.02	19.32	4.48%
MP43	346.95	15.65	4.51%
MP44	38.31	2.00	5.23%
MP48	220.85	13.99	6.33%
MP50	42.15	2.06	4.88%
MP51	3790.27	192.51	5.08%
MP53	862.22	42.58	4.94%
MP57	294.40	22.63	7.69%
MP60	289.66	21.06	7.27%
MP61	234.07	5.07	2.17%
MP62	93.28	1.84	1.98%
MP64	614.82	21.48	3.49%
MP64-REP	614.82	21.48	3.49%
MP71	229.06	8.63	3.77%
MP71A-REP	222.21	8.51	3.83%
MP79A	144.63	6.74	4.66%

Table 4-2: Impervious Cover Results			
Site ID	**Drainage Area (acres)**	**Impervious Area (acres)**	**Impervious Percentage**
MP80A	167.91	16.01	9.54%
MP86A	91.15	6.68	7.33%
MP88A	36.88	1.90	5.15%
MP92A	78.52	6.98	8.89%
MP97A	237.91	5.16	2.17%
MP98A	563.63	24.70	4.38%

4.8 INTEGRATED ASSESSMENT

The instream macroinvertebrate community is inextricably linked with water quality and physical habitat. Water quality and physical habitat can be ever changing variables throughout the life of an aquatic organism and can influence the biological assemblage found within a given site. The field work that was conducted looked at a brief snapshot of the conditions present at each sampling location and therefore can only be used to infer a limited amount of information on the macroinvertebrate community.

As described earlier, the RBP and PHI metrics were used to assess physical habitat and the BIBI scores were used to determine the health of the macroinvertebrate community. While these techniques can often show strong correlation between one another, they can also vary widely which would indicate that other factors are influencing the biological community within a stream. When comparing the BIBI scores to both the RBP and PHI for the Lower and Middle Patuxent sampling sites one can see there is only a moderate Pearson correlation, as expressed by *r* (rho), between BIBI scores and RBP scores (r=0.507) and with PHI scores (r=0.427) (Appendix J). The lack of strong correlation between the BIBI and habitat assessment scores would likely indicate that there are other factors influencing the macroinvertebrate community such as water quality or the local hydrology.

When comparing the *r* values of the BIBI scores with the water quality parameters, little correlation can be seen with pH (r =0.0002), temperature (r =-0.1586), DO (r =0.1796) and conductivity (r = -0.2700) (Appendix J). When comparing the BIBI scores to total dissolved solids and turbidity, one can see a slight correlation (TSD r =-0.3902 and Turbidity r =-0.3935). When looking at the correlation between all of the water quality parameters and BIBI, RBP and PHI, one can see a weak to moderate, but consistent, correlation when compared to turbidity across all three scores (BIBI r =-0.3935, RBP r =-0.3790 and PHI r =-0.4112). The increase in turbidity could lead to less than desirable water quality which could reduce the BIBI score. It is important to note that while the correlation coefficient may show potential for a relationship between these metrics, when a paired T-test was run to determine the probability, all the results found no significant relationship (>95% probability) between any of these metrics (Appendix J).

The weak to moderate consistency seen with turbidity can also be seen when correlating the BIBI scores with both the RBP and PHI habitat assessment parameters of bank stability and pool habitat. The correlation between BIBI and bank stability has a *r* value of 0.546 for the PHI and 0.438 for RBP pool character metric (Appendix J). Lack of bank stability may lead to increased sediment deposition which has the potential to limit the amount of available habitat for certain species of macroinvertebrates. When comparing bank stability metrics with the sediment deposition metric, very little correlation can be noted (r values between 0.1896 and 0.2093). This indicates that sediment deposition caused by bank erosion, if present at these sample locations, is not likely

significantly influencing BIBI numbers. The abundance and character of the pool habitat could provide specific niche habitats that are preferred by certain species that would increase BIBI scores. This is supported by the comparison of the PHI pool/glide/eddie quality metric to the BIBI scoring metric for percent Ephemeroptera taxa, the *r* value was 0.471 indicating that this is a potential cause for increase BIBI scores at some stations. Similar to the results of the comparison between the BIBI scores and the water quality parameters, the comparison of BIBI scores to the habitat assessment parameters showed no significant (>95% probability) relationship between any of the metrics (Appendix J). This also included the relationship between BIBI scores and impervious surfaces and forest cover.

Additional analysis was performed to determine if there were any appreciable difference between the Middle Patuxent (MP) and Lower Patuxent (LP) watersheds. Since only five (5) of the 74 samples were collected in the Lower Patuxent watershed there is not a sufficient amount of data to make statistical comparisons; however, some general observations can be made. The PHI scores for LP showed that none of the sites were either minimally or partially degraded, 12% of the sites in MP were minimally degraded and 30% were partially degraded, indicating that the overall habitat may be better within MP. The same can be seen with the BIBI scores. Within the LP watershed, 0% of the sites had a rating of good while 17% of the sample sites in MP were categorized as good. When analyzing the BIBI metrics and their associated scores (1, 3, and 5) there were numerous categories in which the LP had a larger proportion of sites that ranked poor and a smaller proportion of sites that ranked good when compared to MP. These include:

- Number of Taxa
- Number of EPT Taxa
- Number of Ephemeroptera
- Percent Intolerant
- Percent Ephemeroptera
- Number of Scraper Taxa
- Percent Climbers

While anecdotal, these metrics indicate that the Lower Patuxent watershed may have more stressors that affect the biological community than the Middle Patuxent. Refer to Appendix K for supplemental graphing analysis of BIBI metrics, BIBI scoring, and stream habitat scoring.

5 CONCLUSIONS

Seventy-four sites were sampled in the Middle and Lower Patuxent Watersheds during the 2016 Spring Index Period. The results provided in Section 4 and in the appendices of this report support the following conclusions regarding the water quality and habitats present at the 74 sampled sites.

For the RBP habitat assessment, two (2) of the 74 sites (~3%) fall within the "Comparable to Reference" narrative score, 14 of the 74 sites (~19%) fall within the "Supporting" narrative score, 36 of the 74 sites (~49%) fall within the "Partially Supporting" narrative score, and 22 of the 74 sites fall with the "Non-Supporting" narrative score. The highest RBP score (162) was recorded at site MP01; while the lowest score (51) was record at MP88A. The distribution of these results is more heavily skewed toward "Partially Supporting" and "Non-Supporting" narrative scores than the MBSS PHI scores. Further investigation and monitoring of the sites falling with in these narratives may enhance the probability of identifying and addressing stressors to the potential habitat and furthering degradation of the stream channel.

For the PHI habitat assessment, eight (8) of the 74 sites (~11%) of the sites fall within the "Minimally Degraded" narrative score, 21 of the 74 sites (~28%) fall within the "Partially Degraded" narrative score, 32 of the 74 sites (~43%) fall within the "Degraded" narrative score, and 13 of the 74 sites (~18%) fall within the "Severely

Degraded" narrative score. The highest PHI score (83.84) was recorded at site MP01; while the lowest score (41.97) was recorded at site MP88A.The bell-shaped curve produced by this data supports and normal probability distribution; however further investigation and monitoring of the sites falling with in the "Degraded" to "Severely Degraded" narrative scores may enhance the probability of identifying and addressing stressors to the potential habitat and furthering degradation of the stream channel.

The BIBI scores determined 12 of the 74 sites (~17%) fall within in the "Good" narrative score, 30 of the 74 sites (41%) fall within the "Fair" narrative score, 23 of the 74 sites (~31%) fall within the "Poor" narrative score, nine (9) of the 74 sites (~12%) fall within the "Very Poor" narrative score. The highest BIBI Score (5) was recorded at site MP124A, and the lowest score (1) was recorded at site LP04. The bell-shaped curve produced by this data supports and normal probability distribution; however further investigation and monitoring of the sites falling with in the "Poor" to "Very Poor" may enhance the probability of identifying and addressing stressors to the potential habitat of benthic macroinvertebrates at these sites, and their respective subwatersheds.

Of the water quality "point in time" measurements made, pH, specific conductivity, and dissolved oxygen were the parameters to be found to be in violation of State of Maryland Standards for Use 1 waters. The failed sites should be investigated more thoroughly as several of the pH levels were very acidic and can be detrimental to aquatic life. It is possible, however, that acidic soils in the county are causing this condition and consideration should be given for this. The high values for conductivity are also of concern; however, may potentially be due to the inputs of mineral soils, elevated chloride levels in the stream baseflow, uncontrolled stormwater road runoff or defective septic systems.

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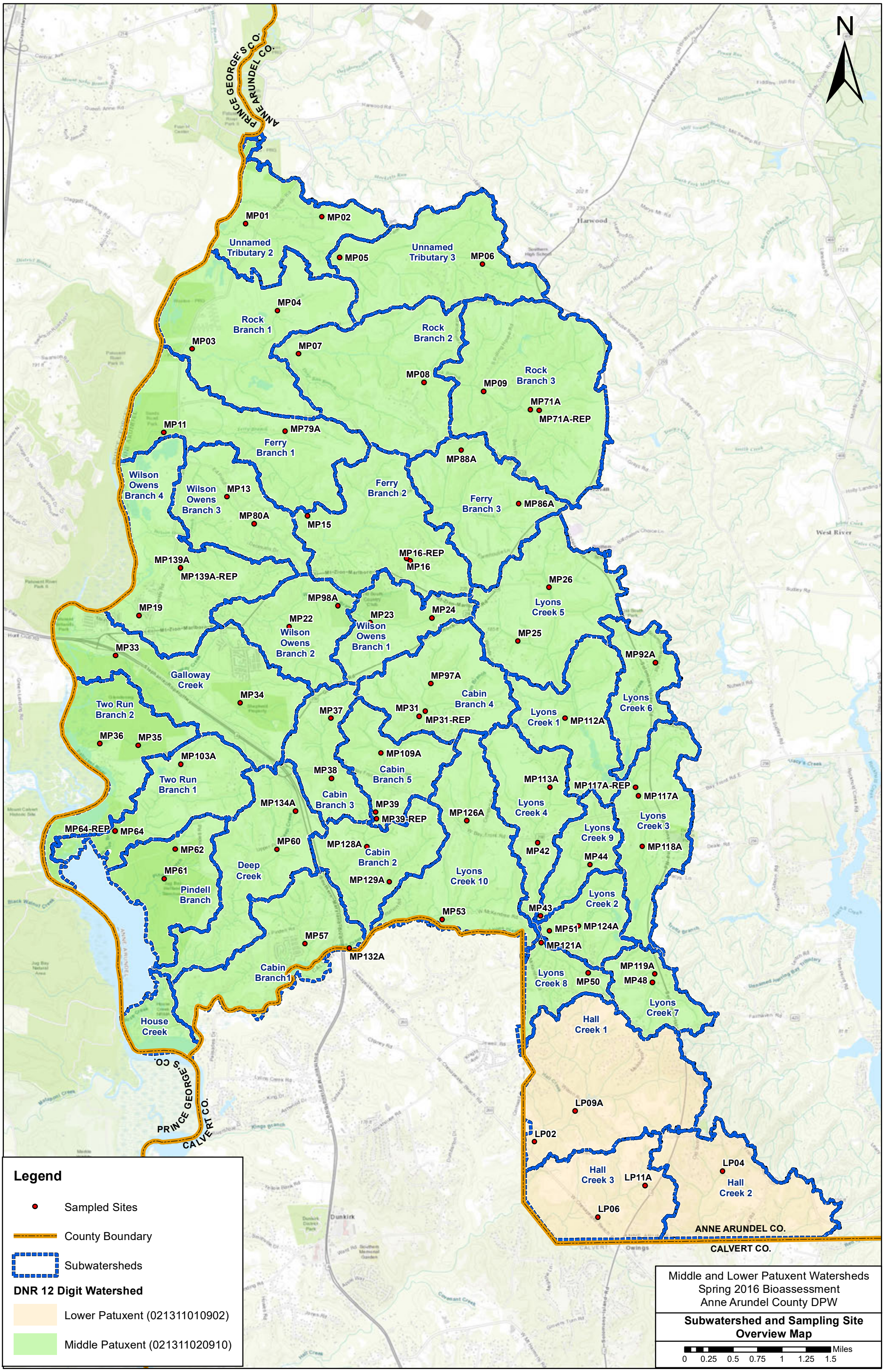
APPENDIX A –
SUBWATERSHED AND SAMPLING SITE OVERVIEW MAPPING


N
PRINCE GEORGE'S CO.
ANNE ARUNDEL CO.
MP01
MP02
Unnamed Tributary 2
MP05
Unnamed Tributary 3
MP06
MP04
Rock Branch 1
Rock Branch 2
MP03
MP07
MP08
MP09
Rock Branch 3
MP71A
MP71A-REP
MP11
MP79A
Ferry Branch 1
MP88A
Wilson Owens Branch 4
Wilson Owens Branch 3
MP13
Ferry Branch 2
Ferry Branch 3
MP86A
MP80A
MP15
MP16-REP
MP16
MP139A
MP139A-REP
MP26
MP98A
Lyons Creek 5
MP19
MP22
MP23
MP24
Wilson Owens Branch 2
Wilson Owens Branch 1
MP25
MP33
MP92A
Galloway Creek
MP97A
MP34
Cabin Branch 4
Lyons Creek 6
Two Run Branch 2
MP37
MP31
MP31-REP
Lyons Creek 1
MP112A
MP36
MP35
MP109A
MP103A
MP38
Cabin Branch 5
MP113A
MP117A-REP
MP117A
Two Run Branch 1
MP134A
Cabin Branch 3
MP39
MP39-REP
MP126A
Lyons Creek 4
Lyons Creek 3
MP64-REP
MP64
Lyons Creek 9
MP118A
MP60
MP128A
MP62
Cabin Branch 2
MP42
MP44
MP61
Deep Creek
MP129A
Lyons Creek 10
Lyons Creek 2
Pindell Branch
MP53
MP43
MP57
MP51
MP124A
MP132A
MP121A
Cabin Branch1
MP119A
Lyons Creek 8
MP50
MP48
Lyons Creek 7
House Creek
Hall Creek 1
PRINCE GEORGE'S CO.
CALVERT CO.
LP09A
LP02
LP04
Hall Creek 3
LP11A
Hall Creek 2
LP06
ANNE ARUNDEL CO.
CALVERT CO.
Harwood
West River
Dunkirk
Owings
Legend
Sampled Sites
County Boundary
Subwatersheds
DNR 12 Digit Watershed
Lower Patuxent (021311010902)
Middle Patuxent (021311020910)
Middle and Lower Patuxent Watersheds
Spring 2016 Bioassessment
Anne Arundel County DPW
Subwatershed and Sampling Site Overview Map
Miles
0 0.25 0.5 0.75 1 1.25 1.5

APPENDIX B –
INDIVIDUAL SITE FIELD DATA SHEETS

v. 2009

MBSS SPRING HABITAT DATA SHEET

SITE — Watershed Code: LP | Segment: 02 | Type: 1 | Year: 2016

Reviewer: First KB / Second JT

DATE — Year: 16 | Month: 03 | Day: 29

600 Dist. from Nearest Road to Site (m)

16 Trash Rating 0 - 20

LANDUSE (Y/N)

N	Old Field	Y	Residential
Y	Deciduous Forest	N	Commercial/Industrial
N	Coniferous Forest	N	Cropland
N	Wetland	N	Pasture
N	Surface Mine	N	Orchard/Vineyard/Nursery
N	Landfill	N	Golf Course

RIPARIAN VEGETATION
(facing upstream)

	LEFT BANK	RIGHT BANK
Width (50m max)	45	50
Adjacent Land Cover	FR	FR
Vegetation Type	M Y L R	M Y R
Buffer Breaks (Y/N)	N	N

	LEFT BANK	RIGHT BANK
Storm Drain		
Tile Drain		
Impervious Drainage		
Gully		
Orchard		
Crop		
Pasture		
New Construction		
Dirt Road		
Gravel Road		
Raw Sewage		
Railroad		

Buffer Break Types (M = minor; S = severe)

ROAD CULVERT

Present in Segment (Y/N)	N
Sampleable? (Y/N)	N
Width of Culvert (m)	XX
Length of Culvert (m)	XX

STREAM GRADIENT

	Location (m)	Height (m)
1		
2		
3		

CHANNELIZATION

N Evidence of Channel Straightening or Dredging (Y/N)

TYPE	EXTENT (m) LEFT BANK	BOTTOM	RIGHT BANK
Concrete			
Gabion			
Rip-Rap			
Earthen Berm		N/A	
Dredge Spoil Off Channel		N/A	
Pipe Culvert			

Actual Coordinates
(If >30m distance between original coordinates and stream)

Lat
Lon

Stream Block Ht. (m)
Stream Block Type
Lat
Lon

v. 2009

MBSS SPRING INDEX PERIOD DATA SHEET

Page 2 Of 7

SITE Watershed Code LP | Segment 02 | Type 11 | Year 2016

Reviewer: First KB / Second JT

DATE Year 16 Month 03 Day 29

CREW: KB / JT

STREAM: LP02

TIME 1349 (Military)

LOCALITY: Friendship, MD

SAMPLEABILITY

- [x] Benthos
- [x] Habitat Assessment
- [x] Water Quality
- [ ] Vernal Pool [A] (PRESENT/ABSENT)

OTHER (SPECIFY)

SITE ACCESS ROUTE

through adjacent field to tree line,

SAMPLE LABELS

Verified by: JT

QC LABEL

Watershed Code LP | Segment 02 (Letters only) | Type | Year 2016

Dup. (D) or Blank (B): | Verified by:

TEMP. LOGGER

	(Y/N)	(TIME - Military)	
WATER			#
AIR			#

LOCATION

PHOTODOCUMENTATION

Number	Title	Voucher (Y/N)
	U- US IDS	
	DS- US IDS	
	US- US IDS	
	frog	
	tree pole (on GPS)	

BENTHIC HABITAT SAMPLED

01	Riffle	05	Leaf Pack	00	Undercut Banks
14	Rootwad/Woody Debris	00	Macrophytes	00	Other

SAMPLING CONSID.: (NUM. ANODES)

STREAM WIDTH (m)

0 m 75 m

v. 2009

MBSS SPRING FAUNA DATA SHEET

SITE — Watershed Code: LP | Segment: 02 | Type: II | Year: 2016

Reviewer: First: KB / Second: JT

HERPETOFAUNA

☐ None Observed

Species	Lifestage (Adult, Juv., Larval, Egg)	SEEN (Y/N)	HEARD (Y/N)	NUMBER RETAINED	NUMBER PHOTOS TAKEN
1 Tadpole	Larval	Y	N	0	1
3 northern green frog	Juv.	Y	N	0	1
1 Salamander	Juv.	Y	N	0	1

MUSSELS

☑ None Observed

Species	LIVE	DEAD	NUMBER RETAINED	NUMBER PHOTOS TAKEN

Corbicula — LIVE ☐ DEAD ☐ NONE ☐

CRAYFISHES

☑ None Observed

Species	NUMBER RETAINED

Crayfish Burrows [ ]
(Absent, Present, Extensive)

COMMENTS

Physical Habitat Assessment and Water Quality Data Sheet

Site ID: LP02
Subwatershed: HALL CREEK / LOWER Patuxent
Length of Reach: 75 m Date: 3/29/16
Team Members: KB/ST Time: 1:00p

Weather
Current: Sunny, windy, 55°F
Past 24hrs: Rain in AM
Past 48hrs: Sunny

Stream Character

P Meandering	A Channelized
A Braided	A Straight
P Riffle	P Run/Glide
A Deep Pool >.5m	[illegible] Silt/Clay
P Shallow Pool <.5m	P Sand
P Gravel	P Cobble
A Boulder >2m	A Boulder <2m
A Concrete/Gabion	A Bedrock
P Undercut Bank	P Rootwad
P Overhead Cover	A Storm Drain
A Effluent Discharge	A Human Refuse
P Emergent Vegetation	A Beaver Pond
A Floating Vegetation	

A=Absent *P=Present* *E=Extensive*

Parameter	Down-stream	Mid-stream	Up-stream
Description			
pH	7.22	7.4	7.17
Temperature (°C)	14.1	14.0	14.2
DO (mg/l)	10.32	11.25	11.32
Conductivity (uS/cm)	171.8	172.0	171.8
TDS (mg/l)	141.05	141.7	140.4
Turbidity (NTU)	9.46	8.97	8.11

Notes: BaroM-30.071 mHg
D-30.072 mHg
U-30.072 mHg

Bar Formation
☐ None
☑ Minor
☐ Moderate
☐ Extensive

Photographs/Observations:
1 Frog photo
M- US/DS
DS- US/DS
US - US/DS
1 tadpole photo
1 salamander photo

Bank Erosion (see guidance sheet)

	Left Bank	Right Bank
Extent (m)	75	75
Severity	2	2
Avg. Height	3'	3'

Severity: *0=none*, *1=min*, *2=mod*, *3=severe*

Maximum stream depth (cm) 46

Benthic Habitat Sampled (20 total)

	Sq. ft.
Riffle	1
Rootwad/Woody Debris	14
Leaf Pack	~~4~~ 5
Submerged Vegetation	0
Undercut Banks	0
Other: N/A	0

Rootwads/Woody Debris

# Instream Woody Debris	~~14~~ 5
# Dewatered Woody Debris	6
# Instream Rootwads	5
# Dewatered Rootwads	8

~~**Stream Gradient**~~
~~Location (ft) Height (ft) Water Depth (ft)~~

MBSS Physical Habitat Assessment Sheet

Stream Habitat Assessment Guidance Sheet

Habitat Parameter	Optimal 16-20	Sub-Optimal 11-15	Marginal 6-10	Poor 0-5
1. Instream Habitat[2] SCORE 10	Greater than 50% of a variety of cobble, boulder, submerged logs, undercut banks, snags, rootwads, aquatic plants or other stable habitat	30-50% of stable habitat. Adequate habitat	10-30% mix of stable habitat. Habitat availability less than desireable	Less than 10% stable habitat. Lack of habitat is obvious
2. Epifaunal Substrate[3] SCORE 5	Preferred substrate abundant, stable, and at full colonization potential (riffles well developed and dominated by cobble; and/or woody debris prevalent, not new; and not transient	Abund. of cobble with gravel and/or boulders common; or woody debris, aquatic veg., undercut banks common but not prevalent/suited for full colonization	Large boulder and/or bedrock prevalent; cobble, woody debris, or other preferred surfaces uncommon	Stable substrate lacking; or particles are over 75% surrounded by fine sediment or flocculent material
3. Velocity/Depth Diversity[4] SCORE 10	Slow (<0.3m/s), deep (>0.5m); slow, shallow (<0.5m); fast (>0.3m/s), deep; fast, shallow habitats all present	Only 3 of the 4 habitat categories present	Only 2 of the 4 habitat categories present	Dominated by 1 velocity/depth category (usually pools)
4. Pool/Glide/Eddy Quality[4] SCORE 10	Complex cover/l/or depth >1.5m; both deep (>0.5m)/shallows (<0.2m) present	Deep (>0.5m) areas present; but only moderate cover	Shallows (<0.2m) prevalent in pool/glide/eddy habitat; little cover	Max depth <0.2m in pool/glide/eddy habitat; or absent completely
5. Riffle/Run Quality[4] SCORE 8	Riffle/run depth generally >10cm, with maximum depth greater than 50 cm (maximum score); substrate stable (e.g. cobble, boulder) & variety of current velocities	Riffle/run depth generally 5-10cm, variety of current velocities	Riffle/run depth generally 1-5cm; primarily a single current velocity	Riffle/run depth <1cm; or riffle/run substrates concreted
6. Bank Stability[4] (facing downstream.) Score each bank. LB SCORE 5 RB SCORE 5	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected. 10 9	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion. 8 7 6	Moderately unstable; 30-60% of bank in reach as areas of erosion; high erosion potential during floods. 5 4 3	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars. 2 1 0
7. Embeddedness SCORE 60 %	Percentage that gravel, cobble, and boulder particles are surrounded by fine sediment or flocculent material			
8. Shading SCORE 75 %	Percentage of segment that is shaded (duration is considered in scoring). 0% = fully exposed to sunlight all day in summer; 100% = fully and densely shaded all day in summer			
9. Riparian Buffer Zone Width (m)[4] LB 30 RB 50	Zone width in which human activity is not evident. 50m (164ft) is the maximum recorded value.			
10. Remoteness SCORE 15	Roads greater than 400 meters (0.25 mi) from stream	Roads within 400 meters (0.25 mi) of stream; stream NOT accessible by trail	Roads within 400 meters (0.25 mi) of stream; stream accessible by trail	Roads adjacent to stream.
11. Aesthetic (trash) Rating[4] SCORE 16	Little or no human refuse visible from stream channel or riparian zone	Refuse present in minor amounts	Refuse present in moderate amounts	Refuse abundant and unsightly
12. Number of Woody Debris and Rootwads[4] SCORE 10	Count only woody debris and rootwads within the wetted portion of the sampling segment. Count only woody debris >10cm (4in) diameter and >1.5m (5ft) long and rootwads with trunk diameter (at chest height) >15cm (6in) that are functional habitat within the wetted portion of the stream.			

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS

Parameters to be evaluated broader than sampling reach

Habitat Parameter	Condition Category			
	Optimal	Suboptimal	Marginal	Poor
6. Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr) may be present, but recent channelization is not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.
SCORE 19	20 (19) 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
7. Channel Sinuosity	The bends in the stream increase the stream length 3 to 4 times longer than if it was in a straight line. (Note - channel braiding is considered normal in coastal plains and other low-lying areas. This parameter is not easily rated in these areas.)	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	Channel straight; waterway has been channelized for a long distance.
SCORE 11	20 19 18 17 16	15 14 13 12 (11)	10 9 8 7 6	5 4 3 2 1 0
8. Bank Stability (score each bank)	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.
SCORE 5 (LB)	Left Bank 10 9	8 7 6	(5) 4 3	2 1 0
SCORE 5 (RB)	Right Bank 10 9	8 7 6	(5) 4 3	2 1 0
9. Vegetative Protection (score each bank) Note: determine left or right side by facing downstream.	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
SCORE 4 (LB)	Left Bank 10 9	8 7 6	5 (4) 3	2 1 0
SCORE 4 (RB)	Right Bank 10 9	8 7 6	5 (4) 3	2 1 0
10. Riparian Vegetative Zone Width (score each bank riparian zone)	Width of riparian zone >18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone.	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6-12 meters; human activities have impacted zone a great deal.	Width of riparian zone <6 meters: little or no riparian vegetation due to human activities.
SCORE 9 (LB)	Left Bank 10 (9)	8 7 6	5 4 3	2 1 0
SCORE 7 (RB)	Right Bank 10 9	8 (7) 6	5 4 3	2 1 0

Total Score 134

Form # EL2 - _____

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS

STREAM NAME LP02	LOCATION Friendship MD
STATION # _____ REACH ID# _____	STREAM CLASS Perennial
UTM N _____ UTM E	RIVER BASIN Patuxent
STORET #	AGENCY CEI
INVESTIGATORS KB/JJT	
FORM COMPLETED BY KB	DATE 3/29/16 TIME 1150 PM
REASON FOR SURVEY MBSS	

Parameters to be evaluated in sampling reach

Habitat Parameter	Condition Category			
	Optimal	Suboptimal	Marginal	Poor
1. Epifaunal Substrate/ Available Cover	Greater than 50% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient).	30-50% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale).	10-30% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 10% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
SCORE 13	20 19 18 17 16	15 14 (13) 12 11	10 9 8 7 6	5 4 3 2 1 0
2. Pool Substrate Characterization	Mixture of substrate materials, with gravel and firm sand prevalent; root mats and submerged vegetation common.	Mixture of soft sand, mud, or clay; mud may be dominant; some root mats and submerged vegetation present.	All mud or clay or sand bottom; little or no root mat; no submerged vegetation.	Hard-pan clay or bedrock; no root mat or vegetation.
SCORE 15	20 19 18 17 16	(15) 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
3. Pool Variability	Even mix of large-shallow, large-deep, small-shallow, small-deep pools present.	Majority of pools large-deep; very few shallow.	Shallow pools much more prevalent than deep pools.	Majority of pools small-shallow or pools absent.
SCORE 10	20 19 18 17 16	15 14 13 12 11	(10) 9 8 7 6	5 4 3 2 1 0
4. Sediment Deposition	Little or no enlargement of islands or point bars and less than <20% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 20-50% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 50-80% of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; more than 80% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
SCORE 14	20 19 18 17 16	15 (14) 13 12 11	10 9 8 7 6	5 4 3 2 1 0
5. Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills >75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
SCORE 18	20 19 (18) 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0

MBSS SPRING HABITAT DATA SHEET

Page 1 of 7

SITE — Watershed Code: LR | Segment: 04 | Type: W | Year: 2016

DATE — Year: 16 | Month: 03 | Day: 29

Reviewer: First JT / Second KB

600 Dist. from Nearest Road to Site (m)

15 Trash Rating 0 - 20

LANDUSE (Y/N)

N	Old Field	Y	Residential
Y	Deciduous Forest	N	Commercial/Industrial
N	Coniferous Forest	N	Cropland
N	Wetland	Y	Pasture
N	Surface Mine	N	Orchard/Vineyard/Nursery
N	Landfill	N	Golf Course

RIPARIAN VEGETATION
(facing upstream)

	LEFT BANK	RIGHT BANK
Width (50m max)	10	20
Adjacent Land Cover	E M	E M
Vegetation Type	G R L	G R L
Buffer Breaks (Y/N)	N	N

ROAD CULVERT

Present in Segment (Y/N): N

Sampleable? (Y/N):

Width of Culvert (m):

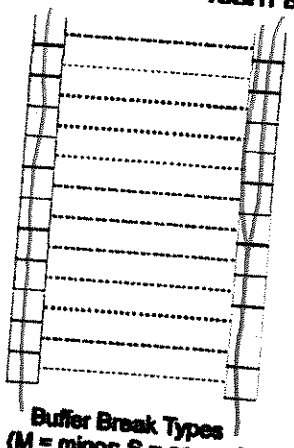
Length of Culvert (m):

STREAM GRADIENT

	Position (m)	Height (m)
1		
2		
3		

LEFT BANK / RIGHT BANK

Storm Drain
Tile Drain
Impervious Drainage
Gully
Orchard
Crop
Pasture
New Construction
Dirt Road
Gravel Road
Raw Sewage
Railroad



Buffer Break Types
(M = minor; S = severe)

CHANNELIZATION

N Evidence of Channel Straightening or Dredging (Y/N)

TYPE	EXTENT (m) LEFT BANK	BOTTOM	RIGHT BANK
Concrete			
Gabion			
Rip-Rap			
Earthen Berm		N/A	
Dredge Spoil Off Channel		N/A	
Pipe Culvert			

Actual Coordinates
(If >30m distance between original coordinates and stream)

Lat
Lon

Stream Block Ht. (m)

Stream Block Type

Lat

Lon

v. 2009

MBSS SPRING INDEX PERIOD DATA SHEET

SITE (Watershed Code: LP | Segment: 04 | Type: T | Year: 2016)

Reviewer: First JT / Second KB

DATE (Year: 16 | Month: 03 | Day: 29)

CREW: KB/JT

STREAM: LP04

TIME: 1100 (Military)

LOCALITY: Friendship, MD

SAMPLEABILITY

- [x] Benthos
- [x] Habitat Assessment
- [x] Water Quality
- [ ] Vernal Pool [A] (ASSESSMENT)

OTHER (SPECIFY)

SITE ACCESS ROUTE

Access from BGE utility row off Friendship road. ~2000 ft hike from road

SAMPLE LABELS

Verified by: KB

QC LABEL

Watershed Code: LP | Segment: 04 (Letters only) | Type: | Year: 2016

Dup. (D) or Blank (B): | Verified by:

TEMP. LOGGER

	(Y/N)	(TIME - Military)	#
WATER			
AIR			

LOCATION

PHOTODOCUMENTATION

Number	Title	Voucher (Y/N)
	Midpoint US/DS	
	Downstream US/DS	
	Upstream US/DS	
	Frog photo (TBD)	
	Fish photo (TBD)	

BENTHIC HABITAT SAMPLED

- [10] Riffle
- [10] Rootwad/Woody Debris
- [0] Leaf Pack
- [0] Macrophytes
- [0] Undercut Banks
- [0] Other

SAMPLING CONSID.: (NUM. ANODES)

STREAM WIDTH (m): 0 m | 75 m

v. 2009

MBSS SPRING FAUNA DATA SHEET

SITE Watershed Code LP | Segment 04 | Type # | Year 2016

Reviewer: First JT / Second MB

HERPETOFAUNA

☐ None Observed

Species	Lifestage (Adult, Juv., Larval, Egg)	SEEN (Y/N)	HEARD (Y/N)	NUMBER RETAINED	NUMBER PHOTOS TAKEN
Frog juvenile TBD	☐ ☒ ☐ ☐	☒	☐	☐	1
	☐ ☐ ☐ ☐	☐	☐	☐	☐
	☐ ☐ ☐ ☐	☐	☐	☐	☐
	☐ ☐ ☐ ☐	☐	☐	☐	☐
	☐ ☐ ☐ ☐	☐	☐	☐	☐
	☐ ☐ ☐ ☐	☐	☐	☐	☐
	☐ ☐ ☐ ☐	☐	☐	☐	☐

MUSSELS

☒ None Observed

Species	LIVE	DEAD	NUMBER RETAINED	NUMBER PHOTOS TAKEN
	☐	☐	☐☐	☐
	☐	☐	☐☐	☐
	☐	☐	☐☐	☐
	☐	☐	☐☐	☐
	☐	☐	☐☐	☐

Corbicula: LIVE ☐ DEAD ☐ NONE ☐

CRAYFISHES

☐ None Observed

Species	NUMBER RETAINED
[illegible] (juvenile)	☐☐
	☐☐
	☐☐
	☐☐
	☐☐

Crayfish Burrows: E

(Absent, Present, Extensive)

COMMENTS

1 fish TBD - 1 photo

Physical Habitat Assessment and Water Quality Data Sheet

Site ID: LP04 HOLY CREEK 2 – **Weather**
Subwatershed: Lower Patuxent **Current:** clear, windy, 55°F
Length of Reach: 75 m **Date:** 3/29/16 **Past 24hrs:** rain in AM
Team Members: KB/JT **Time:** 10:30am **Past 48hrs:** clear

Parameter	Down-stream	Mid-stream	Up-stream
Description			
pH	6.91	6.88	6.84
Temperature (°C)	10.3	10.2	10.5
DO (mg/l)	10.45	10.78	10.61
Conductivity (uS/cm)	148.2	115.3	154.2
TDS (mg/l)	133.9	104.00	138.45
Turbidity (NTU)	14.6	16.6	19.3

Notes: Barometer M - 30.019 in Hg
D - 30.019 in Hg
U - 30.022 in Hg

Stream Character

- [P] Meandering
- [A] Braided
- [P] Riffle
- [A] Deep Pool >.5m
- [P] Shallow Pool <.5m
- [A] Gravel
- [A] Boulder >2m
- [A] Concrete/Gabion
- [P] Undercut Bank
- [A] Overhead Cover
- [A] Effluent Discharge
- [P] Emergent Vegetation
- [P] Floating Vegetation
- [A] Channelized
- [A] Straight
- [P] Run/Glide
- [P] Silt/Clay
- [P] Sand
- [P] Cobble
- [A] Boulder <2m
- [A] Bedrock
- [A] Rootwad
- [A] Storm Drain
- [A] Human Refuse
- [A] Beaver Pond

A=Absent P=Present E=Extensive

Bar Formation

- [x] None
- [ ] Minor
- [ ] Moderate
- [ ] Extensive

Bank Erosion (see guidance sheet)

	Left Bank	Right Bank
Extent (m)	75m	75m
Severity	2	2
Avg. Height	0.6m	0.6m

Severity: 0=none 1=min 2=mod 3=severe

Maximum stream depth (cm) 14

Benthic Habitat Sampled (20 total)

	Sq. ft.
Riffle	10
Rootwad/Woody Debris	10
Leaf Pack	0
Submerged Vegetation	0
Undercut Banks	0
Other: N/A	0

Rootwads/Woody Debris

# Instream Woody Debris	5
# Dewatered Woody Debris	3
# Instream Rootwads	20
# Dewatered Rootwads	30

Stream Gradient

Location (ft)	Height (ft)	Water Depth (ft)

Photographs/Observations:

- Midpoint US/DS
- Downstream point US/DS
- Upstream point US/DS
- Frog
- fish

MBSS Physical Habitat Assessment Sheet

Stream Habitat Assessment Guidance Sheet				
Habitat Parameter	Optima 16-20	Sub-Optimal 11-15	Marginal 6-10	Poor 0-5
1. Instream Habitat* SCORE 10	Greater than 50% of a variety of cobble, boulder, submerged logs, undercut banks, snags, rootwads, aquatic plants or other stable habitat	30-50% of stable habitat. Adequate habitat	10-30% mix of stable habitat. Habitat availability less than desireable 10	Less than 10% stable habitat. Lack of habitat is obvious
2. Epifaunal Substrate* SCORE 3	Preferred substrate abundant, stable, and at full colonization potential (riffles well developed and dominated by cobble; and/or woody debris prevalent, not new, and not transient	Abund. of cobble with gravel and/or boulders common; or woody debris, aquatic veg., undercut banks common but not prevalent/suited for full colonization	Large boulders and/or bedrock prevalent; cobble, woody debris, or other preferred surfaces uncommon	Stable substrate lacking; or particles are over 75% surrounded by fine sediment or flocculent material 3
3. Velocity/Depth Diversity* SCORE 11	Slow (<0.3m/s), deep (>0.5m); slow, shallow (<0.5m); fast (>0.3m/s), deep; fast, shallow habitats all present	Only 3 of the 4 habitat categories present	Only 2 of the 4 habitat categories present	Dominated by 1 velocity/depth category (usually pools)
4. Pool/Glide/Eddy Quality* SCORE 6	Complex cover/& for depth >1.5m; both deep (>0.5m)/shallows (<0.2m) present	Deep (>0.5m) areas present; but only moderate cover	Shallows (<0.2m) prevalent in pool/glide/eddy habitat; little cover	Max depth <0.2m in pool/glide/eddy habitat; or absent completely
5. Riffle/Run Quality* SCORE 9	Riffle/run depth generally >10cm, with maximum depth greater than 50 cm (maximum score); substrate stable (e.g. cobble, boulder) & variety of current velocities	Riffle/run depth generaly 5-10cm, variety of current velocities	Riffle/run depth generaly 1-5cm; primarily a single current velocity	Riffle/run depth <1cm; or riffle/run substrates concreted
6. Bank Stability* (facing downstream.) Score each bank. LB SCORE 4 RB SCORE 4	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected. 10 9	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion. 8 7 6	Moderately unstable; 30-60% of bank in reach as areas of erosion; high erosion potential during floods. 5 4 3	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars. 2 1 0
7. Embeddedness SCORE 80 %	Percentage that gravel, cobble, and boulder particles are surrounded by fine sediment or flocculent material			
8. Shading SCORE 20 %	Percentage of segment that is shaded (duration is considered in scoring). 0% = fully exposed to sunlight all day in summer; 100% = fully and densely shaded all day in summer			
9. Riparian Buffer Zone Width (m)* LB 50 RB 50	Zone width in which human activity is not evident. 50m (164ft) is the maximum recorded value.			
10. Remoteness* SCORE 18	Roads greater than 400 meters (0.25 mi) from stream	Roads within 400 meters (0.25 mi) of stream; stream NOT accessible by trail.	Roads within 400 meters (0.25 mi) of stream; stream accessible by trail.	Roads adjacent to stream.
11. Aesthetic (trash) Rating* SCORE 18	Little or no human refuse visible from stream channel or riparian zone	Refuse present in minor amounts	Refuse present in moderate amounts	Refuse abundant and unsightly
12. Number of Woody Debris and Rootwads* SCORE 25	Count only woody debris and rootwads within the wetted portion of the sampling segment. Count only woody debris >10cm (4in) diameter and >1.5m (5ft) long and rootwads with trunk diameter (at chest height) >15cm (6in) that are functional habitat within the wetted portion of the stream.			

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS

STREAM NAME LP04	LOCATION Friendship, MD
STATION # _____ REACH ID# _____	STREAM CLASS Perennial
UTM N _____ UTM E	RIVER BASIN Patuxent River
STORET #	AGENCY (5)
INVESTIGATORS KB/JT	
FORM COMPLETED BY JT	DATE 3/29/16 TIME ~ 11:00 PM
REASON FOR SURVEY MBSS	

Parameters to be evaluated in sampling reach

Habitat Parameter	Condition Category			
	Optimal	Suboptimal	Marginal	Poor
1. Epifaunal Substrate/ Available Cover	Greater than 50% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient).	30-50% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale).	10-30% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 10% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
SCORE 12	20 19 18 17 16	15 14 13 (12) 11	10 9 8 7 6	5 4 3 2 1 0
2. Pool Substrate Characterization	Mixture of substrate materials, with gravel and firm sand prevalent; root mats and submerged vegetation common.	Mixture of soft sand, mud, or clay; mud may be dominant; some root mats and submerged vegetation present.	All mud or clay or sand bottom; little or no root mat; no submerged vegetation.	Hard-pan clay or bedrock; no root mat or vegetation.
SCORE 12	20 19 18 17 16	15 14 13 (12) 11	10 9 8 7 6	5 4 3 2 1 0
3. Pool Variability	Even mix of large-shallow, large-deep, small-shallow, small-deep pools present.	Majority of pools large-deep; very few shallow.	Shallow pools much more prevalent than deep pools.	Majority of pools small-shallow or pools absent.
SCORE 2	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 (2) 1 0
4. Sediment Deposition	Little or no enlargement of islands or point bars and less than <20% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 20-50% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 50-80% of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; more than 80% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
SCORE 6	20 19 18 17 16	15 14 13 12 11	10 9 8 7 (6)	5 4 3 2 1 0
5. Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills >75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
SCORE 11	20 19 18 17 16	15 14 13 12 (11)	10 9 8 7 6	5 4 3 2 1 0

Form # EL - _____

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS

Parameters to be evaluated broader than sampling reach

Habitat Parameter	Condition Category			
	Optimal	Suboptimal	Marginal	Poor
6. Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr) may be present, but recent channelization is not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.
SCORE 17	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
7. Channel Sinuosity	The bends in the stream increase the stream length 3 to 4 times longer than if it was in a straight line. (Note - channel braiding is considered normal in coastal plains and other low-lying areas. This parameter is not easily rated in these areas.)	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	Channel straight; waterway has been channelized for a long distance.
SCORE 11	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
8. Bank Stability (score each bank)	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.
SCORE 4 (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE 4 (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0
9. Vegetative Protection (score each bank) Note: determine left or right side by facing downstream.	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
SCORE 5 (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE 5 (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0
10. Riparian Vegetative Zone Width (score each bank riparian zone)	Width of riparian zone >18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone.	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6-12 meters; human activities have impacted zone a great deal.	Width of riparian zone <6 meters: little or no riparian vegetation due to human activities.
SCORE 10 (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE 10 (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0

Total Score 109

Form # EL2 - _____

v. 2009

MBSS SPRING HABITAT DATA SHEET

SITE Watershed Code: L P | Segment: 0 6 | Type: 11 | Year: 2 0 1 6

Reviewer: First: JJ / Second: KB

DATE Year: 1 6 | Month: 0 4 | Day: 1 9

1 . 2 0 Dist. from Nearest Road to Site (m)

1 3 Trash Rating 0 - 20

LANDUSE (Y/N)

N	Old Field	Y	Residential
Y	Deciduous Forest	Y	Commercial/Industrial
N	Coniferous Forest	N	Cropland
N	Wetland	N	Pasture
N	Surface Mine	N	Orchard/Vineyard/Nursery
N	Landfill	N	Golf Course

ROAD CULVERT

Present in Segment (Y/N): N

Sampleable? (Y/N):

Width of Culvert (m):

Length of Culvert (m):

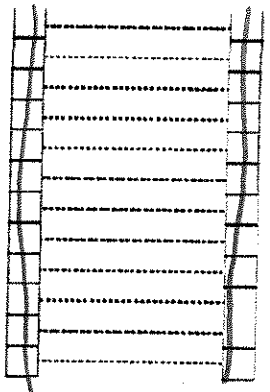
STREAM GRADIENT

	Position (m)	Height (m)
1		
2		
3		

RIPARIAN VEGETATION
(facing upstream)

	LEFT BANK	RIGHT BANK
Width (50m max)	2 0	5 0
Adjacent Land Cover	P V	F R
Vegetation Type	B R Y M	G R Y M
Buffer Breaks (Y/N)	N	N

	LEFT BANK	RIGHT BANK
Storm Drain		
Tile Drain		
Impervious Drainage		
Gully		
Orchard		
Crop		
Pasture		
New Construction		
Dirt Road		
Gravel Road		
Raw Sewage		
Railroad		



Buffer Break Types
(M = minor; S = severe)

CHANNELIZATION

N Evidence of Channel Straightening or Dredging (Y/N)

TYPE	EXTENT (m)		
	LEFT BANK	BOTTOM	RIGHT BANK
Concrete			
Gebion			
Rip-Rap			
Earthen Berm		N/A	
Dredge Spoil Off Channel		N/A	
Pipe Culvert			

Actual Coordinates
(If >30m distance between original coordinates and stream)

Lat

Lon

Stream Block Ht. (m)

Stream Block Type

Lat

Lon

v. 2009

MBSS SPRING INDEX PERIOD DATA SHEET

SITE Watershed Code LP | Segment 06 | Type 11 | Year 2016

Reviewer: First JT / Second KB

DATE Year 16 Month 04 Day 19

CREW: KB/JT

STREAM: LP06

TIME 1205 (Military)

LOCALITY: AA Co., MD

SAMPLEABILITY

- [Y] Benthos
- [Y] Habitat Assessment
- [Y] Water Quality
- [N] Vernal Pool [A] (ASSESSMENT)

OTHER (SPECIFY)

SITE ACCESS ROUTE

SAMPLE LABELS

Verified by: KB

QC LABEL

Watershed Code LP | Segment 06 (Letters only) | Type | Year 2016

Dup. (D) or Blank (B): D Verified by: KB

TEMP. LOGGER

	(Y/N)	(TIME - Military)	#
WATER			
AIR			

LOCATION

PHOTODOCUMENTATION

Number	Title	Voucher (Y/N)
	Midpoint US/DS	
	Upstream US/DS	
	Downstream US/DS	

BENTHIC HABITAT SAMPLED

- [ ] Riffle
- [11] Rootwad/Woody Debris
- [09] Leaf Pack
- [ ] Macrophytes
- [ ] Undercut Banks
- [ ] Other

SAMPLING CONSID.: (NUM. ANODES)

STREAM WIDTH (m) 0 m | 75 m

v. 2009

MBSS SPRING FAUNA DATA SHEET

SITE — Watershed Code: LP | Segment: 06 | Type: 11 | Year: 2016 — Reviewer: First: JT / Second: HB

HERPETOFAUNA

☐ None Observed

Species	Lifestage: Adult	Lifestage: Juv.	Lifestage: Larval	Lifestage: Egg	SEEN (Y/N)	HEARD (Y/N)	NUMBER RETAINED	NUMBER PHOTOS TAKEN
Frogs unknown spp.	☒	☒	☐	☐	☑	☑	☐	☐
Salamander	☒	☐	☐	☐	☑	☐	☐	1
	☐	☐	☐	☐	☐	☐	☐	☐
	☐	☐	☐	☐	☐	☐	☐	☐
	☐	☐	☐	☐	☐	☐	☐	☐
	☐	☐	☐	☐	☐	☐	☐	☐
	☐	☐	☐	☐	☐	☐	☐	☐

MUSSELS

☒ None Observed

Species	LIVE	DEAD	NUMBER RETAINED	NUMBER PHOTOS TAKEN
	☐	☐	☐☐	☐
	☐	☐	☐☐	☐
	☐	☐	☐☐	☐
	☐	☐	☐☐	☐
	☐	☐	☐☐	☐

Corbicula — LIVE ☐ DEAD ☐ NONE ☐

CRAYFISHES

☒ None Observed

Species	NUMBER RETAINED
	☐☐
	☐☐
	☐☐
	☐☐
	☐☐

Crayfish Burrows ☒ (Absent, Present, Extensive)

COMMENTS

Physical Habitat Assessment and Water Quality Data Sheet

Site ID: LP06
Subwatershed: Hall Creek LOWER PATUXENT
Length of Reach: 75m Date: 4/19/16
Team Members: KB/JT Time: 1205

Weather
Current: clear ~60°F
Past 24hrs: clear
Past 48hrs: clear

Parameter	Down-stream	Mid-stream	Up-stream
Description			
pH	7.39	7.44	7.42
Temperature (°C)	16.9	16.6	16.7
DO (mg/l)	10.43	10.44	10.03
Conductivity (uS/cm)	157.6	154.1	153.4
TDS (mg/l)	121.55	119.6	118.3
Turbidity (NTU)	18.2	20.1	14.3

Notes:

Stream Character

P Meandering	A Channelized	
A Braided	A Straight	
A Riffle	P Run/Glide	
A Deep Pool >.5m	P Silt/Clay	
P Shallow Pool <.5m	A Sand	
A Gravel	A Cobble	
A Boulder >2m	A Boulder <2m	
A Concrete/Gabion	A Bedrock	
P Undercut Bank	A Rootwad	
A Overhead Cover	A Storm Drain	
A Effluent Discharge	A Human Refuse	
A Emergent Vegetation	A Beaver Pond	
A Floating Vegetation		

A=Absent P=Present E=Extensive

Bar Formation
☐ None ☐ Minor ☒ Moderate ☐ Extensive

Bank Erosion (see guidance sheet)

	Left Bank	Right Bank
Extent (m)	75	75
Severity	1	1
Avg. Height	60cm	60cm

Severity: 0=none 1=min 2=mod 3=severe

Maximum stream depth (cm) 20cm

Benthic Habitat Sampled (20 total)

	Sq. ft.
Riffle	0
Rootwad/Woody Debris	11
Leaf Pack	4
Submerged Vegetation	0
Undercut Banks	0
Other:	

Rootwads/Woody Debris

# Instream Woody Debris	3
# Dewatered Woody Debris	3
# Instream Rootwads	4
# Dewatered Rootwads	4

Stream Gradient

Location (ft)	Height (ft)	Water Depth (ft)

Photographs/Observations:
Midpoint US/DS
upstream point US/DS
Downstream point US/DS

MBSS Physical Habitat Assessment Sheet

Stream Habitat Assessment Guidance Sheet				
Habitat Parameter	Optimal 16-20	Sub-Optimal 11-15	Marginal 6-10	Poor 0-5
1. Instream Habitat[1] SCORE 7	Greater than 50% of a variety of cobble, boulder, submerged logs, undercut banks, snags, rootwads, aquatic plants or other stable habitat	30-50% of stable habitat. Adequate habitat	10-30% mix of stable habitat. Habitat availability less than desireable	Less than 10% stable habitat. Lack of habitat is obvious
2. Epifaunal Substrate[2] SCORE 2	Preferred substrate abundant, stable, and at full colonization potential (riffles well developed and dominated by cobble; and/or woody debris prevalent, not new, and not transient	Abund. of cobble with gravel and/or boulders common; or woody debris, aquatic veg., undercut banks common but not prevalent/suited for full colonization	Large boulders and/or bedrock prevalent; cobble, woody debris, or other preferred surfaces uncommon	Stable substrate lacking; or particles are over 75% surrounded by fine sediment or flocculent material
3. Velocity/Depth Diversity[3] SCORE 7	Slow (<0.3m/s), deep (>0.5m); slow, shallow (<0.5m); fast (>0.3m/s), deep; fast, shallow habitats all present	Only 3 of the 4 habitat categories present	Only 2 of the 4 habitat categories present	Dominated by 1 velocity/depth category (usually pools)
4. Pool/Glide/Eddy Quality[4] SCORE 7	Complex cover/&/or depth >1.5m; both deep (>0.5m)/shallows (<0.2m) present	Deep (>0.5m) areas present; but only moderate cover	Shallows (<0.2m) prevalent in pool/glide/eddy habitat; little cover	Max depth <0.2m in pool/glide/eddy habitat; or absent completely
5. Riffle/Run Quality[5] SCORE 5	Riffle/run depth generally >10cm, with maximum depth greater than 50 cm (maximum score); substrate stable (e.g. cobble, boulder) & variety of current velocities	Riffle/run depth generally 5-10cm, variety of current velocities	Riffle/run depth generally 1-5cm; primarily a single current velocity	Riffle/run depth <1cm; or riffle/run substrates concreted
6. Bank Stability[6] (facing downstream.) Score each bank LB SCORE 5 RB SCORE 3	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected. 10 9	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion. 8 7 6	Moderately unstable; 30-60% of bank in reach as areas of erosion; high erosion potential during floods. 5 4 3	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars. 2 1 0
7. Embeddedness SCORE 90 %	Percentage that gravel, cobble, and boulder particles are surrounded by fine sediment or flocculent material			
8. Shading SCORE 75 %	Percentage of segment that is shaded (duration is considered in scoring). 0% = fully exposed to sunlight all day in summer; 100% = fully and densely shaded all day in summer			
9. Riparian Buffer Zone Width (m)[7] LB 10 RB 50	Zone width in which human activity is not evident. 50m (164ft) is the maximum recorded value.			
10. Remoteness[8] SCORE 6	Roads greater than 400 meters (0.25 mi) from stream	Roads within 400 meters (0.25 mi) of stream; stream NOT accessible by trail.	Roads within 400 meters (0.25 mi) of stream; stream accessible by trail.	Roads adjacent to stream.
11. Aesthetic (trash) Rating[9] SCORE 13	Little or no human refuse visible from stream channel or riparian zone	Refuse present in minor amounts	Refuse present in moderate amounts	Refuse abundant and unsightly
12. Number of Woody Debris and Rootwads[10] SCORE 4	Count only woody debris and rootwads within the wetted portion of the sampling segment. Count only woody debris >10cm (4in) diameter and >1.5m (5ft) long and rootwads with trunk diameter (at chest height) >15cm (6in) that are functional habitat within the wetted portion of the stream.			

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS

STREAM NAME LP06	LOCATION Olney, MD	
STATION # _____ REACH ID# _____	STREAM CLASS PERENNIAL	
UTM N _____ UTM E	RIVER BASIN Patuxent River	
STORET #	AGENCY (E)	
INVESTIGATORS MB/JT		
FORM COMPLETED BY JT	DATE 4/14/15 TIME 1205 PM	REASON FOR SURVEY MBSS Bru

Parameters to be evaluated in sampling reach

Habitat Parameter	Condition Category			
	Optimal	Suboptimal	Marginal	Poor
1. Epifaunal Substrate/ Available Cover	Greater than 50% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are <u>not</u> new fall and <u>not</u> transient).	30-50% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale).	10-30% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 10% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
SCORE 7	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
2. Pool Substrate Characterization	Mixture of substrate materials, with gravel and firm sand prevalent; root mats and submerged vegetation common.	Mixture of soft sand, mud, or clay; mud may be dominant; some root mats and submerged vegetation present.	All mud or clay or sand bottom; little or no root mat; no submerged vegetation.	Hard-pan clay or bedrock; no root mat or vegetation.
SCORE 8	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
3. Pool Variability	Even mix of large-shallow, large-deep, small-shallow, small-deep pools present.	Majority of pools large-deep; very few shallow.	Shallow pools much more prevalent than deep pools.	Majority of pools small-shallow or pools absent.
SCORE 7	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
4. Sediment Deposition	Little or no enlargement of islands or point bars and less than <20% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 20-50% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 50-80% of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; more than 80% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
SCORE 2	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
5. Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills >75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
SCORE 8	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0

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HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS

Parameters to be evaluated broader than sampling reach

Habitat Parameter	Condition Category			
	Optimal	Suboptimal	Marginal	Poor
6. Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr) may be present, but recent channelization is not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.
SCORE 19	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
7. Channel Sinuosity	The bends in the stream increase the stream length 3 to 4 times longer than if it was in a straight line. (Note - channel braiding is considered normal in coastal plains and other low-lying areas. This parameter is not easily rated in these areas.)	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	Channel straight; waterway has been channelized for a long distance.
SCORE 7	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
8. Bank Stability (score each bank)	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.
SCORE 6 (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE 6 (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0
9. Vegetative Protection (score each bank) Note: determine left or right side by facing downstream.	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
SCORE 5 (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE 5 (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0
10. Riparian Vegetative Zone Width (score each bank riparian zone)	Width of riparian zone >18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone.	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6-12 meters; human activities have impacted zone a great deal.	Width of riparian zone <6 meters: little or no riparian vegetation due to human activities.
SCORE 5 (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE 10 (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0

Total Score 95

Form # EL2 - _____

MBSS SPRING HABITAT DATA SHEET

Page 1 of 7

SITE — Watershed Code: [ ][ ][U][P] Segment: [0][9][A] Type: [3] Year: [2][0][1][6]

Reviewer: First KB / Second JT

DATE — Year: [1][6] Month: [0][4] Day: [1][9]

[ ][2][0][0] Dist. from Nearest Road to Site (m)

[0][5] Trash Rating 0 - 20

LANDUSE (Y/N)

Y	Old Field	N	Residential
Y	Deciduous Forest	N	Commercial/Industrial
N	Coniferous Forest	N	Cropland
Y	Wetland	N	Pasture
N	Surface Mine	N	Orchard/Vineyard/Nursery
N	Landfill	N	Golf Course

ROAD CULVERT

Present in Segment (Y/N): [N]

Sampleable? (Y/N): [ ]

Width of Culvert (m): [ ][ ]

Length of Culvert (m): [ ][ ]

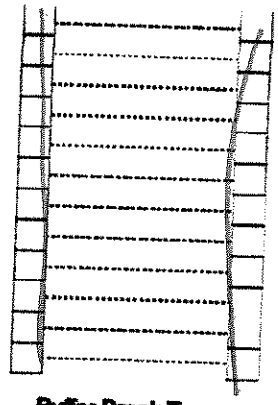
STREAM GRADIENT

	Upstream (m)	Height (m)
1	[ ][ ]	[ ][ ]
2	[ ][ ]	[ ][ ]
3	[ ][ ]	[ ][ ]

RIPARIAN VEGETATION
(facing upstream)

	LEFT BANK	RIGHT BANK
Width (50m max)	[5][0]	[5][0]
Adjacent Land Cover	[F][R]	[F][R]
Vegetation Type	[4][R][L][ ]	[4][R][L][ ]
Buffer Breaks (Y/N)	[N]	[N]

	LEFT BANK	RIGHT BANK
Storm Drain		
Tile Drain		
Impervious Drainage		
Gully		
Orchard		
Crop		
Pasture		
New Construction		
Dirt Road		
Gravel Road		
Raw Sewage		
Railroad		



Buffer Break Types
(M = minor; S = severe)

CHANNELIZATION

[N] Evidence of Channel Straightening or Dredging (Y/N)

TYPE	EXTENT (m)		
	LEFT BANK	BOTTOM	RIGHT BANK
Concrete	[ ][ ]	[ ][ ]	[ ][ ]
Gabion	[ ][ ]	[ ][ ]	[ ][ ]
Rip-Rap	[ ][ ]	[ ][ ]	[ ][ ]
Earthen Berm	[ ][ ]	N/A	[ ][ ]
Dredge Spoil Off Channel	[ ][ ]	N/A	[ ][ ]
Pipe Culvert	[ ][ ]	[ ][ ]	[ ][ ]

Actual Coordinates
(If >30m distance between original coordinates and stream)

Lat [ ][ ][ ][ ][ ][ ][ ][ ]

Lon [ ][ ][ ][ ][ ][ ][ ][ ]

Stream Block Ht. (m) [ ][ ]

Stream Block Type [ ][ ]

Lat [ ][ ][ ][ ][ ][ ][ ][ ]

Lon [ ][ ][ ][ ][ ][ ][ ][ ]

v. 2009

MBSS SPRING INDEX PERIOD DATA SHEET

Page 2 Of 2

SITE Watershed Code LP | Segment 09A | Type 3 | Year 2016

Reviewer: First KB / Second JT

DATE Year 16 Month 04 Day 19

CREW: KB/JT

STREAM: Hare Creek

TIME 1355 (Military)

LOCALITY: Owings, MD

SAMPLEABILITY

- [1] Benthos
- [1] Habitat Assessment
- [1] Water Quality
- [ ] Vernal Pool [A] (PRESENT/ABSENT)

OTHER (SPECIFY)

SITE ACCESS ROUTE

MSM Rd. down fire trail to the east along stream.

SAMPLE LABELS

Verified by: KB

QC LABEL

Watershed Code LP | Segment 09A (Letters only) | Type 3 | Year 2016

Dup. (D) or Blank (B): [ ] Verified by: _____

TEMP. LOGGER

	(Y/N)	(TIME - Military)	#
WATER			#
AIR			#

LOCATION _____

PHOTODOCUMENTATION

Number	Title	Voucher (Y/N)
	M - US/DS	
	D - US/DS	
	U - US/DS	

BENTHIC HABITAT SAMPLED

10	Riffle	02	Leaf Pack	00	Undercut Banks
15	Rootwad/Woody Debris	02	Macrophytes	01	Other Trash

SAMPLING CONSID.: ([ ] NUM. ANODES)

STREAM WIDTH (m) 0 m _____ 75 m _____

v. 2009

MBSS SPRING FAUNA DATA SHEET

SITE Watershed Code LIP | Segment 39A | Type B | Year 2010

Reviewer: First KB / Second JT

HERPETOFAUNA

☐ None Observed

Species	Lifestage (Adult, Juv., Larval, Egg)	SEEN (Y/N)	HEARD (Y/N)	NUMBER RETAINED	NUMBER PHOTOS TAKEN
Green Frogs (Several)	☑	Y	N	0	0

MUSSELS

☑ None Observed

Species	LIVE	DEAD	NUMBER RETAINED	NUMBER PHOTOS TAKEN

Corbicula: LIVE ☐ DEAD ☐ NONE ☐

CRAYFISHES

☑ None Observed

Species	NUMBER RETAINED

Crayfish Burrows: P

(Absent, Present, Extensive)

COMMENTS

Physical Habitat Assessment and Water Quality Data Sheet

Site ID: LP09A LOWER PATUXENT
Subwatershed: Hall Creek
Length of Reach: 75m **Date:** 4/19/16
Team Members: KB/JT **Time:** 1353

Weather
Current: Sunny, 80°
Past 24hrs: Sunny, 80°
Past 48hrs: Sunny, 70°

Stream Character

N Meandering	N Channelized
N Braided	N Straight
N Riffle	Y Run/Glide
N Deep Pool >.5m	E Silt/Clay
Y Shallow Pool <.5m	N Sand
N Gravel	N Cobble
N Boulder >2m	N Boulder <2m
N Concrete/Gabion	N Bedrock
N Undercut Bank	Y Rootwad
Y Overhead Cover	Y Storm Drain
N Effluent Discharge	E Human Refuse
N Emergent Vegetation	N Beaver Pond
N Floating Vegetation	

A=Absent P=Present E=Extensive

Parameter	Down-stream	Mid-stream	Up-stream
Description			
pH	7.18	~~7.5~~	7.21
Temperature (°C)	19.3	19.1	18.8
DO (mg/l)	9.75	9.89	10.71
Conductivity (uS/cm)	205.6	208.3	206.6
TDS (mg/l)	152.1	152.75	152.1
Turbidity (NTU)	20.2	15.8	17.6

Mid-stream pH (outlier) eliminated from calculated average.

Notes:

Bar Formation
☑ None ☐ Moderate
☐ Minor ☐ Extensive

Bank Erosion (see guidance sheet)

	Left Bank	Right Bank
Extent (m)	0	0
Severity	0	0
Avg. Height	0	0

Severity: 0=none 1=min 2=mod 3=severe

Maximum stream depth (cm) 45

Benthic Habitat Sampled (20 total)

	Sq. ft.
Riffle	2
Rootwad/Woody Debris	15
Leaf Pack	2
Submerged Vegetation	2
Undercut Banks	
Other: Trash	1

Rootwads/Woody Debris

# Instream Woody Debris	4
# Dewatered Woody Debris	5
# Instream Rootwads	2
# Dewatered Rootwads	4

Stream Gradient

Location (ft)	Height (ft)	Water Depth (ft)

Photographs/Observations:
Extensive trash in reach.
Relocated downstream due to beaver dam at pm location.

MBSS Physical Habitat Assessment Sheet

Stream Habitat Assessment Guidance Sheet				
Habitat Parameter	Optima: 16-20	Sub-Optimal 11-15	Marginal 6-10	Poor 0-5
1. Instream Habitat[a] SCORE 5	Greater than 50% of a variety of cobble, boulder, submerged logs, undercut banks, snags, rootwads, aquatic plants or other stable habitat	30-50% of stable habitat. Adequate habitat	10-30% mix of stable habitat. Habitat availability less than desireable	Less than 10% stable habitat. Lack of habitat is obvious
2. Epifaunal Substrate[b] SCORE 3	Preferred substrate abundant, stable, and at full colonization potential (riffles well developed and dominated by cobble; and/or woody debris prevalent, not new, and not transient	Abund. of cobble with gravel and/or boulders common; or woody debris, aquatic veg., undercut banks common but not prevalent/suited for full colonization	Large boulders and/or bedrock prevalent; cobble, woody debris, or other preferred surfaces uncommon	Stable substrate lacking; or particles are over 75% surrounded by fine sediment or flocculent material
3. Velocity/Depth Diversity[c] SCORE 5	Slow (<0.3m/s), deep (>0.5m); slow, shallow (<0.5m); fast (>0.3m/s), deep; fast, shallow habitats all present	Only 3 of the 4 habitat categories present	Only 2 of the 4 habitat categories present	Dominated by 1 velocity/depth category (usually pools)
4. Pool/Glide/Eddy Quality[d] SCORE 6	Complex cover/d/or depth >1.5m; both deep (>0.5m)/shallows (<0.2m) present	Deep (>0.5m) areas present; but only moderate cover	Shallows (<0.2m) prevalent in pool/glide/eddy habitat; little cover	Max depth <0.2m in pool/glide/eddy habitat; or absent completely
5. Riffle/Run Quality[e] SCORE 4	Riffle/run depth generally >10cm, with maximum depth greater than 50 cm (maximum score); substrate stable (e.g. cobble, boulder) & variety of current velocities	Riffle/run depth generally 5-10cm, variety of current velocities	Riffle/run depth generally 1-5cm; primarily a single current velocity	Riffle/run depth <1cm; or riffle/run substrates concreted
6. Bank Stability[f] (facing downstream.) Score each bank LB SCORE 6 RB SCORE 6	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected. 10 9	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion. 8 7 6	Moderately unstable; 30-60% of bank in reach as areas of erosion; high erosion potential during floods. 5 4 3	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars. 2 1 0
7. Embeddedness SCORE 50 %	Percentage that gravel, cobble, and boulder particles are surrounded by fine sediment or flocculent material			
8. Shading SCORE 40 %	Percentage of segment that is shaded (duration is considered in scoring). 0% = fully exposed to sunlight all day in summer; 100% = fully and densely shaded all day in summer			
9. Riparian Buffer Zone Width (m)[g] LB 50 RB 50	Zone width in which human activity is not evident. 50m (164ft) is the maximum recorded value.			
10. Remoteness[h] SCORE 9	Roads greater than 400 meters (0.25 mi) from stream	Roads within 400 meters (0.25 mi) of stream; stream NOT accessible by trail	Roads within 400 meters (0.25 mi) of stream; stream accessible by trail	Roads adjacent to stream.
11. Aesthetic (trash) Rating[i] SCORE 8	Little or no human refuse visible from stream channel or riparian zone	Refuse present in minor amounts	Refuse present in moderate amounts	Refuse abundant and unsightly
12. Number of Woody Debris and Rootwads[j] SCORE 6	Count only woody debris and rootwads within the wetted portion of the sampling segment. Count only woody debris >10cm (4in) diameter and >1.5m (5ft) long and rootwads with trunk diameter (at chest height) >15cm (6in) that are functional habitat within the wetted portion of the stream.			

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS

STREAM NAME LP09A	LOCATION OLNEY, MD
STATION # _____ REACH ID# _____	STREAM CLASS Perennial
UTM N _____ UTM E	RIVER BASIN Patuxent
STORET #	AGENCY CES
INVESTIGATORS KB/MT	
FORM COMPLETED BY KB	DATE 4/19/16 TIME 1355 PM
REASON FOR SURVEY MBSS	

Parameters to be evaluated in sampling reach

Habitat Parameter	Condition Category			
	Optimal	Suboptimal	Marginal	Poor
1. Epifaunal Substrate/ Available Cover	Greater than 50% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient).	30-50% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale).	10-30% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 10% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
SCORE 5	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
2. Pool Substrate Characterization	Mixture of substrate materials, with gravel and firm sand prevalent; root mats and submerged vegetation common.	Mixture of soft sand, mud, or clay; mud may be dominant; some root mats and submerged vegetation present.	All mud or clay or sand bottom; little or no root mat; no submerged vegetation.	Hard-pan clay or bedrock; no root mat or vegetation.
SCORE 11	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
3. Pool Variability	Even mix of large-shallow, large-deep, small-shallow, small-deep pools present.	Majority of pools large-deep; very few shallow.	Shallow pools much more prevalent than deep pools.	Majority of pools small-shallow or pools absent.
SCORE 5	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
4. Sediment Deposition	Little or no enlargement of islands or point bars and less than <20% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 20-50% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 50-80% of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; more than 80% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
SCORE 5	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
5. Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills >75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
SCORE 11	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS

Parameters to be evaluated broader than sampling reach

Habitat Parameter	Condition Category			
	Optimal	Suboptimal	Marginal	Poor
6. Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr) may be present, but recent channelization is not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.
SCORE 18	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
7. Channel Sinuosity	The bends in the stream increase the stream length 3 to 4 times longer than if it was in a straight line. (Note - channel braiding is considered normal in coastal plains and other low-lying areas. This parameter is not easily rated in these areas.)	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	Channel straight; waterway has been channelized for a long distance.
SCORE 10	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
8. Bank Stability (score each bank)	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.
SCORE 6 (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE 6 (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0
9. Vegetative Protection (score each bank) Note: determine left or right side by facing downstream.	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
SCORE 4 (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE 4 (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0
10. Riparian Vegetative Zone Width (score each bank riparian zone)	Width of riparian zone >18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone.	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6-12 meters; human activities have impacted zone a great deal.	Width of riparian zone <6 meters: little or no riparian vegetation due to human activities.
SCORE 9 (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE 9 (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0

Total Score 103

Form # EL2 - _____

v. 2009

MBSS SPRING HABITAT DATA SHEET

Page 1 of 7

SITE — Watershed Code: LP | Segment: 111 | Type: A | Year: 1 | 2016

Reviewer: First KB / Second JT

DATE — Year: 16 | Month: 04 | Day: 22

400 Dist. from Nearest Road to Site (m)

16 Trash Rating 0 - 20

LANDUSE (Y/N)

N	Old Field	Y	Residential
Y	Deciduous Forest	N	Commercial/Industrial
N	Coniferous Forest	N	Cropland
Y	Wetland	N	Pasture
N	Surface Mine	N	Orchard/Vineyard/Nursery
N	Landfill	N	Golf Course

RIPARIAN VEGETATION
(facing upstream)

	LEFT BANK	RIGHT BANK
Width (50m max)	50	30
Adjacent Land Cover	FR	LN
Vegetation Type	RYMO	GRY
Buffer Breaks (Y/N)	N	N

ROAD CULVERT

Present in Segment (Y/N): N

Sampleable? (Y/N):

Width of Culvert (m):

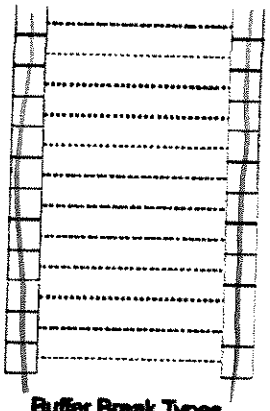
Length of Culvert (m):

STREAM GRADIENT

	Position (m)	Height (m)
1		
2		
3		

Buffer Breaks

	LEFT BANK	RIGHT BANK
Storm Drain		
Tile Drain		
Impervious Drainage		
Gully		
Orchard		
Crop		
Pasture		
New Construction		
Dirt Road		
Gravel Road		
Raw Sewage		
Railroad		



Buffer Break Types
(M = minor; S = severe)

CHANNELIZATION

N Evidence of Channel Straightening or Dredging (Y/N)

TYPE	EXTENT (m)		
	LEFT BANK	BOTTOM	RIGHT BANK
Concrete			
Gabion			
Rip-Rap			
Earthen Berm		N/A	
Dredge Spoil Off Channel		N/A	
Pipe Culvert			

Actual Coordinates
(If >30m distance between original coordinates and stream)

Lat

Lon

Stream Block Ht. (m)

Stream Block Type

Lat

Lon

v. 2009

MBSS SPRING INDEX PERIOD DATA SHEET

SITE Watershed Code LP | Segment 111A | Type 1 | Year 2016

Reviewer: First KB / Second JT

DATE Year 16 Month 04 Day 22

CREW: KB/JT

STREAM: Trib to Hall Creek

TIME 1000 (Military)

LOCALITY: Dundee, MD

SAMPLEABILITY

- [x] Benthos
- [x] Habitat Assessment
- [x] Water Quality
- [ ] Vernal Pool A (PRESENT/ABSENT)

OTHER (SPECIFY)

SITE ACCESS ROUTE

6948 Solomons Island Rd.
enter woods at right at driveway

SAMPLE LABELS

Verified by: KB

QC LABEL

Watershed Code LP | Segment 111A (Letters only) | Type 1 | Year 2016

Dup. (D) or Blank (B): | Verified by:

TEMP. LOGGER

	(Y/N)	(TIME - Military)	
WATER			#
AIR			#

LOCATION

PHOTODOCUMENTATION

Number	Title	Voucher (Y/N)
	M-US/DS	
	D-US/DS	
	U-US/DS	
	Salamander	
	Frog	

BENTHIC HABITAT SAMPLED

03	Riffle	10	Leaf Pack	01	Undercut Banks
06	Rootwad/Woody Debris	00	Macrophytes		Other

SAMPLING CONSID.: (NUM. ANODES)

STREAM WIDTH (m) 0 m | 75 m

v. 2009

MBSS SPRING FAUNA DATA SHEET

SITE Watershed Code LP | Segment 11A | Type 1 | Year 2016

Reviewer: First KB / Second JT

HERPETOFAUNA

☐ None Observed

Species	Lifestage (Adult, Juv., Larval, Egg)	SEEN (Y/N)	HEARD (Y/N)	NUMBER RETAINED	NUMBER PHOTOS TAKEN
Green tree frog		N	Y	0	0
Bullfrog	Juv.	Y	N	0	1
N. two-lined Salamander	Juv.	Y	N	0	1

MUSSELS

☑ None Observed

Species	LIVE	DEAD	NUMBER RETAINED	NUMBER PHOTOS TAKEN

Corbicula: LIVE ☐ DEAD ☐ NONE ☐

CRAYFISHES

☑ None Observed

Species	NUMBER RETAINED

Crayfish Burrows: A

(Absent, Present, Extensive)

COMMENTS

Physical Habitat Assessment and Water Quality Data Sheet

Site ID: LP11A LOWER PATUXENT **Weather**
Subwatershed: Hale Creek **Current:** Cloudy, 70°
Length of Reach: 75m **Date:** 4/22/16 **Past 24hrs:** Sunny, 75°
Team Members: KB / JT **Time:** 1000 **Past 48hrs:** Sunny, 75°

Stream Character

[P] Meandering	[A] Channelized
[A] Braided	[A] Straight
[P] Riffle	[P] Run/Glide
[P] Deep Pool >.5m	[A] Silt/Clay
[P] Shallow Pool <.5m	[P] Sand
[P] Gravel	[P] Cobble
[A] Boulder >2m	[P] Boulder <2m
[A] Concrete/Gabion	[A] Bedrock
[P] Undercut Bank	[A] Rootwad
[P] Overhead Cover	[A] Storm Drain
[A] Effluent Discharge	[A] Human Refuse
[A] Emergent Vegetation	[A] Beaver Pond
[A] Floating Vegetation	

A=Absent P=Present E=Extensive

Bar Formation
[ ] None [ ] Moderate
[✓] Minor [ ] Extensive

Bank Erosion (see guidance sheet)

	Left Bank	Right Bank
Extent (m)	75	75
Severity	2	2
Avg. Height	60	60

Severity: 0=none 1=min 2=mod 3=severe

Maximum stream depth (cm) 8

Benthic Habitat Sampled (20 total)

	Sq. ft.
Riffle	3
Rootwad/Woody Debris	6
Leaf Pack	10
Submerged Vegetation	0
Undercut Banks	1
Other:	0

Rootwads/Woody Debris

# Instream Woody Debris	3
# Dewatered Woody Debris	3
# Instream Rootwads	0
# Dewatered Rootwads	2

Stream Gradient

Location (ft)	Height (ft)	Water Depth (ft)

Parameter	Down-stream	Mid-stream	Up-stream
Description			
pH	7.16	7.46	7.13
Temperature (°C)	15.1	15.1	15.1
DO (mg/l)	10.19	10.09	9.6
Conductivity (uS/cm)	178.0	153.4	160.9
TDS (mg/l)	142.35	122.85	129.35
Turbidity (NTU)	41.8	36.4	29.9

Notes:

Photographs/Observations:
M - LS IDS
D - US IDS
U - US IDS

MBSS Physical Habitat Assessment Sheet

Stream Habitat Assessment Guidance Sheet				
Habitat Parameter	Optimal 16-20	Sub-Optimal 11-15	Marginal 6-10	Poor 0-5
1. Instream Habitat[a] SCORE 8	Greater than 50% of a variety of cobble, boulder, submerged logs, undercut banks, snags, rootwads, aquatic plants or other stable habitat	30-50% of stable habitat. Adequate habitat	10-30% mix of stable habitat. Habitat availability less than desireable	Less than 10% stable habitat. Lack of habitat is obvious
2. Epifaunal Substrate[b] SCORE 3	Preferred substrate abundant, stable, and at full colonization potential (riffles well developed and dominated by cobble; and/or woody debris prevalent, not new, and not transient	Abund. of cobble with gravel and/or boulders common; or woody debris, aquatic veg., undercut banks common but not prevalent/suited for full colonization	Large boulders and/or bedrock prevalent; cobble, woody debris, or other preferred surfaces uncommon	Stable substrate lacking; or particles are over 75% surrounded by fine sediment or flocculent material
3. Velocity/Depth Diversity[c] SCORE 8	Slow (<0.3m/s), deep (>0.5m); slow, shallow (<0.5m); fast (>0.3m/s), deep; fast, shallow habitats all present	Only 3 of the 4 habitat categories present	Only 2 of the 4 habitat categories present	Dominated by 1 velocity/depth category (usually pools)
4. Pool/Glide/Eddy Quality[d] SCORE 8	Complex cover/&/or depth >1.5m; both deep (>0.5m)/shallows (<0.2m) present	Deep (>0.5m) areas present; but only moderate cover	Shallows (<0.2m) prevalent in pool/glide/eddy habitat; little cover	Max depth <0.2m in pool/glide/eddy habitat; or absent completely
5. Riffle/Run Quality[e] SCORE 6	Riffle/run depth generally >10cm, with maximum depth greater than 50 cm (maximum score); substrate stable (e.g. cobble, boulder) & variety of current velocities	Riffle/run depth generally 5-10cm, variety of current velocities	Riffle/run depth generally 1-5cm; primarily a single current velocity	Riffle/run depth <1cm; or riffle/run substrates concreted
6. Bank Stability[f] (facing downstream.) Score each bank LB SCORE 2 RB SCORE 2	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected. 10 9	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion. 8 7 6	Moderately unstable; 30-60% of bank in reach as areas of erosion; high erosion potential during floods. 5 4 3	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars. 2 1 0
7. Embeddedness SCORE 75 %	Percentage that gravel, cobble, and boulder particles are surrounded by fine sediment or flocculent material			
8. Shading SCORE 75 %	Percentage of segment that is shaded (duration is considered in scoring). 0% = fully exposed to sunlight all day in summer; 100% = fully and densely shaded all day in summer			
9. Riparian Buffer Zone Width (m)[g] LB 50 RB 30	Zone width in which human activity is not evident. 50m (164ft) is the maximum recorded value.			
10. Remoteness[h] SCORE 11	Roads greater than 400 meters (0.25 mi) from stream	Roads within 400 meters (0.25 mi) of stream; stream NOT accessible by trail.	Roads within 400 meters (0.25 mi) of stream; stream accessible by trail.	Roads adjacent to stream.
11. Aesthetic (trash) Rating[i] SCORE 11	Little or no human refuse visible from stream channel or riparian zone	Refuse present in minor amounts	Refuse present in moderate amounts	Refuse abundant and unsightly
12. Number of Woody Debris and Rootwads[j] SCORE 3	Count only woody debris and rootwads within the wetted portion of the sampling segment. Count only woody debris >10cm (4in) diameter and >1.5m (5ft) long and rootwads with trunk diameter (at chest height) >15cm (6in) that are functional habitat within the wetted portion of the stream.			

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS

STREAM NAME Tnb to Hall Cr.	LOCATION LP11A
STATION # _____ REACH ID# _____	STREAM CLASS Perennial
UTM N _____ UTM E	RIVER BASIN Patuxent
STORET #	AGENCY CE1
INVESTIGATORS KB JST	
FORM COMPLETED BY KB	DATE 4/22/16 TIME ~1015 PM
REASON FOR SURVEY MBSS	

Parameters to be evaluated in sampling reach

Habitat Parameter	Condition Category			
	Optimal	Suboptimal	Marginal	Poor
1. Epifaunal Substrate/ Available Cover	Greater than 50% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient).	30-50% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale).	10-30% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 10% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
SCORE 8	20 19 18 17 16	15 14 13 12 11	10 9 (8) 7 6	5 4 3 2 1 0
2. Pool Substrate Characterization	Mixture of substrate materials, with gravel and firm sand prevalent; root mats and submerged vegetation common.	Mixture of soft sand, mud, or clay; mud may be dominant; some root mats and submerged vegetation present.	All mud or clay or sand bottom; little or no root mat; no submerged vegetation.	Hard-pan clay or bedrock; no root mat or vegetation.
SCORE 8	20 19 18 17 16	15 14 13 12 11	10 9 (8) 7 6	5 4 3 2 1 0
3. Pool Variability	Even mix of large-shallow, large-deep, small-shallow, small-deep pools present.	Majority of pools large-deep; very few shallow.	Shallow pools much more prevalent than deep pools.	Majority of pools small-shallow or pools absent.
SCORE 8	20 19 18 17 16	15 14 13 12 11	10 9 (8) 7 6	5 4 3 2 1 0
4. Sediment Deposition	Little or no enlargement of islands or point bars and less than <20% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 20-50% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 50-80% of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; more than 80% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
SCORE 8	20 19 18 17 16	15 14 13 12 11	10 9 (8) 7 6	5 4 3 2 1 0
5. Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills >75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
SCORE 10	20 19 18 17 16	15 14 13 12 11	(10) 9 8 7 6	5 4 3 2 1 0

Form # EL - _____

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS

Parameters to be evaluated broader than sampling reach

Habitat Parameter	Condition Category			
	Optimal	Suboptimal	Marginal	Poor
6. Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr) may be present, but recent channelization is not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.
SCORE 18	20 19 (18) 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
7. Channel Sinuosity	The bends in the stream increase the stream length 3 to 4 times longer than if it was in a straight line. (Note - channel braiding is considered normal in coastal plains and other low-lying areas. This parameter is not easily rated in these areas.)	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	Channel straight; waterway has been channelized for a long distance.
SCORE 13	20 19 18 17 16	15 14 (13) 12 11	10 9 8 7 6	5 4 3 2 1 0
8. Bank Stability (score each bank)	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.
SCORE 2 (LB)	Left Bank 10 9	8 7 6	5 4 3	(2) 1 0
SCORE 2 (RB)	Right Bank 10 9	8 7 6	5 4 3	(2) 1 0
9. Vegetative Protection (score each bank) Note: determine left or right side by facing downstream.	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
SCORE 2 (LB)	Left Bank 10 9	8 7 6	5 4 3	(2) 1 0
SCORE 2 (RB)	Right Bank 10 9	8 7 6	5 4 3	(2) 1 0
10. Riparian Vegetative Zone Width (score each bank riparian zone)	Width of riparian zone >18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone.	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6-12 meters; human activities have impacted zone a great deal.	Width of riparian zone <6 meters: little or no riparian vegetation due to human activities.
SCORE 9 (LB)	Left Bank 10 (9)	8 7 6	5 4 3	2 1 0
SCORE 8 (RB)	Right Bank 10 9	(8) 7 6	5 4 3	2 1 0

Total Score 98

v. 2009

MBSS SPRING HABITAT DATA SHEET

Page 1 of 7

SITE Watershed Code [ ][ ][A][P] Segment [0][1] Type [2] Year [2][0][1][6]

Reviewer: First [JS] / Second [JT]

DATE Year [16] Month [04] Day [04]

[2][0][0] Dist. from Nearest Road to Site (m)

[15] Trash Rating 0 - 20

LANDUSE (Y/N)

[N]	Old Field	[N]	Residential
[Y]	Deciduous Forest	[N]	Commercial/Industrial
[N]	Coniferous Forest	[N]	Cropland
[Y]	Wetland	[N]	Pasture
[N]	Surface Mine	[N]	Orchard/Vineyard/Nursery
[N]	Landfill	[N]	Golf Course

RIPARIAN VEGETATION
(facing upstream)

	LEFT BANK	RIGHT BANK
Width (50m max)	[50]	[50]
Adjacent Land Cover	[F][R]	[F][R]
Vegetation Type	[R][Y][M][O]	[R][Y][M][O]
Buffer Breaks (Y/N)	[N]	[N]

ROAD CULVERT

Present in Segment (Y/N) [N]

Samplesable? (Y/N) [ ]

Width of Culvert (m) [ ][ ]

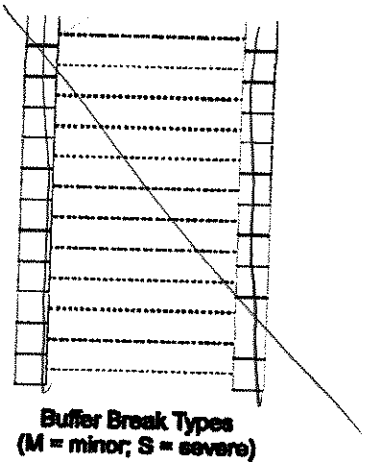
Length of Culvert (m) [ ][ ]

STREAM GRADIENT

	Position (m)	Height (m)
1	[ ][ ]	[ ][ ]
2	[ ][ ]	[ ][ ]
3	[ ][ ]	[ ][ ]

Buffer Break Types
(M = minor; S = severe)

	LEFT BANK	RIGHT BANK
Storm Drain		
Tile Drain		
Impervious Drainage		
Gully		
Orchard		
Crop		
Pasture		
New Construction		
Dirt Road		
Gravel Road		
Raw Sewage		
Railroad		



CHANNELIZATION

[N] Evidence of Channel Straightening or Dredging (Y/N)

TYPE	EXTENT (m) LEFT BANK	BOTTOM	RIGHT BANK
Concrete	[ ][ ]	[ ][ ]	[ ][ ]
Gabion	[ ][ ]	[ ][ ]	[ ][ ]
Rip-Rap	[ ][ ]	[ ][ ]	[ ][ ]
Earthen Berm	[ ][ ]	N/A	[ ][ ]
Dredge Spoil Off Channel	[ ][ ]	N/A	[ ][ ]
Pipe Culvert	[ ][ ]	[ ][ ]	[-][3] *

Actual Coordinates
(If >30m distance between original coordinates and stream)

Lat [ ][ ][ ][ ][ ][ ][ ][ ]

Lon [ ][ ][ ][ ][ ][ ][ ][ ]

Stream Block Ht. (m) [ ][ ]

Stream Block Type [ ][ ]

Lat [ ][ ][ ][ ][ ][ ][ ][ ]

Lon [ ][ ][ ][ ][ ][ ][ ][ ]

* Remarks

v. 2009

MBSS SPRING INDEX PERIOD DATA SHEET

Page 2 of 7 (First / Second)

SITE: Watershed Code mp | Segment 01 | Type 2 | Year 2016

Reviewer: /

DATE: Year 16 | Month 09 | Day 09

CREW: JS JT

STREAM: MP01

TIME: 945 (Military)

LOCALITY: AA

SAMPLEABILITY

- Y Benthos
- Y Habitat Assessment
- Y Water Quality
- N Vernal Pool — N (PRESENT/ABSENT)

OTHER (SPECIFY)

SITE ACCESS ROUTE

Path along sands NW @ culvert at walk down

SAMPLE LABELS

Verified by: JS

QC LABEL

Watershed Code	Segment	Type	Year
mp	01	2	2016

(Letters only)

Dup. (D) or Blank (B): ☐ Verified by: _____

TEMP. LOGGER

	(Y/N)	(TIME - Military)	#
WATER			#
AIR			#

LOCATION _____

PHOTODOCUMENTATION

Number	Title	Voucher (Y/N)
	Midpoint UP/DS	
	Upstream US/DS	
	Downstream US/DS	
	structure on LB	

BENTHIC HABITAT SAMPLED

16	Riffle	11	Leaf Pack	11	Undercut Banks
02	Rootwad/Woody Debris	10	Macrophytes	10	Other _____

SAMPLING CONSID.: (☐ NUM. ANODES) _____

STREAM WIDTH (m): 17 (0 m) | 17 (75 m)

v. 2009

MBSS SPRING FAUNA DATA SHEET

SITE Watershed Code MP | Segment 011 | Type 2 | Year 2016 | 9:45 AM | Reviewer: First SS / Second ST

HERPETOFAUNA

☒ None Observed

Species	Lifestage (Adult, Juv, Larval, Egg)	SEEN (Y/N)	HEARD (Y/N)	NUMBER RETAINED	NUMBER PHOTOS TAKEN
None	☐☐☐☐	☐	☐	☐	☐
	☐☐☐☐	☐	☐	☐	☐
	☐☐☐☐	☐	☐	☐	☐
	☐☐☐☐	☐	☐	☐	☐
	☐☐☐☐	☐	☐	☐	☐
	☐☐☐☐	☐	☐	☐	☐
	☐☐☐☐	☐	☐	☐	☐

MUSSELS

☒ None Observed

Species	LIVE	DEAD	NUMBER RETAINED	NUMBER PHOTOS TAKEN
None	☐	☐	☐☐	☐
	☐	☐	☐☐	☐
	☐	☐	☐☐	☐
	☐	☐	☐☐	☐
	☐	☐	☐☐	☐

Corbicula LIVE ☐ DEAD ☐ NONE ☐

CRAYFISHES

☒ None Observed

Species	NUMBER RETAINED
Present	☐☐
	☐☐
	☐☐
	☐☐
	☐☐

Crayfish Burrows ☐
(Absent, Present, Extensive)

COMMENTS

Physical Habitat Assessment and Water Quality Data Sheet

Site ID: MP01
Subwatershed: _____
Length of Reach: _____ Date: 4
Team Members: JS JT Time: 9:45

Stream Character

[M] Meandering	[A] Channelized
[P] Braided	[A] Straight
[E] Riffle	[P] Run/Glide
[P] Deep Pool >.5m	[A] Silt/Clay
[E] Shallow Pool <.5m	[A] Sand
[P] Gravel	[P] Cobble
[A] Boulder >2m	[A] Boulder <2m
[A] Concrete/Gabion	[P] Bedrock
[P] Undercut Bank	[A] Rootwad
[P] Overhead Cover	[A] Storm Drain
[A] Effluent Discharge	[A] Human Refuse
[P] Emergent Vegetation	[A] Beaver Pond
[A] Floating Vegetation	

A=Absent P=Present E=Extensive

Bar Formation
☐ None ☐ Minor ☒ Moderate ☐ Extensive

Bank Erosion (see guidance sheet)

	Left Bank	Right Bank
Extent (m)	20	30
Severity	1	2
Avg. Height	1.5	1.5

Severity: 0=none 1=min 2=mod 3=severe

Maximum stream depth (cm): 30

Benthic Habitat Sampled (20 total)	Sq. ft.
Riffle	16
Rootwad/Woody Debris	2
Leaf Pack	1
Submerged Vegetation	0
Undercut Banks	1
Other: _____	____

Rootwads/Woody Debris

# Instream Woody Debris	5
# Dewatered Woody Debris	2
# Instream Rootwads	0
# Dewatered Rootwads	0

Stream Gradient

Location (ft)	Height (ft)	Water Depth (ft)

Weather
Current: Sunny
Past 24hrs: Windy
Past 48hrs: Sunny

Parameter	Down-stream	Mid-stream	Up-stream
Description			
pH	6.19	6.08	6.29
Temperature (°C)	9.30	9.18	9.39
DO (mg/l)	12.34	12.40	12.41
Conductivity (uS/cm)	144	144	145
TDS (mg/l)	134	134	134
Turbidity (NTU)	0.3	0.3	0.4

Notes: 0.206 0.206 0.206 mS/cm²

Photographs/Observations:
4 Riffles

4/4/0016 JS/JT 9:45AM

MP01

MBSS Physical Habitat Assessment Sheet

Stream Habitat Assessment Guidance Sheet				
Habitat Parameter	Optimal 16-20	Sub-Optimal 11-15	Marginal 6-10	Poor 0-5
1. Instream Habitat[a] SCORE 15	Greater than 50% of a variety of cobble, boulder, submerged logs, undercut banks, snags, rootwads, aquatic plants or other stable habitat	30-50% of stable habitat. Adequate habitat	10-30% mix of stable habitat. Habitat availability less than desireable	Less than 10% stable habitat. Lack of habitat is obvious
2. Epifaunal Substrate[b] SCORE 15	Preferred substrate abundant, stable, and at full colonization potential (riffles well developed and dominated by cobble; and/or woody debris prevalent, not new, and not transient	Abund. of cobble with gravel and/or boulders common; or woody debris, aquatic veg., undercut banks common but not prevalent/suited for full colonization	Large boulders and/or bedrock prevalent; cobble, woody debris, or other preferred surfaces uncommon	Stable substrate lacking; or particles are over 75% surrounded by fine sediment or flocculent material
3. Velocity/Depth Diversity[c] SCORE 18	Slow (<0.3m/s), deep (>0.5m); slow, shallow (<0.5m); fast (>0.3m/s), deep; fast, shallow habitats all present	Only 3 of the 4 habitat categories present	Only 2 of the 4 habitat categories present	Dominated by 1 velocity/depth category (usually pools)
4. Pool/Glide/Eddy Quality[d] SCORE 16	Complex cover/& or depth >1.5m; both deep (>0.5m)/shallows (<0.2m) present	Deep (>0.5m) areas present; but only moderate cover	Shallows (<0.2m) prevalent in pool/glide/eddy habitat; little cover	Max depth <0.2m in pool/glide/eddy habitat; or absent completely
5. Riffle/Run Quality[e] SCORE 16	Riffle/run depth generally >10cm, with maximum depth greater than 50 cm (maximum score); substrate stable (e.g. cobble, boulder) & variety of current velocities	Riffle/run depth generally 5-10cm, variety of current velocities	Riffle/run depth generally 1-5cm; primarily a single current velocity	Riffle/run depth <1cm; or riffle/run substrates concreted
6. Bank Stability[f] (facing downstream.) Score each bank LB SCORE 9 RB SCORE 8	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected. 10 9	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion. 8 7 6	Moderately unstable; 30-60% of bank in reach as areas of erosion; high erosion potential during floods. 5 4 3	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars. 2 1 0
7. Embeddedness SCORE 75 %	Percentage that gravel, cobble, and boulder particles are surrounded by fine sediment or flocculent material			
8. Shading SCORE 80 %	Percentage of segment that is shaded (duration is considered in scoring). 0% = fully exposed to sunlight all day in summer; 100% = fully and densely shaded all day in summer			
9. Riparian Buffer Zone Width (m)[g] LB 50 RB 30	Zone width in which human activity is not evident. 50m (164ft) is the maximum recorded value.			
10. Remoteness SCORE 14	Roads greater than 400 meters (0.25 mi) from stream	Roads within 400 meters (0.25 mi) of stream; stream NOT accessible by trail.	Roads within 400 meters (0.25 mi) of stream; stream accessible by trail.	Roads adjacent to stream.
11. Aesthetic (trash) Rating[h] SCORE 15	Little or no human refuse visible from stream channel or riparian zone	Refuse present in minor amounts	Refuse present in moderate amounts	Refuse abundant and unsightly
12. Number of Woody Debris and Rootwads[i] SCORE 5	Count only woody debris and rootwads within the wetted portion of the sampling segment. Count only woody debris >10cm (4in) diameter and >1.5m (5ft) long and rootwads with trunk diameter (at chest height) >15cm (6in) that are functional habitat within the wetted portion of the stream.			

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS

STREAM NAME	MPO 1	LOCATION	AA
STATION #	REACH ID#	STREAM CLASS	
UTM N	UTM E	RIVER BASIN	Patuxent
STORET #		AGENCY	CEI
INVESTIGATORS	JS/JT		
FORM COMPLETED BY		DATE / TIME	9:45 AM / PM
		REASON FOR SURVEY	BMI

Parameters to be evaluated in sampling reach

Habitat Parameter	Condition Category			
	Optimal	Suboptimal	Marginal	Poor
1. Epifaunal Substrate/ Available Cover	Greater than 50% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient).	30-50% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale).	10-30% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 10% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
SCORE 15	20 19 18 17 16	(15) 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
2. Pool Substrate Characterization	Mixture of substrate materials, with gravel and firm sand prevalent; root mats and submerged vegetation common.	Mixture of soft sand, mud, or clay; mud may be dominant; some root mats and submerged vegetation present.	All mud or clay or sand bottom; little or no root mat; no submerged vegetation.	Hard-pan clay or bedrock; no root mat or vegetation.
SCORE 16	20 19 18 17 (16)	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
3. Pool Variability	Even mix of large-shallow, large-deep, small-shallow, small-deep pools present.	Majority of pools large-deep; very few shallow.	Shallow pools much more prevalent than deep pools.	Majority of pools small-shallow or pools absent.
SCORE 16	20 19 18 17 (16)	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
4. Sediment Deposition	Little or no enlargement of islands or point bars and less than <20% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 20-50% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 50-80% of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; more than 80% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
SCORE 16	20 19 18 17 (16)	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
5. Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills >75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
SCORE 15	20 19 18 17 16	(15) 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0

MP01 4/4/2016 9:45

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS

Parameters to be evaluated broader than sampling reach

Habitat Parameter	Condition Category			
	Optimal	Suboptimal	Marginal	Poor
6. Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr) may be present, but recent channelization is not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.
SCORE 18	20 19 (18) 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
7. Channel Sinuosity	The bends in the stream increase the stream length 3 to 4 times longer than if it was in a straight line. (Note - channel braiding is considered normal in coastal plains and other low-lying areas. This parameter is not easily rated in these areas.)	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	Channel straight; waterway has been channelized for a long distance.
SCORE 17	20 19 18 (17) 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
8. Bank Stability (score each bank)	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.
SCORE 9 (LB)	Left Bank 10 (9)	8 7 6	5 4 3	2 1 0
SCORE 8 (RB)	Right Bank 10 9	(8) 7 6	5 4 3	2 1 0
9. Vegetative Protection (score each bank) Note: determine left or right side by facing downstream.	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
SCORE 6 (LB)	Left Bank 10 9	8 7 (6)	5 4 3	2 1 0
SCORE 6 (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0
10. Riparian Vegetative Zone Width (score each bank riparian zone)	Width of riparian zone >18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone.	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6-12 meters; human activities have impacted zone a great deal.	Width of riparian zone <6 meters: little or no riparian vegetation due to human activities.
SCORE 10 (LB)	Left Bank (10) 9	8 7 6	5 4 3	2 1 0
SCORE 10 (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0

Total Score 162

0915-01-d / MP016 JOE - AUDIT

v. 2009

MBSS SPRING HABITAT DATA SHEET

Page 1 of 7

SITE Watershed Code 0915 Segment 01d Type 1 Year 2016 MP016

DATE Year 16 Month 04 Day 11

Reviewer: First JS / Second KB

206 Dist. from Nearest Road to Site (m)

15 Trash Rating 0 - 20

LANDUSE (Y/N)

N	Old Field	Y	Residential
N	Deciduous Forest	N	Commercial/Industrial
N	Coniferous Forest	N	Cropland
N	Wetland	N	Pasture
N	Surface Mine	N	Orchard/Vineyard/Nursery
N	Landfill	N	Golf Course

RIPARIAN VEGETATION
(facing upstream)

	LEFT BANK	RIGHT BANK
Width (50m max)	50	50
Adjacent Land Cover	FR	HO
Vegetation Type	M/R	H/R
Buffer Breaks (Y/N)	N	N

ROAD CULVERT

Present in Segment (Y/N) N

Sampleable? (Y/N)

Width of Culvert (m)

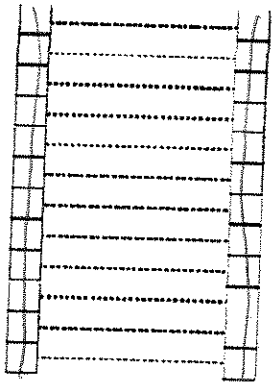
Length of Culvert (m)

STREAM GRADIENT

	Location (m)	Height (m)
1		
2		
3		

LEFT BANK / RIGHT BANK

Storm Drain
Tile Drain
Impervious Drainage
Gully
Orchard
Crop
Pasture
New Construction
Dirt Road
Gravel Road
Raw Sewage
Railroad



Buffer Break Types
(M = minor; S = severe)

CHANNELIZATION

N Evidence of Channel Straightening or Dredging (Y/N)

TYPE	EXTENT (m) LEFT BANK	BOTTOM	RIGHT BANK
Concrete			
Gebion			
Rip-Rap			
Earthen Berm		N/A	
Dredge Spoil Off Channel		N/A	
Pipe Culvert			

Actual Coordinates
(If >30m distance between original coordinates and stream)

Lat

Lon

Stream Block Ht. (m)

Stream Block Type

Lat

Lon

v. 2009

MBSS SPRING INDEX PERIOD DATA SHEET

Page 7 Of 7

SITE Watershed Code 0195 Segment 01d Type 1 Year 2016

Reviewer: First JS / Second KB

DATE Year 16 Month 04 Day 11

CREW: Joe Smith / Karen Bowman

STREAM: Trib to Tony Branch

TIME 1100 (Military)

LOCALITY: Harwood, MD

SAMPLEABILITY

- [1] Benthos
- [1] Habitat Assessment
- [1] Water Quality
- [ ] Vernal Pool [A] (ASSESSMENT)

OTHER (SPECIFY)

SITE ACCESS ROUTE

Cottonwood Dr, enter County property to stream on west side

SAMPLE LABELS

Verified by: _____

QC LABEL

Watershed Code 0195 Segment 01d (Latitude only) Type 1 Year 2016

Dup. (D) or Blank (B): [ ] Verified by: _____

TEMP. LOGGER

	(Y/N)	(TIME - Military)	#
WATER			#
AIR			

LOCATION _____

PHOTODOCUMENTATION

Number	Title	Voucher (Y/N)
	M- US/DS	
	D- US/DS	
	U- US/DS	

BENTHIC HABITAT SAMPLED

- [06] Riffle
- [00] Rootwad/Woody Debris
- [14] Leaf Pack
- [00] Macrophytes
- [00] Undercut Banks
- [00] Other _____

SAMPLING CONSID.: ([ ] NUM. ANODES)

STREAM WIDTH (m): 0 m 10 | 75 m 10

v. 2009

MBSS SPRING FAUNA DATA SHEET

SITE Watershed Code 0 1 9 5 Segment 0 1 d Type 1 Year 2 0 1 6

Reviewer: First JS / Second KB

HERPETOFAUNA

☑ None Observed

Species	Lifestage (Adult, Juv, Larval, Egg)	SEEN (Y/N)	HEARD (Y/N)	NUMBER RETAINED	NUMBER PHOTOS TAKEN
	☐ ☐ ☐ ☐	☐	☐	☐	☐
	☐ ☐ ☐ ☐	☐	☐	☐	☐
	☐ ☐ ☐ ☐	☐	☐	☐	☐
	☐ ☐ ☐ ☐	☐	☐	☐	☐
	☐ ☐ ☐ ☐	☐	☐	☐	☐
	☐ ☐ ☐ ☐	☐	☐	☐	☐
	☐ ☐ ☐ ☐	☐	☐	☐	☐

MUSSELS

☑ None Observed

Species	LIVE	DEAD	NUMBER RETAINED	NUMBER PHOTOS TAKEN
	☐	☐	☐☐	☐
	☐	☐	☐☐	☐
	☐	☐	☐☐	☐
	☐	☐	☐☐	☐
	☐	☐	☐☐	☐

Corbicula LIVE ☐ DEAD ☐ NONE ☐

CRAYFISHES

☑ None Observed

Species	NUMBER RETAINED
	☐☐
	☐☐
	☐☐
	☐☐
	☐☐

Crayfish Burrows P

(Absent, Present, Extensive)

COMMENTS

Physical Habitat Assessment and Water Quality Data Sheet

MP/16

Site ID: 2195-Old-
Subwatershed: Fern Branch
Length of Reach: 75m **Date:** 4/11/16
Team Members: SLeB **Time:** 1111

Weather
Current: Cloudy, 50°
Past 24hrs: Smoky, 55°
Past 48hrs: Rain, 50°

Parameter	Down-stream	Mid-stream	Up-stream
Description			
pH	5.03	5.52	5.74
Temperature (°C)	10.48	10.4	10.4
DO (mg/l)	9.98	10.22	10.28
Conductivity (uS/cm)	164	167	155
TDS (mg/l)	152	149	140
Turbidity (NTU)	9.2	9.1	10.9

A small tributary was at the US point @

Notes:

Stream Character

P Meandering	A Channelized	
A Braided	A Straight	
P Riffle	P Run/Glide	
A Deep Pool >.5m	P Silt/Clay	
P Shallow Pool <.5m	P Sand	
A Gravel	A Cobble	
A Boulder >2m	A Boulder <2m	
A Concrete/Gabion	A Bedrock	
A Undercut Bank	A Rootwad	
P Overhead Cover	A Storm Drain	
A Effluent Discharge	A Human Refuse	
P Emergent Vegetation	A Beaver Pond	
A Floating Vegetation		

A=Absent P=Present E=Extensive

Bar Formation
☑ None ☐ Moderate
☐ Minor ☐ Extensive

Bank Erosion (see guidance sheet)

	Left Bank	Right Bank
Extent (m)	30	30
Severity	2	2
Avg. Height	45	45

Severity: 0=none 1=min 2=mod 3=severe

Maximum stream depth (cm) 10

Benthic Habitat Sampled (20 total)

	Sq. ft.
Riffle	6
Rootwad/Woody Debris	5
Leaf Pack	14
Submerged Vegetation	2
Undercut Banks	0
Other:	

Rootwads/Woody Debris

# Instream Woody Debris	0
# Dewatered Woody Debris	0
# Instream Rootwads	0
# Dewatered Rootwads	0

Stream Gradient

Location (ft)	Height (ft)	Water Depth (ft)

Photographs/Observations:
M - US/DS
D - US/DS
U - US/DS

MBSS Physical Habitat Assessment Sheet

Stream Habitat Assessment Guidance Sheet				
Habitat Parameter	Optimal 16-20	Sub-Optimal 11-15	Marginal 6-10	Poor 0-5
1. Instream Habitat[1] SCORE 8	Greater than 50% of a variety of cobble, boulder, submerged logs, undercut banks, snags, rootwads, aquatic plants or other stable habitat	30-50% of stable habitat. Adequate habitat	10-30% mix of stable habitat. Habitat availability less than desireable	Less than 10% stable habitat. Lack of habitat is obvious
2. Epifaunal Substrate[2] SCORE 3	Preferred substrate abundant, stable, and at full colonization potential (riffles well developed and dominated by cobble; and/or woody debris prevalent, not new; and not transient	Abund. of cobble with gravel and/or boulders common; or woody debris, aquatic veg., undercut banks common but not prevalent/suited for full colonization	Large boulders and/or bedrock prevalent; cobble, woody debris, or other preferred surfaces uncommon	Stable substrate lacking; or particles are over 75% surrounded by fine sediment or flocculent material
3. Velocity/Depth Diversity[3] SCORE 6	Slow (<0.3m/s), deep (>0.5m); slow, shallow (<0.5m); fast (>0.3m/s), deep; fast, shallow habitats all present	Only 3 of the 4 habitat categories present	Only 2 of the 4 habitat categories present	Dominated by 1 velocity/depth category (usually pools)
4. Pool/Glide/Eddy Quality[4] SCORE 16	Complex cover/& /or depth >1.5m; both deep (>0.5m)/shallows (<0.2m) present	Deep (>0.5m) areas present; but only moderate cover	Shallows (<0.2m) prevalent in pool/glide/eddy habitat; little cover	Max depth <0.2m in pool/glide/eddy habitat; or absent completely
5. Riffle/Run Quality[4] SCORE 16	Riffle/run depth generally >10cm, with maximum depth greater than 50 cm (maximum score); substrate stable (e.g. cobble, boulder) & variety of current velocities	Riffle/run depth generally 5-10cm, variety of current velocities	Riffle/run depth generally 1-5cm; primarily a single current velocity	Riffle/run depth <1cm; or riffle/run substrates concreted
6. Bank Stability[4] (facing downstream) Score each bank LB SCORE 5 RB SCORE 5	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected. 10 9	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion. 8 7 6	Moderately unstable; 30-60% of bank in reach as areas of erosion; high erosion potential during floods. 5 4 3	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars. 2 1 0
7. Embeddedness SCORE 70 %	Percentage that gravel, cobble, and boulder particles are surrounded by fine sediment or flocculent material			
8. Shading SCORE 75 %	Percentage of segment that is shaded (duration is considered in scoring); 0% = fully exposed to sunlight all day in summer; 100% = fully and densely shaded all day in summer			
9. Riparian Buffer Zone Width (m)[5] LB 50 RB 50	Zone width in which human activity is not evident. 50m (164ft) is the maximum recorded value.			
10. Remoteness SCORE 5	Roads greater than 400 meters (0.25 mi) from stream	Roads within 400 meters (0.25 mi) of stream; stream NOT accessible by trail.	Roads within 400 meters (0.25 mi) of stream; stream accessible by trail.	Roads adjacent to stream.
11. Aesthetic (trash) Rating[6] SCORE 15	Little or no human refuse visible from stream channel or riparian zone	Refuse present in minor amounts	Refuse present in moderate amounts	Refuse abundant and unsightly
12. Number of Woody Debris and Rootwads[4] SCORE 0	Count only woody debris and rootwads within the wetted portion of the sampling segment. Count only woody debris >10cm (4in) diameter and >1.5m (5ft) long and rootwads with trunk diameter (at chest height) >15cm (6in) that are functional habitat within the wetted portion of the stream.			

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS

0915-01-d

STREAM NAME MP16	LOCATION Harwood, MD
STATION # _____ REACH ID# _____	STREAM CLASS Perennial
UTM N _____ UTM E	RIVER BASIN Patuxent
STORET #	AGENCY CE1
INVESTIGATORS JS/KB	
FORM COMPLETED BY KB	DATE 4/11/16 TIME 1115 PM
REASON FOR SURVEY MBSS 8m2	

Parameters to be evaluated in sampling reach

Habitat Parameter	Condition Category			
	Optimal	Suboptimal	Marginal	Poor
1. Epifaunal Substrate/ Available Cover	Greater than 50% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient).	30-50% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale).	10-30% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 10% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
SCORE 8	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
2. Pool Substrate Characterization	Mixture of substrate materials, with gravel and firm sand prevalent; root mats and submerged vegetation common.	Mixture of soft sand, mud, or clay; mud may be dominant; some root mats and submerged vegetation present.	All mud or clay or sand bottom; little or no root mat; no submerged vegetation.	Hard-pan clay or bedrock; no root mat or vegetation.
SCORE 8	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
3. Pool Variability	Even mix of large-shallow, large-deep, small-shallow, small-deep pools present.	Majority of pools large-deep; very few shallow.	Shallow pools much more prevalent than deep pools.	Majority of pools small-shallow or pools absent.
SCORE 8	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
4. Sediment Deposition	Little or no enlargement of islands or point bars and less than <20% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 20-50% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 50-80% of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; more than 80% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
SCORE 6	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
5. Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills >75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
SCORE 10	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS

Parameters to be evaluated broader than sampling reach

Habitat Parameter	Condition Category			
	Optimal	Suboptimal	Marginal	Poor
6. Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr) may be present, but recent channelization is not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.
SCORE 16	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
7. Channel Sinuosity	The bends in the stream increase the stream length 3 to 4 times longer than if it was in a straight line. (Note - channel braiding is considered normal in coastal plains and other low-lying areas. This parameter is not easily rated in these areas.)	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	Channel straight; waterway has been channelized for a long distance.
SCORE 10	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
8. Bank Stability (score each bank)	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.
SCORE 6 (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE 6 (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0
9. Vegetative Protection (score each bank) Note: determine left or right side by facing downstream.	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
SCORE 5 (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE 5 (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0
10. Riparian Vegetative Zone Width (score each bank riparian zone)	Width of riparian zone >18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone.	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6-12 meters; human activities have impacted zone a great deal.	Width of riparian zone <6 meters: little or no riparian vegetation due to human activities.
SCORE 9 (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE 9 (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0

Total Score 106

Form # EL2 - _____

0915-01-d /MP016QC

KAREN/AUDIT

v. 2009

MBSS SPRING HABITAT DATA SHEET

Page 1 of 7

SITE Watershed Code: MP | Segment: 16 QC | Type: 1 | Year: 2016

Reviewer: First: JS / Second: KB

DATE Year: 16 | Month: 04 | Day: 11

100 Dist. from Nearest Road to Site (m)

15 Trash Rating 0 - 20

LANDUSE (Y/N)

N	Old Field	Y	Residential
Y	Deciduous Forest	N	Commercial/Industrial
N	Coniferous Forest	N	Cropland
Y	Wetland	N	Pasture
N	Surface Mine	N	Orchard/Vineyard/Nursery
N	Landfill	N	Golf Course

RIPARIAN VEGETATION
(facing upstream)

	LEFT BANK	RIGHT BANK
Width (50m max)	50	35
Adjacent Land Cover	FR	LN
Vegetation Type	W O M R	W O M R
Buffer Breaks (Y/N)	N	N

ROAD CULVERT

Present in Segment (Y/N): N

Sampleable? (Y/N):

Width of Culvert (m):

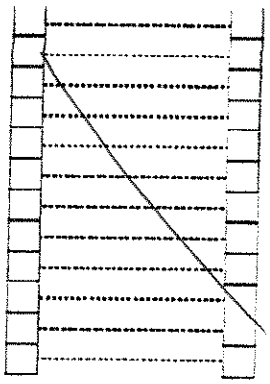
Length of Culvert (m):

STREAM GRADIENT

	Location (m)	Height (m)
1		
2		
3		

LEFT BANK / RIGHT BANK

Storm Drain
Tile Drain
Impervious Drainage
Gully
Orchard
Crop
Pasture
New Construction
Dirt Road
Gravel Road
Raw Sewage
Railroad



Buffer Break Types
(M = minor; S = severe)

CHANNELIZATION

N Evidence of Channel Straightening or Dredging (Y/N)

TYPE	EXTENT (m) LEFT BANK	BOTTOM	RIGHT BANK
Concrete			
Gabion			
Rip-Rap			
Earthen Berm		N/A	
Dredge Spoil Off Channel		N/A	
Pipe Culvert			

Actual Coordinates
(If >30m distance between original coordinates and stream)

Lat

Lon

Stream Block Ht. (m)

Stream Block Type

Lat

Lon

0915-01-d / MP016 QC

v. 2009

MBSS SPRING INDEX PERIOD DATA SHEET

Page 2 of 7

SITE: Watershed Code 0195 | Segment 01d | Type 1 | Year 2016

Reviewer: First RB / Second JS

DATE: Year 16 | Month 04 | Day 11

CREW: Joe Smith / Karen Bonner

STREAM: Trib. to Forey Branch

TIME: 1230 (Military)

LOCALITY: Herwood MD

SAMPLEABILITY

- Y Benthos
- Y Habitat Assessment
- Y Water Quality
- N Vernal Pool (PRESENT/ABSENT)

OTHER (SPECIFY)

SITE ACCESS ROUTE

Cottonwood Dr enter Camp property to stream from the west

SAMPLE LABELS

Verified by: _____

QC LABEL

Watershed Code 0195 | Segment 01d (Letters only) | Type 1 | Year 2016

Dup. (D) or Blank (B): ☐ Verified by: _____

TEMP. LOGGER

	(Y/N)	(TIME - Military)	#
WATER			#
AIR			

LOCATION _____

PHOTODOCUMENTATION

Number	Title	Voucher (Y/N)
	m us/ds	
	D us/ds	
	V - us/ds	

BENTHIC HABITAT SAMPLED

- 0 Riffle
- 8 Rootwad/Woody Debris
- 12 Leaf Pack
- 0 Macrophytes
- 0 Undercut Banks
- 0 Other

SAMPLING CONSID.: (☐ NUM. ANODES)

STREAM WIDTH (m): 10 (0 m) | 10 (75 m)

0915-01-d / MP016 - QC

v. 2009

MBSS SPRING FAUNA DATA SHEET

SITE Watershed Code MP | Segment 16 QC | Type 1 | Year 2016

Reviewer: First KB / Second SS

HERPETOFAUNA

☐ None Observed

Species	Lifestage (Adult, Juv., Larval, Egg)	SEEN (Y/N)	HEARD (Y/N)	NUMBER RETAINED	NUMBER PHOTOS TAKEN
BULLFROG	☑	☑			
GREEN FROG	☑	☑			
GRAY TREE-FROG	☑		☑		

MUSSELS

☒ None Observed

Species	LIVE	DEAD	NUMBER RETAINED	NUMBER PHOTOS TAKEN

Corbicula: LIVE ☐ DEAD ☐ NONE ☐

CRAYFISHES

☒ None Observed

Species	NUMBER RETAINED

Crayfish Burrows: P

(Absent, Present, Extensive)

COMMENTS

0915-01-01
MP016 QC

Physical Habitat Assessment and Water Quality Data Sheet

Site ID: MP 16QC
Subwatershed: Frosty Branch 2
Length of Reach: _____ **Date:** _____
Team Members: _____ **Time:** _____

Weather
Current: _____
Past 24hrs: _____
Past 48hrs: _____

Stream Character

P Meandering	A Channelized
A Braided	A Straight
P Riffle	A Run/Glide
A Deep Pool >.5m	P Silt/Clay
P Shallow Pool <.5m	P Sand
A Gravel	A Cobble
A Boulder >2m	A Boulder <2m
A Concrete/Gabion	A Bedrock
A Undercut Bank	A Rootwad
P Overhead Cover	A Storm Drain
A Effluent Discharge	A Human Refuse
A Emergent Vegetation	A Beaver Pond
A Floating Vegetation	

A=Absent P=Present E=Extensive

Parameter	Down-stream	Mid-stream	Up-stream
Description			
pH	6.09	6.11	6.17
Temperature (°C)	13.87	13.39	13.39
DO (mg/l)	10.36	10.19	9.96
Conductivity (uS/cm)	172	163	145
TDS (mg/l)	142	134	119
Turbidity (NTU)	(350)	20.8	7.72
	655	96.3	37.4
	0.219	0.311	0.146

ORP mS/cm

Notes: DS point was turbid because of US sample
Data point deleted from average Turbidity

Bar Formation
☒ None ☐ Moderate
☐ Minor ☐ Extensive

Bank Erosion (see guidance sheet)

	Left Bank	Right Bank
Extent (m)	10	30
Severity	1	1
Avg. Height	1.2	1.2

Severity: 0=none 1=min 2=mod 3=severe

Maximum stream depth (cm) 25

Benthic Habitat Sampled (20 total)

	Sq. ft.
Riffle	0
Rootwad/Woody Debris	3
Leaf Pack	12
Submerged Vegetation	0
Undercut Banks	0
Other: _____	0

Rootwads/Woody Debris

# Instream Woody Debris	1
# Dewatered Woody Debris	1
# Instream Rootwads	0
# Dewatered Rootwads	0

Stream Gradient

Location (ft)	Height (ft)	Water Depth (ft)

Photographs/Observations:

0915-01-9

MP016 QC

MBSS Physical Habitat Assessment Sheet

Stream Habitat Assessment Guidance Sheet				
Habitat Parameter	Optimal 16-20	Sub-Optimal 11-15	Marginal 6-10	Poor 0-5
1. Instream Habitat[a] SCORE 7	Greater than 50% of a variety of cobble, boulder, submerged logs, undercut banks, snags, rootwads, aquatic plants or other stable habitat	30-50% of stable habitat. Adequate habitat	10-30% mix of stable habitat. Habitat availability less than desireable	Less than 10% stable habitat. Lack of habitat is obvious
2. Epifaunal Substrate[a] SCORE 3	Preferred substrate abundant, stable, and at full colonization potential (riffles well developed and dominated by cobble; and/or woody debris prevalent, not new; and not transient	Abund. of cobble with gravel and/or boulders common; or woody debris, aquatic veg., undercut banks common but not prevalent/suited for full colonization	Large boulders and/or bedrock prevalent; cobble, woody debris, or other preferred surfaces uncommon	Stable substrate lacking; or particles are over 75% surrounded by fine sediment or flocculent material
3. Velocity/Depth Diversity[a] SCORE 6	Slow (<0.3m/s), deep (>0.5m); slow, shallow (<0.5m); fast (>0.3m/s), deep; fast, shallow habitats all present	Only 3 of the 4 habitat categories present	Only 2 of the 4 habitat categories present	Dominated by 1 velocity/depth category (usually pools)
4. Pool/Glide/Eddy Quality[a] SCORE 5	Complex cover&/or depth >1.5m; both deep (>0.5m)/shallows (<0.2m) present	Deep (>0.5m) areas present; but only moderate cover	Shallows (<0.2m) prevalent in pool/glide/eddy habitat; little cover	Max depth <0.2m in pool/glide/eddy habitat; or absent completely
5. Riffle/Run Quality[a] SCORE 6	Riffle/run depth generally >10cm, with maximum depth greater than 50 cm (maximum score); substrate stable (e.g. cobble, boulder) & variety of current velocities	Riffle/run depth generaly 5-10cm, variety of current velocities	Riffle/run depth generaly 1-5cm; primarily a single current velocity	Riffle/run depth <1cm; or riffle/run substrates concreted
6. Bank Stability[a] (facing downstream.) Score each bank LB SCORE 6 RB SCORE 6	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected. 10 9	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion. 8 7 6	Moderately unstable; 30-60% of bank in reach as areas of erosion; high erosion potential during floods. 5 4 3	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars. 2 1 0
7. Embeddedness SCORE 85 %	Percentage that gravel, cobble, and boulder particles are surrounded by fine sediment or flocculent material			
8. Shading SCORE 80 %	Percentage of segment that is shaded (duration is considered in scoring). 0% = fully exposed to sunlight all day in summer; 100% = fully and densely shaded all day in summer			
9. Riparian Buffer Zone Width (m)[a] LB 50 RB 35	Zone width in which human activity is not evident. 50m (164ft) is the maximum recorded value.			
10. Remoteness SCORE 5	Roads greater than 400 meters (0.25 mi) from stream	Roads within 400 meters (0.25 mi) of stream; stream NOT accessible by trail.	Roads within 400 meters (0.25 mi) of stream; stream accessible by trail.	Roads adjacent to stream.
11. Aesthetic (trash) Rating[a] SCORE 15	Little or no human refuse visible from stream channel or riparian zone	Refuse present in minor amounts	Refuse present in moderate amounts	Refuse abundant and unsightly
12. Number of Woody Debris and Rootwads[a] SCORE 1	Count only woody debris and rootwads within the wetted portion of the sampling segment. Count only woody debris >10cm (4in) diameter and >1.5m (5ft) long and rootwads with trunk diameter (at chest height) >15cm (6in) that are functional habitat within the wetted portion of the stream.			

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS

STREAM NAME MP16 - QC		LOCATION Harwood MD	
STATION #	REACH ID#	STREAM CLASS Perennial	
UTM N	UTM E	RIVER BASIN Patuxent	
STORET #		AGENCY CEI	
INVESTIGATORS Joe Smith / Karen Bowman			
FORM COMPLETED BY JS	DATE 4/11/2016 TIME 12:30 PM	REASON FOR SURVEY MBSS BMI	

Parameters to be evaluated in sampling reach

Habitat Parameter	Condition Category			
	Optimal	Suboptimal	Marginal	Poor
1. Epifaunal Substrate/ Available Cover SCORE 6	Greater than 50% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient). 20 19 18 17 16	30-50% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale). 15 14 13 12 11	10-30% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed. 10 9 8 7 6	Less than 10% stable habitat; lack of habitat is obvious; substrate unstable or lacking. 5 4 3 2 1 0
2. Pool Substrate Characterization SCORE 7	Mixture of substrate materials, with gravel and firm sand prevalent; root mats and submerged vegetation common. 20 19 18 17 16	Mixture of soft sand, mud, or clay; mud may be dominant; some root mats and submerged vegetation present. 15 14 13 12 11	All mud or clay or sand bottom; little or no root mat; no submerged vegetation. 10 9 8 7 6	Hard-pan clay or bedrock; no root mat or vegetation. 5 4 3 2 1 0
3. Pool Variability SCORE 7	Even mix of large-shallow, large-deep, small-shallow, small-deep pools present. 20 19 18 17 16	Majority of pools large-deep; very few shallow. 15 14 13 12 11	Shallow pools much more prevalent than deep pools. 10 9 8 7 6	Majority of pools small-shallow or pools absent. 5 4 3 2 1 0
4. Sediment Deposition SCORE 7	Little or no enlargement of islands or point bars and less than <20% of the bottom affected by sediment deposition. 20 19 18 17 16	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 20-50% of the bottom affected; slight deposition in pools. 15 14 13 12 11	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 50-80% of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent. 10 9 8 7 6	Heavy deposits of fine material, increased bar development; more than 80% of the bottom changing frequently; pools almost absent due to substantial sediment deposition. 5 4 3 2 1 0
5. Channel Flow Status SCORE 10	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed. 20 19 18 17 16	Water fills >75% of the available channel; or <25% of channel substrate is exposed. 15 14 13 12 11	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed. 10 9 8 7 6	Very little water in channel and mostly present as standing pools. 5 4 3 2 1 0

MP016 QC / 0915-01-01

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS

Parameters to be evaluated broader than sampling reach

Habitat Parameter	Condition Category: Optimal	Suboptimal	Marginal	Poor
6. Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr) may be present, but recent channelization is not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.
SCORE 17	20 19 18 (17) 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
7. Channel Sinuosity	The bends in the stream increase the stream length 3 to 4 times longer than if it was in a straight line. (Note - channel braiding is considered normal in coastal plains and other low-lying areas. This parameter is not easily rated in these areas.)	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	Channel straight; waterway has been channelized for a long distance.
SCORE 17	20 19 18 (17) 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
8. Bank Stability (score each bank)	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.
SCORE 7 (LB)	Left Bank 10 9	8 (7) 6	5 4 3	2 1 0
SCORE 6 (RB)	Right Bank 10 9	8 7 (6)	5 4 3	2 1 0
9. Vegetative Protection (score each bank) Note: determine left or right side by facing downstream.	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
SCORE 7 (LB)	Left Bank 10 9	8 (7) 6	5 4 3	2 1 0
SCORE 6 (RB)	Right Bank 10 9	8 7 (6)	5 4 3	2 1 0
10. Riparian Vegetative Zone Width (score each bank riparian zone)	Width of riparian zone >18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone.	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6-12 meters; human activities have impacted zone a great deal.	Width of riparian zone <6 meters: little or no riparian vegetation due to human activities.
SCORE 9 (LB)	Left Bank 10 (9)	8 7 6	5 4 3	2 1 0
SCORE 7 (RB)	Right Bank 10 9	8 (7) 6	5 4 3	2 1 0

Total Score 113

v. 2009

MBSS SPRING HABITAT DATA SHEET

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MP06 2 cont

SITE — Watershed Code: MP | Segment: 02 | Type: 1 | Year: 2016

Reviewer: First: EW / Second: CR

DATE — Year: 16 | Month: 04 | Day: 06

100 Dist. from Nearest Road to Site (m)

18 Trash Rating 0 - 20

LANDUSE (Y/N)

N	Old Field	Y	Residential
N	Deciduous Forest	N	Commercial/Industrial
N	Coniferous Forest	N	Cropland
Y	Wetland	N	Pasture
N	Surface Mine	N	Orchard/Vineyard/Nursery
N	Landfill	N	Golf Course

RIPARIAN VEGETATION
(facing upstream)

	LEFT BANK	RIGHT BANK
Width (50m max)	50	50
Adjacent Land Cover	LN	FR
Vegetation Type	MYRG	MYRG
Buffer Breaks (Y/N)	Y	N

ROAD CULVERT

Present in Segment (Y/N): N

Sampleable? (Y/N): N

Width of Culvert (m): N/A

Length of Culvert (m): N/A

STREAM GRADIENT

~~Location (m) | Height (m)~~

~~1~~

~~2~~

~~3~~

Buffer Breaks

	LEFT BANK	RIGHT BANK
Storm Drain	N	N
Tile Drain	N	N
Impervious Drainage	M	N
Gully	N	N
Orchard	N	N
Crop	N	N
Pasture	N	N
New Construction	N	N
Dirt Road	N	N
Gravel Road	N	N
Raw Sewage	N	N
Railroad	N	N

Buffer Break Types
(M = minor; S = severe)

CHANNELIZATION

N Evidence of Channel Straightening or Dredging (Y/N)

TYPE	EXTENT (m) N/A		
	LEFT BANK	BOTTOM	RIGHT BANK
Concrete			
Gabion			
Rip-Rap			
Earthen Berm		N/A	
Dredge Spoil Off Channel		N/A	
Pipe Culvert			

Actual Coordinates
(If >30m distance between original coordinates and stream)

Lat

Lon

Stream Block Ht. (m)

Stream Block Type

Lat

Lon

v. 2009

MBSS SPRING INDEX PERIOD DATA SHEET

SITE Watershed Code: MP | Segment: 02 | Type: | Year: 2016

Reviewer: First: EW / Second: CR

DATE: Year 16 | Month 04 | Day 06

CREW: ELEANOR WILSON | CARISSA REH

STREAM: UNNAMED TRIB TO PATUXENT RIVER - MP02

TIME: 1230 (Military)

LOCALITY: HARWOOD, AA Co., MD

SAMPLEABILITY

- [Y] Benthos
- [Y] Habitat Assessment
- [Y] Water Quality
- [N] Vernal Pool [A] (PRESENT/ABSENT)

OTHER (SPECIFY): N/A

SITE ACCESS ROUTE

- PARK ALONG PRESERVATION LANE
- FOLLOW DIRT PATH ~ 300 m US TO MIDPOINT OF REACH

SAMPLE LABELS

Verified by: CR

QC LABEL

Watershed Code: MP | Segment: 02 | Type: | Year: 2016 (Letters only)

Dup. (D) or Blank (B): | Verified by:

TEMP. LOGGER N/A

	(Y/N)	(TIME - Military)	#
WATER			#
AIR			#

LOCATION

PHOTODOCUMENTATION

Number	Title	Voucher (Y/N)
	MP - US, DS	
	DS - US, DS	
	US - US, DS	
	CUTTING	
	HUNTING STAND	
	SALAMANDERS (3 PICS)	
	C. BURROW	

BENTHIC HABITAT SAMPLED

11	Riffle	04	Leaf Pack	00	Undercut Banks
05	Rootwad/Woody Debris	00	Macrophytes	00	Other

SAMPLING CONSID.: (| NUM. ANODES)

NARROW CHANNEL MAY WETTED WIDTH ~1 m

STREAM WIDTH (m): 0 m: 09 | 75 m: 08

v. 2009

MBSS SPRING FAUNA DATA SHEET

SITE Watershed Code MP | Segment 02 | Type | Year 2016

Reviewer: First EW / Second CR

HERPETOFAUNA

☐ None Observed

Species	Lifestage (Adult, Juv., Larval, Egg)	SEEN (Y/N)	HEARD (Y/N)	NUMBER RETAINED	NUMBER PHOTOS TAKEN
TADPOLES OBSERVED AMONG UPSTREAM	Larval				
PORTION OF REACH W/IN SLOW FLOW					
SHALLOW POOLS					
NORTHERN 2-LINED SALAMANDERS (11)	Adult	Y			1

MUSSELS

☒ None Observed

Species	LIVE	DEAD	NUMBER RETAINED	NUMBER PHOTOS TAKEN

Corbicula: LIVE ☐ DEAD ☐ NONE ☒

CRAYFISHES

☒ None Observed

Species	NUMBER RETAINED
1 [illegible]	

Crayfish Burrows (Absent, Present, Extensive): P (PICTURE)

COMMENTS

Physical Habitat Assessment and Water Quality Data Sheet

Site ID: MP02
Subwatershed: Unnamed Trib 2
Length of Reach: 75m **Date:** 4/6/16
Team Members: EW/CL **Time:** 12:30

Weather
Current: SUNNY, 48° F
Past 24hrs: SUNNY; 40°F
Past 48hrs: RAIN/OVERCAST 50°F

Stream Character

[E] Meandering	[A] Channelized
[A] Braided	[P] Straight
[P] Riffle	[P] Run/Glide
[A] Deep Pool >.5m	[P] Silt/Clay
[P] Shallow Pool <.5m	[P] Sand
[P] Gravel	[A] Cobble
[A] Boulder >2m	[A] Boulder <2m
[A] Concrete/Gabion	[A] Bedrock
[P] Undercut Bank	[P] Rootwad
[E] Overhead Cover	[A] Storm Drain
[A] Effluent Discharge	[A] Human Refuse
[P] Emergent Vegetation	[A] Beaver Pond
[A] Floating Vegetation	

A=Absent P=Present E=Extensive

Bar Formation
[ ] None [ ] Moderate
[ ] Minor [X] Extensive

Bank Erosion (see guidance sheet)

	Left Bank	Right Bank
Extent (m)	30	30
Severity	2	2
Avg. Height	1m	1m

Severity: 0=none 1=min 2=mod 3=severe

Maximum stream depth (cm): 30

Benthic Habitat Sampled (20 total)

	Sq. ft.
Riffle	11
Rootwad/Woody Debris	5
Leaf Pack	4
Submerged Vegetation	0
Undercut Banks	0
Other: N/A	0

Rootwads/Woody Debris

# Instream Woody Debris	1
# Dewatered Woody Debris	1
# Instream Rootwads	2
# Dewatered Rootwads	1

Stream Gradient

Location (ft)	Height (ft)	Water Depth (ft)

Parameter	Downstream	Midstream	Upstream
Description	–	–	–
pH	5.88	6.07	3.63
Temperature (°C)	10.81	10.46	12.38
DO (mg/l)	13.04	13.88	14.91
Conductivity (uS/cm)	58	56	61
TDS (mg/l)	51	52	52
Turbidity (NTU)	1.3	2.7	0.7
Notes: BARO (mmHg)	767.5	767.5	766.5

Photographs/Observations:

- STREAM BUFFER DOMINATED BY HEALTHY MID-SUCCESSIONAL DECIDUOUS FOREST
- NARROW SLOW VELOCITY STREAM THAT EXPERIENCES HIGH FLOWS DURING STORM EVENT
- VARIED SUBSTRATE – SAND, SILT, CLAY, COBBLE/GRAVEL
- MOST SEVERE BANK EROSION @ UPSTREAM POINT, RIGHT BANK
- IRON DEPOSITS PRESENT
- HUMAN DISRUPTION W/IN IMMEDIATE FOREST (TREES CUT, OLD HUNTING STAND, ETC.)
- DIRT PATH RUNS PARALLEL TO RIGHT BANK

MBSS Physical Habitat Assessment Sheet

Stream Habitat Assessment Guidance Sheet

Habitat Parameter	Optimal 16-20	Sub-Optimal 11-15	Marginal 6-10	Poor 0-5
1. Instream Habitat[a] SCORE 11	Greater than 50% of a variety of cobble, boulder, submerged logs, undercut banks, snags, rootwads, aquatic plants or other stable habitat	30-50% of stable habitat. Adequate habitat	10-30% mix of stable habitat. Habitat availability less than desireable	Less than 10% stable habitat. Lack of habitat is obvious
2. Epifaunal Substrate[b] SCORE 12	Preferred substrate abundant, stable, and at full colonization potential (riffles well developed and dominated by cobble; and/or woody debris prevalent, not new, and not transient	Abund. of cobble with gravel and/or boulders common; or woody debris, aquatic veg., undercut banks common but not prevalent/suited for full colonization	Large boulders and/or bedrock prevalent; cobble, woody debris, or other preferred surfaces uncommon	Stable substrate lacking; or particles are over 75% surrounded by fine sediment or flocculent material
3. Velocity/Depth Diversity[c] SCORE 6	Slow (<0.3m/s), deep (>0.5m); slow, shallow (<0.5m); fast (>0.3m/s), deep; fast, shallow habitats all present	Only 3 of the 4 habitat categories present	Only 2 of the 4 habitat categories present	Dominated by 1 velocity/depth category (usually pools)
4. Pool/Glide/Eddy Quality[d] SCORE 6	Complex cover/& or depth >1.5m; both deep (>0.5m)/shallows (<0.2m) present	Deep (>0.5m) areas present; but only moderate cover	Shallows (<0.2m) prevalent in pool/glide/eddy habitat; little cover	Max depth <0.2m in pool/glide/eddy habitat; or absent completely
5. Riffle/Run Quality[e] SCORE 6	Riffle/run depth generally >10cm, with maximum depth greater than 50 cm (maximum score); substrate stable (e.g. cobble, boulder) & variety of current velocities	Riffle/run depth generally 5-10cm, variety of current velocities	Riffle/run depth generally 1-5cm; primarily a single current velocity	Riffle/run depth <1cm; or riffle/run substrates concreted
6. Bank Stability[f] (facing downstream) Score each bank LB SCORE 6 RB SCORE 5	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected. 10 9	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion. 8 7 6	Moderately unstable; 30-60% of bank in reach as areas of erosion; high erosion potential during floods. 5 4 3	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars. 2 1 0
7. Embeddedness SCORE 60 %	Percentage that gravel, cobble, and boulder particles are surrounded by fine sediment or flocculent material			
8. Shading SCORE 80 %	Percentage of segment that is shaded (duration is considered in scoring). 0% = fully exposed to sunlight all day in summer, 100% = fully and densely shaded all day in summer			
9. Riparian Buffer Zone Width (m)[g] LB 50 RB 50	Zone width in which human activity is not evident. 50m (164ft) is the maximum recorded value.			
10. Remoteness SCORE 6	Roads greater than 400 meters (0.25 mi) from stream	Roads within 400 meters (0.25 mi) of stream; stream NOT accessible by trail.	Roads within 400 meters (0.25 mi) of stream; stream accessible by trail.	Roads adjacent to stream.
11. Aesthetic (trash) Rating[h] SCORE 18	Little or no human refuse visible from stream channel or riparian zone	Refuse present in minor amounts	Refuse present in moderate amounts	Refuse abundant and unsightly
12. Number of Woody Debris and Rootwads[i] SCORE 3	Count only woody debris and rootwads within the wetted portion of the sampling segment. Count only woody debris >10cm (4in) diameter and >1.5m (5ft) long and rootwads with trunk diameter (at chest height) >15cm (6in) that are functional habitat within the wetted portion of the stream.			

* DIRT TRAIL THAT GOES FROM PRESERVATION LN ALONG RIGHT BANK OF STREAM

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS

STREAM NAME MP02	LOCATION HARWOOD, AA Co., MD	
STATION # _____ REACH ID# _____	STREAM CLASS I	
UTM N _____ UTM E	RIVER BASIN PATUXENT RIVER	
STORET #	AGENCY CEI	
INVESTIGATORS EW/CR		
FORM COMPLETED BY CR	DATE 4/6/16 TIME ~2:30 (PM)	REASON FOR SURVEY BMI SAMPLING

Parameters to be evaluated in sampling reach

Habitat Parameter	Condition Category			
	Optimal	Suboptimal	Marginal	Poor
1. Epifaunal Substrate/ Available Cover	Greater than 50% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient).	30-50% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale).	10-30% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 10% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
SCORE 12	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
2. Pool Substrate Characterization	Mixture of substrate materials, with gravel and firm sand prevalent; root mats and submerged vegetation common.	Mixture of soft sand, mud, or clay; mud may be dominant; some root mats and submerged vegetation present.	All mud or clay or sand bottom; little or no root mat; no submerged vegetation. SOME GRAVEL	Hard-pan clay or bedrock; no root mat or vegetation.
SCORE 10	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
3. Pool Variability	Even mix of large-shallow, large-deep, small-shallow, small-deep pools present.	Majority of pools large-deep; very few shallow.	Shallow pools much more prevalent than deep pools.	Majority of pools small-shallow or pools absent.
SCORE 7	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
4. Sediment Deposition	Little or no enlargement of islands or point bars and less than <20% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 20-50% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 50-80% of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; more than 80% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
SCORE 11	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
5. Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills >75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
SCORE 8	20 19 18 17 16	15 14 13 12 11	10 9 (8) 7 6	5 4 3 2 1 0

MPD2

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS P 7 OF 7

Parameters to be evaluated broader than sampling reach

Habitat Parameter	Condition Category			
	Optimal	Suboptimal	Marginal	Poor
6. Channel Alteration NO CHANNEL-IZATION OR ALTERATION PRESENT SCORE 20	Channelization or dredging absent or minimal; stream with normal pattern. (20) 19 18 17 16	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr) may be present, but recent channelization is not present. 15 14 13 12 11	Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted. 10 9 8 7 6	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely. 5 4 3 2 1 0
7. Channel Sinuosity SCORE 16	The bends in the stream increase the stream length 3 to 4 times longer than if it was in a straight line. (Note - channel braiding is considered normal in coastal plains and other low-lying areas. This parameter is not easily rated in these areas.) 20 19 18 17 (16)	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line. 15 14 13 12 11	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line. 10 9 8 7 6	Channel straight; waterway has been channelized for a long distance. 5 4 3 2 1 0
8. Bank Stability (score each bank) SCORE 6 (LB) SCORE 5 (RB)	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected. Left Bank 10 9 Right Bank 10 9	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion. 8 7 6 8 7 6	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods. 5 4 3 5 4 3	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars. 2 1 0 2 1 0
9. Vegetative Protection (score each bank) Note: determine left or right side by facing downstream. SCORE 8 (LB) SCORE 8 (RB)	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally. Left Bank 10 9 Right Bank 10 9	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining. (8) 7 6 (8) 7 6	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining. 5 4 3 5 4 3	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height. 2 1 0 2 1 0
10. Riparian Vegetative Zone Width (score each bank riparian zone) SCORE 4 (LB) SCORE 7 (RB)	Width of riparian zone >18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone. Left Bank 10 9 Right Bank 10 9	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally. DIRT PATH 8 7 6 8 (7) 6	Width of riparian zone 6-12 meters; human activities have impacted zone a great deal. TREE CUTTING 5 (4) 3 5 4 3	Width of riparian zone <6 meters: little or no riparian vegetation due to human activities. 2 1 0 2 1 0

Total Score 122

Form # EL2 - _____

v. 2009

MBSS SPRING HABITAT DATA SHEET

Page 1 of 7

SITE — Watershed Code: MP | Segment: 023 | Type: 7 | Year: 2016

Reviewer: First KB / Second JA

DATE — Year: 16 | Month: 04 | Day: 14

800 Dist. from Nearest Road to Site (m)

12 Trash Rating 0 - 20

LANDUSE (Y/N)

N	Old Field	N	Residential
Y	Deciduous Forest	N	Commercial/Industrial
N	Coniferous Forest	N	Cropland
N	Wetland	N	Pasture
N	Surface Mine	N	Orchard/Vineyard/Nursery
N	Landfill	Y	Golf Course

RIPARIAN VEGETATION

(facing upstream)

	LEFT BANK	RIGHT BANK
Width (50m max)	10	45
Adjacent Land Cover	LN	LN
Vegetation Type	Y R M L	Y R M L
Buffer Breaks (Y/N)	N	N

ROAD CULVERT

Present in Segment (Y/N): N

Sampleable? (Y/N):

Width of Culvert (m):

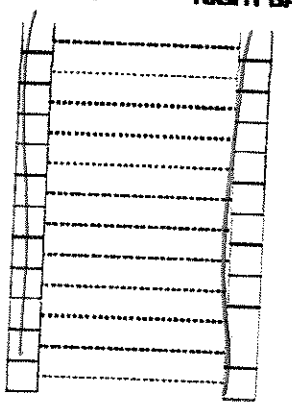
Length of Culvert (m):

STREAM GRADIENT

	Position (m)	Height (m)
1		
2		
3		

LEFT BANK / RIGHT BANK

Storm Drain
Tile Drain
Impervious Drainage
Gully
Orchard
Crop
Pasture
New Construction
Dirt Road
Gravel Road
Raw Sewage
Railroad



Buffer Break Types
(M = minor; S = severe)

CHANNELIZATION

N Evidence of Channel Straightening or Dredging (Y/N)

TYPE	EXTENT (m) LEFT BANK	BOTTOM	RIGHT BANK
Concrete			
Gabion			
Rip-Rap			
Earthen Berm		N/A	
Dredge Spoil Off Channel		N/A	
Pipe Culvert			

Actual Coordinates
(If >30m distance between original coordinates and stream)

Lat

Lon

Stream Block Ht. (m)

Stream Block Type

Lat

Lon

v. 2009

MBSS SPRING INDEX PERIOD DATA SHEET

Page 1 Of 37

SITE Watershed Code MP | Segment 023 | Type 2 | Year 2016

Reviewer: First KB / Second JA

DATE Year 16 Month 04 Day 14

CREW: KB / JA

STREAM: MP023

TIME 1145 (Military)

LOCALITY: Lothian, MD

SAMPLEABILITY

- [x] Benthos
- [x] Habitat Assessment
- [x] Water Quality
- [ ] Vernal Pool [A] (PRESENT / ABSENT)

OTHER (SPECIFY)

SITE ACCESS ROUTE

Cart Road along Old South County Club

SAMPLE LABELS

Verified by: KB

QC LABEL

Watershed Code MP | Segment 023 (Letters only) | Type 2 | Year 2016

Dup. (D) or Blank (B): | Verified by:

TEMP. LOGGER

	(Y/N)	(TIME - Military)	#
WATER			#
AIR			#

LOCATION

PHOTODOCUMENTATION

Number	Title	Voucher (Y/N)
	M- US/DS	
	D- US/DS	
	U- US/DS	

BENTHIC HABITAT SAMPLED

- [x] 15 Riffle
- [x] 05 Rootwad/Woody Debris
- [x] 05 Leaf Pack
- [ ] 10 Macrophytes
- [ ] 10 Undercut Banks
- [ ] 10 Other

SAMPLING CONSID.: (NUM. ANODES)

STREAM WIDTH (m): 0 m | 75 m

v. 2009

MBSS SPRING FAUNA DATA SHEET

Page ____ Of ____

SITE Watershed Code [ ][ ][M][P] Segment [0][2][3] Type [2] Year [2][0][1][6]

Reviewer: First KB / Second JA

HERPETOFAUNA

☒ None Observed

Species	Lifestage (Adult, Juv, Larval, Egg)	SEEN (Y/N)	HEARD (Y/N)	NUMBER RETAINED	NUMBER PHOTOS TAKEN
	☐☐☐☐	☐	☐	☐	☐
	☐☐☐☐	☐	☐	☐	☐
	☐☐☐☐	☐	☐	☐	☐
	☐☐☐☐	☐	☐	☐	☐
	☐☐☐☐	☐	☐	☐	☐
	☐☐☐☐	☐	☐	☐	☐
	☐☐☐☐	☐	☐	☐	☐

MUSSELS

☒ None Observed

Species	LIVE	DEAD	NUMBER RETAINED	NUMBER PHOTOS TAKEN
	☐	☐	☐☐	☐
	☐	☐	☐☐	☐
	☐	☐	☐☐	☐
	☐	☐	☐☐	☐
	☐	☐	☐☐	☐

Corbicula LIVE ☐ DEAD ☐ NONE ☐

CRAYFISHES

☒ None Observed

Species	NUMBER RETAINED
	☐☐
	☐☐
	☐☐
	☐☐
	☐☐

Crayfish Burrows [A]

(Absent, Present, Extensive)

COMMENTS

Physical Habitat Assessment and Water Quality Data Sheet

Site ID: UP 23
Subwatershed: Wilson Owens Br 2
Length of Reach: 75m **Date:** 4/14/16
Team Members: VB / IA **Time:** 1145

Weather
Current: Sunny, 60°
Past 24hrs: Sunny, 60°
Past 48hrs: Sunny, 60° cm rain

Stream Character

P Meandering	A Channelized
A Braided	A Straight
P Riffle	P Run/Glide
A Deep Pool >.5m	P Silt/Clay
P Shallow Pool <.5m	P Sand
P Gravel	A Cobble
A Boulder >2m	A Boulder <2m
A Concrete/Gabion	A Bedrock
P Undercut Bank	A Rootwad
P Overhead Cover	A Storm Drain
A Effluent Discharge	A Human Refuse
A Emergent Vegetation	A Beaver Pond
A Floating Vegetation	

A=Absent P=Present E=Extensive

Bar Formation
☐ None ☐ Moderate
☑ Minor ☐ Extensive

Bank Erosion (see guidance sheet)

	Left Bank	Right Bank	Severity:
Extent (m)	60	60	
Severity	2	2	0=none
Avg. Height	45	45	1=min
			2=mod
Maximum stream depth (cm)	10		3=severe

Benthic Habitat Sampled (20 total)	Sq. ft.
Riffle	10
Rootwad/Woody Debris	5
Leaf Pack	5
Submerged Vegetation	0
Undercut Banks	0
Other:	0

Rootwads/Woody Debris

# Instream Woody Debris	0
# Dewatered Woody Debris	3
# Instream Rootwads	0
# Dewatered Rootwads	4

Stream Gradient

Location (ft)	Height (ft)	Water Depth (ft)

Parameter	Down-stream	Mid-stream	Up-stream
Description			
pH	7	7.15	7.5
Temperature (°C)	11.1	10.7	9.8
DO (mg/l)	14.04	14.49	14.08
Conductivity (uS/cm)	171.2	169.9	166.2
TDS (mg/l)	151.45	152.1	152.1
Turbidity (NTU)	4.06	5.1	10.1

Notes: barometer: 769 mmHg

Photographs/Observations:
M - US DS
D - US DS
V - US DS

Site has significant silt/clay and algae

MBSS Physical Habitat Assessment Sheet

Stream Habitat Assessment Guidance Sheet

Habitat Parameter	Optimal 16-20	Sub-Optimal 11-15	Marginal 6-10	Poor 0-5
1. Instream Habitat[a] SCORE 10	Greater than 50% of a variety of cobble, boulder, submerged logs, undercut banks, snags, rootwads, aquatic plants or other stable habitat	30-50% of stable habitat. Adequate habitat	10-30% mix of stable habitat. Habitat availability less than desireable	Less than 10% stable habitat. Lack of habitat is obvious
2. Epifaunal Substrate[a] SCORE 5	Preferred substrate abundant, stable, and at full colonization potential (riffles well developed and dominated by cobble; and/or woody debris prevalent, not new, and not transient	Abund. of cobble with gravel and/or boulders common; or woody debris, aquatic veg., undercut banks common but not prevalent/suited for full colonization	Large boulders and/or bedrock prevalent; cobble, woody debris, or other preferred surfaces uncommon	Stable substrate lacking; or particles are over 75% surrounded by fine sediment or flocculent material
3. Velocity/Depth Diversity[a] SCORE 6	Slow (<0.3m/s), deep (>0.5m); slow, shallow (<0.5m); fast (>0.3m/s), deep; fast, shallow habitats all present	Only 3 of the 4 habitat categories present	Only 2 of the 4 habitat categories present	Dominated by 1 velocity/depth category (usually pools)
4. Pool/Glide/Eddy Quality[a] SCORE 8	Complex cover/&/or depth >1.5m; both deep (>0.5m)/shallows (<0.2m) present	Deep (>0.5m) areas present; but only moderate cover	Shallows (<0.2m) prevalent in pool/glide/eddy habitat; little cover	Max depth <0.2m in pool/glide/eddy habitat; or absent completely
5. Riffle/Run Quality[a] SCORE 8	Riffle/run depth generally >10cm, with maximum depth greater than 50 cm (maximum score); substrate stable (e.g. cobble, boulder) & variety of current velocities	Riffle/run depth generally 5-10cm, variety of current velocities	Riffle/run depth generally 1-5cm; primarily a single current velocity	Riffle/run depth <1cm; or riffle/run substrates concreted
6. Bank Stability[a] (facing downstream.) Score each bank LB SCORE 4 RB SCORE 4	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected. 10 9	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion. 8 7 6	Moderately unstable; 30-60% of bank in reach as areas of erosion; high erosion potential during floods. 5 4 3	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars. 2 1 0
7. Embeddedness SCORE 80 %	Percentage that gravel, cobble, and boulder particles are surrounded by fine sediment or flocculent material			
8. Shading SCORE 60 %	Percentage of segment that is shaded (duration is considered in scoring). 0% = fully exposed to sunlight all day in summer; 100% = fully and densely shaded all day in summer			
9. Riparian Buffer Zone Width (m)[a] LB 10 RB 45	Zone width in which human activity is not evident. 50m (164ft) is the maximum recorded value.			
10. Remoteness[a] SCORE 15	Roads greater than 400 meters (0.25 mi) from stream	Roads within 400 meters (0.25 mi) of stream; stream NOT accessible by trail.	Roads within 400 meters (0.25 mi) of stream; stream accessible by trail.	Roads adjacent to stream.
11. Aesthetic (trash) Rating[a] SCORE 11	Little or no human refuse visible from stream channel or riparian zone	Refuse present in minor amounts	Refuse present in moderate amounts	Refuse abundant and unsightly
12. Number of Woody Debris and Rootwads[a] SCORE 0	Count only woody debris and rootwads within the wetted portion of the sampling segment. Count only woody debris >10cm (4in) diameter and >1.5m (5ft) long and rootwads with trunk diameter (at chest height) >15cm (6in) that are functional habitat within the wetted portion of the stream.			

adjacent to cart path

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS

STREAM NAME UP023	LOCATION Lothian MD
STATION # _____ REACH ID# _____	STREAM CLASS Perennial
UTM N _____ UTM E _____	RIVER BASIN Patuxent
STORET #	AGENCY CEI
INVESTIGATORS KB/JA	
FORM COMPLETED BY KB	DATE 4/14/16 TIME 1145 PM
REASON FOR SURVEY MBSS	

Parameters to be evaluated in sampling reach

Habitat Parameter	Condition Category			
	Optimal	Suboptimal	Marginal	Poor
1. Epifaunal Substrate/ Available Cover	Greater than 50% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient).	30-50% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale).	10-30% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 10% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
SCORE 8	20 19 18 17 16	15 14 13 12 11	10 9 (8) 7 6	5 4 3 2 1 0
2. Pool Substrate Characterization	Mixture of substrate materials, with gravel and firm sand prevalent; root mats and submerged vegetation common.	Mixture of soft sand, mud, or clay; mud may be dominant; some root mats and submerged vegetation present.	All mud or clay or sand bottom; little or no root mat; no submerged vegetation.	Hard-pan clay or bedrock; no root mat or vegetation.
SCORE 11	20 19 18 17 16	15 14 13 12 (11)	10 9 8 7 6	5 4 3 2 1 0
3. Pool Variability	Even mix of large-shallow, large-deep, small-shallow, small-deep pools present.	Majority of pools large-deep; very few shallow.	Shallow pools much more prevalent than deep pools.	Majority of pools small-shallow or pools absent.
SCORE 5	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	(5) 4 3 2 1 0
4. Sediment Deposition	Little or no enlargement of islands or point bars and less than <20% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 20-50% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 50-80% of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; more than 80% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
SCORE 5	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	(5) 4 3 2 1 0
5. Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills >75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
SCORE 8	20 19 18 17 16	15 14 13 12 11	10 9 (8) 7 6	5 4 3 2 1 0

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS

Parameters to be evaluated broader than sampling reach

Habitat Parameter	Condition Category			
	Optimal	Suboptimal	Marginal	Poor
6. Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr) may be present, but recent channelization is not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.
SCORE 18	20 19 (18) 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
7. Channel Sinuosity	The bends in the stream increase the stream length 3 to 4 times longer than if it was in a straight line. (Note - channel braiding is considered normal in coastal plains and other low-lying areas. This parameter is not easily rated in these areas.)	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	Channel straight; waterway has been channelized for a long distance.
SCORE 11	20 19 18 17 16	15 14 13 12 (11)	10 9 8 7 6	5 4 3 2 1 0
8. Bank Stability (score each bank)	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.
SCORE 5 (LB)	Left Bank 10 9	8 7 6	(5) 4 3	2 1 0
SCORE 5 (RB)	Right Bank 10 9	8 7 6	(5) 4 3	2 1 0
9. Vegetative Protection (score each bank) Note: determine left or right side by facing downstream.	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
SCORE 2 (LB)	Left Bank 10 9	8 7 6	5 4 3	(2) 1 0
SCORE 2 (RB)	Right Bank 10 9	8 7 6	5 4 3	(2) 1 0
10. Riparian Vegetative Zone Width (score each bank riparian zone)	Width of riparian zone >18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone.	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6-12 meters; human activities have impacted zone a great deal.	Width of riparian zone <6 meters: little or no riparian vegetation due to human activities.
SCORE 5 (LB)	Left Bank 10 9	8 7 6	(5) 4 3	2 1 0
SCORE 7 (RB)	Right Bank 10 9	8 (7) 6	5 4 3	2 1 0

Total Score 92

v. 2009

MBSS SPRING HABITAT DATA SHEET

SITE — Watershed Code: MP | Segment: 03 | Type: 3 | Year: 2016

Reviewer: First: KB / Second: JT

DATE — Year: 16 | Month: 04 | Day: 19

50 Dist. from Nearest Road to Site (m)

08 Trash Rating 0 - 20

LANDUSE (Y/N)

N	Old Field	Y	Residential
N	Deciduous Forest	N	Commercial/Industrial
N	Coniferous Forest	N	Cropland
N	Wetland	N	Pasture
N	Surface Mine	N	Orchard/Vineyard/Nursery
N	Landfill	N	Golf Course

ROAD CULVERT

Present in Segment (Y/N): N

Sampleable? (Y/N):

Width of Culvert (m):

Length of Culvert (m):

STREAM GRADIENT

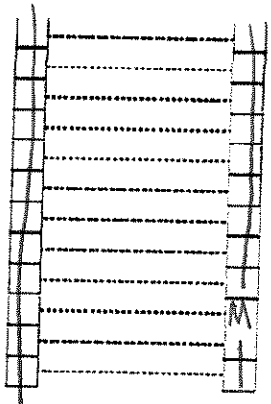
	Location (m)	Height (m)
1		
2		
3		

RIPARIAN VEGETATION
(facing upstream)

	LEFT BANK	RIGHT BANK
Width (50m max)	50	10
Adjacent Land Cover	PK	HD
Vegetation Type	V R M L	V R L
Buffer Breaks (Y/N)	N	Y

Buffer Breaks: LEFT BANK / RIGHT BANK

Storm Drain
Tile Drain
Impervious Drainage
Gully
Orchard
Crop
Pasture
New Construction
Dirt Road
Gravel Road
Raw Sewage
Railroad



Buffer Break Types
(M = minor; S = severe)

CHANNELIZATION

N Evidence of Channel Straightening or Dredging (Y/N)

TYPE	EXTENT (m) LEFT BANK	BOTTOM	RIGHT BANK
Concrete			
Gabion			
Rip-Rap			
Earthen Berm		N/A	
Dredge Spoil Off Channel		N/A	
Pipe Culvert			

Actual Coordinates
(If >30m distance between original coordinates and stream)

Lat
Lon

Stream Block Ht. (m)

Stream Block Type

Lat
Lon

v. 2009

MBSS SPRING INDEX PERIOD DATA SHEET

SITE (Watershed Code: MP | Segment: 03 | Type: 3 | Year: 2016) Reviewer: (First: KB / Second: JT)

DATE (Year: 16 | Month: 04 | Day:) CREW: KB/JT

STREAM: Rock Branch

TIME: 1045 (Military) LOCALITY: Friendship, MD

SAMPLEABILITY

- [ ] Benthos
- [ ] Habitat Assessment
- [ ] Water Quality
- [ ] Vernal Pool [A] (ASSESSMENT)

OTHER (SPECIFY)

SITE ACCESS ROUTE

Sands Rd to gravel access rd
short terrain to stream

SAMPLE LABELS

Verified by: KB

QC LABEL

Watershed Code: MP | Segment: 03 (Letters only) | Type: 3 | Year: 2016

Dup. (D) or Blank (B): [ ] Verified by: _____

TEMP. LOGGER

	(Y/N)	(TIME - Military)	#
WATER			#
AIR			#

LOCATION _____

PHOTODOCUMENTATION

Number	Title	Voucher (Y/N)
	M-US/DS	
	D-US/DS	
	U-US/DS	

BENTHIC HABITAT SAMPLED

14	Riffle	02	Leaf Pack	00	Undercut Banks
04	Rootwad/Woody Debris	00	Macrophytes		Other _____

SAMPLING CONSID.: ([ ] NUM. ANODES)

STREAM WIDTH (m): 0 m | 75 m

v. 2009

MBSS SPRING FAUNA DATA SHEET

SITE Watershed Code: MA | Segment: 03 | Type: 3 | Year: 2016 | Reviewer: First KB / Second JT

HERPETOFAUNA

☑ None Observed

Species	Lifestage (Adult, Juv., Larval, Egg)	SEEN (Y/N)	HEARD (Y/N)	NUMBER RETAINED	NUMBER PHOTOS TAKEN

MUSSELS

☑ None Observed

Species	LIVE	DEAD	NUMBER RETAINED	NUMBER PHOTOS TAKEN

Corbicula: LIVE ☐ DEAD ☐ NONE ☐

CRAYFISHES

☑ None Observed

Species	NUMBER RETAINED

Crayfish Burrows: 4
(Absent, Present, Extensive)

COMMENTS

Physical Habitat Assessment and Water Quality Data Sheet

Site ID: MP03
Subwatershed: Rock Branch 1
Length of Reach: 75m **Date:** 4/19/16
Team Members: KR/AT **Time:** 10:45 AM

Weather
Current: Sunny, 75°F
Past 24hrs: Sunny, 80°F
Past 48hrs: Sunny, 70°F

Stream Character

P Meandering	A Channelized
A Braided	A Straight
P Riffle	P Run/Glide
P Deep Pool >.5m	P Silt/Clay
P Shallow Pool <.5m	P Sand
P Gravel	P Cobble
A Boulder >2m	A Boulder <2m
A Concrete/Gabion	A Bedrock
A Undercut Bank	P Rootwad
P Overhead Cover	A Storm Drain
A Effluent Discharge	A Human Refuse
P Emergent Vegetation	A Beaver Pond
A Floating Vegetation	

A=Absent P=Present E=Extensive

Bar Formation
☐ None ☑ Moderate
☐ Minor ☐ Extensive

Bank Erosion (see guidance sheet)

	Left Bank	Right Bank
Extent (m)	30	30
Severity	2	2
Avg. Height	60	100

Severity: 0=none 1=min 2=mod 3=severe

Maximum stream depth (cm) 45

Benthic Habitat Sampled (20 total)

	Sq. ft.
Riffle	14
Rootwad/Woody Debris	4
Leaf Pack	2
Submerged Vegetation	
Undercut Banks	
Other:	

Rootwads/Woody Debris

# Instream Woody Debris	1
# Dewatered Woody Debris	3
# Instream Rootwads	1
# Dewatered Rootwads	3

Stream Gradient

Location (ft)	Height (ft)	Water Depth (ft)

Parameter	Down-stream	Mid-stream	Up-stream
Description			
pH	7.22	7.87	7.3
Temperature (°C)	13.8	13.69	13.7
DO (mg/l)	12.13	12.67	11.98
Conductivity (uS/cm)	149.2	148.1	148.2
TDS (mg/l)	123.5	122.85	122.85
Turbidity (NTU)	13.2	4.95	5.24

Notes:

Photographs/Observations:
11-US/DS
12-US/DS
13-US/DS
Lots of construction refuse in and around channel. Old sewer pipe from previous driveway.

MBSS Physical Habitat Assessment Sheet

Stream Habitat Assessment Guidance Sheet

Habitat Parameter	Optimal 16-20	Sub-Optimal 11-15	Marginal 6-10	Poor 0-5
1. Instream Habitat[a] SCORE 13	Greater than 50% of a variety of cobble, boulder, submerged logs, undercut banks, snags, rootwads, aquatic plants or other stable habitat	30-50% of stable habitat. Adequate habitat	10-30% mix of stable habitat. Habitat availability less than desireable	Less than 10% stable habitat. Lack of habitat is obvious
2. Epifaunal Substrate[b] SCORE 13	Preferred substrate abundant, stable, and at full colonization potential (riffles well developed and dominated by cobble; and/or woody debris prevalent, not new, and not transient	Abund. of cobble with gravel and/or boulders common; or woody debris, aquatic veg., undercut banks common but not prevalent/suited for full colonization	Large boulders and/or bedrock prevalent; cobble, woody debris, or other preferred surfaces uncommon	Stable substrate lacking; or particles are over 75% surrounded by fine sediment or flocculent material
3. Velocity/Depth Diversity[c] SCORE 16	Slow (<0.3m/s), deep (>0.5m); slow, shallow (<0.5m); fast (>0.3m/s), deep; fast, shallow habitats all present	Only 3 of the 4 habitat categories present	Only 2 of the 4 habitat categories present	Dominated by 1 velocity/depth category (usually pools)
4. Pool/Glide/Eddy Quality[d] SCORE 15	Complex cover/& /or depth >1.5m; both deep (>0.5m)/shallows (<0.2m) present	Deep (>0.5m) areas present; but only moderate cover	Shallows (<0.2m) prevalent in pool/glide/eddy habitat; little cover	Max depth <0.2m in pool/glide/eddy habitat or absent completely
5. Riffle/Run Quality[e] SCORE 11	Riffle/run depth generally >10cm, with maximum depth greater than 50 cm (maximum score); substrate stable (e.g. cobble, boulder) & variety of current velocities	Riffle/run depth generally 5-10cm, variety of current velocities	Riffle/run depth generally 1-5cm; primarily a single current velocity	Riffle/run depth <1cm; or riffle/run substrates concreted
6. Bank Stability[d] (facing downstream.) Score each bank LB SCORE 5 RB SCORE 5	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected. 10 9	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion. 8 7 6	Moderately unstable; 30-60% of bank in reach as areas of erosion; high erosion potential during floods. 5 4 3	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars. 2 1 0
7. Embeddedness SCORE 45 %	Percentage that gravel, cobble, and boulder particles are surrounded by fine sediment or flocculent material			
8. Shading SCORE 50 %	Percentage of segment that is shaded (duration is considered in scoring). 0% = fully exposed to sunlight all day in summer, 100% = fully and densely shaded all day in summer			
9. Riparian Buffer Zone Width (m)[e] LB 50 RB 10	Zone width in which human activity is not evident. 50m (164ft) is the maximum recorded value.			
10. Remoteness[f] SCORE 5	Roads greater than 400 meters (0.25 mi) from stream	Roads within 400 meters (0.25 mi) of stream; stream NOT accessible by trail.	Roads within 400 meters (0.25 mi) of stream; stream accessible by trail.	Roads adjacent to stream.
11. Aesthetic (trash) Rating[g] SCORE 10	Little or no human refuse visible from stream channel or riparian zone	Refuse present in minor amounts	Refuse present in moderate amounts	Refuse abundant and unsightly
12. Number of Woody Debris and Rootwads[h] SCORE 2	Count only woody debris and rootwads within the wetted portion of the sampling segment. Count only woody debris >10cm (4in) diameter and >1.5m (5ft) long and rootwads with trunk diameter (at chest height) >15cm (6in) that are functional habitat within the wetted portion of the stream.			

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS

STREAM NAME MP03	LOCATION Friendship, MD
STATION # _____ REACH ID# _____	STREAM CLASS Perennial
UTM N _____ UTM E	RIVER BASIN Patuxent
STORET #	AGENCY CFI
INVESTIGATORS KB/JT	
FORM COMPLETED BY KB	DATE 4/19/16 TIME - 1045 PM
REASON FOR SURVEY MBSS	

Parameters to be evaluated in sampling reach

Habitat Parameter	Condition Category			
	Optimal	Suboptimal	Marginal	Poor
1. Epifaunal Substrate/ Available Cover SCORE 15	Greater than 50% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient). 20 19 18 17 16	30-50% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale). 15 14 13 12 11	10-30% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed. 10 9 8 7 6	Less than 10% stable habitat; lack of habitat is obvious; substrate unstable or lacking. 5 4 3 2 1 0
2. Pool Substrate Characterization SCORE 16	Mixture of substrate materials, with gravel and firm sand prevalent; root mats and submerged vegetation common. 20 19 18 17 16	Mixture of soft sand, mud, or clay; mud may be dominant; some root mats and submerged vegetation present. 15 14 13 12 11	All mud or clay or sand bottom; little or no root mat; no submerged vegetation. 10 9 8 7 6	Hard-pan clay or bedrock; no root mat or vegetation. 5 4 3 2 1 0
3. Pool Variability SCORE 16	Even mix of large-shallow, large-deep, small-shallow, small-deep pools present. 20 19 18 17 16	Majority of pools large-deep; very few shallow. 15 14 13 12 11	Shallow pools much more prevalent than deep pools. 10 9 8 7 6	Majority of pools small-shallow or pools absent. 5 4 3 2 1 0
4. Sediment Deposition SCORE 15	Little or no enlargement of islands or point bars and less than <20% of the bottom affected by sediment deposition. 20 19 18 17 16	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 20-50% of the bottom affected; slight deposition in pools. 15 14 13 12 11	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 50-80% of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent. 10 9 8 7 6	Heavy deposits of fine material, increased bar development; more than 80% of the bottom changing frequently; pools almost absent due to substantial sediment deposition. 5 4 3 2 1 0
5. Channel Flow Status SCORE 14	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed. 20 19 18 17 16	Water fills >75% of the available channel; or <25% of channel substrate is exposed. 15 14 13 12 11	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed. 10 9 8 7 6	Very little water in channel and mostly present as standing pools. 5 4 3 2 1 0

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS

Parameters to be evaluated broader than sampling reach

Habitat Parameter	Condition Category			
	Optimal	Suboptimal	Marginal	Poor
6. Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr) may be present, but recent channelization is not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.
SCORE 17	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
7. Channel Sinuosity	The bends in the stream increase the stream length 3 to 4 times longer than if it was in a straight line. (Note - channel braiding is considered normal in coastal plains and other low-lying areas. This parameter is not easily rated in these areas.)	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	Channel straight; waterway has been channelized for a long distance.
SCORE 11	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
8. Bank Stability (score each bank)	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.
SCORE 5 (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE 5 (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0
9. Vegetative Protection (score each bank) Note: determine left or right side by facing downstream.	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
SCORE 4 (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE 4 (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0
10. Riparian Vegetative Zone Width (score each bank riparian zone)	Width of riparian zone >18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone.	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6-12 meters; human activities have impacted zone a great deal.	Width of riparian zone <6 meters: little or no riparian vegetation due to human activities.
SCORE 9 (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE 5 (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0

Total Score 136

v. 2009

MBSS SPRING HABITAT DATA SHEET

Page 1 of 7

SITE — Watershed Code: MP | Segment: 0311 | Type: 3 | Year: 2016

Reviewer: First: KB / Second: CR

DATE — Year: 16 | Month: 04 | Day: 04

200 Dist. from Nearest Road to Site (m)

17 Trash Rating 0 - 20

LANDUSE (Y/N)

Y	Old Field	Y	Residential
Y	Deciduous Forest	N	Commercial/Industrial
N	Coniferous Forest	Y	Cropland
Y	Wetland	N	Pasture
N	Surface Mine	N	Orchard/Vineyard/Nursery
N	Landfill	N	Golf Course

RIPARIAN VEGETATION
(facing upstream)

	LEFT BANK	RIGHT BANK
Width (50m max)	30	50
Adjacent Land Cover	OF	LN
Vegetation Type	MYR6	MYR6
Buffer Breaks (Y/N)	N	N

ROAD CULVERT

Present in Segment (Y/N): N

Sampleable? (Y/N): N

Width of Culvert (m): N/A

Length of Culvert (m): N/A

STREAM GRADIENT

	Location (m)	Height (m)
1		
2		
3		

LEFT BANK / RIGHT BANK

	LEFT BANK	RIGHT BANK
Storm Drain	N	N
Tile Drain	N	N
Impervious Drainage	N	N
Gully	N	N
Orchard	N	N
Crop	N	N
Pasture	N	N
New Construction	N	N
Dirt Road	N	N
Gravel Road	N	N
Raw Sewage	N	N
Railroad	N	N

Buffer Break Types
(M = minor; S = severe)

CHANNELIZATION

N Evidence of Channel Straightening or Dredging (Y/N)

TYPE	EXTENT (m) N/A		
	LEFT BANK	BOTTOM	RIGHT BANK
Concrete			
Gabion			
Rip-Rap			
Earthen Berm		N/A	
Dredge Spoil Off Channel		N/A	
Pipe Culvert			

Actual Coordinates
(If >30m distance between original coordinates and stream)

Lat

Lon

Stream Block Ht. (m)

Stream Block Type

Lat

Lon

v. 2009

MBSS SPRING INDEX PERIOD DATA SHEET

Page 2 Of 7

SITE: Watershed Code MP | Segment 031 | Type 3 | Year 2016

Reviewer: First KB / Second CR

DATE: Year 16 | Month 04 | Day 04

CREW: KAREN BOWMAN / CARISSA REH

STREAM: MP31 - CABIN BRANCH

TIME: 1010 (Military)

LOCALITY: , AA Co., MD.

SAMPLEABILITY

- Y Benthos
- Y Habitat Assessment
- Y Water Quality
- N Vernal Pool N/A (PRESENT/ABSENT)

OTHER (SPECIFY)

SITE ACCESS ROUTE

PARK @ 4850 CONTE DR - WALK APPRX 200 M NORTHWEST

SAMPLE LABELS

Verified by: CR

QC LABEL

Watershed Code MP | Segment 031 (Letters only) | Type 3 | Year 2016

Dup. (D) or Blank (B): ☐ Verified by: _____

TEMP. LOGGER N/A

	(Y/N)	(TIME - Military)	#
WATER			#
AIR			#

LOCATION _____

PHOTODOCUMENTATION

Number	Title	Voucher (Y/N)
	MP - US, DS	
	US - US, DS, RB	
	DS - US, DS, LB	

BENTHIC HABITAT SAMPLED

- 01 Riffle
- 13 Rootwad/Woody Debris
- 06 Leaf Pack
- 00 Macrophytes
- 00 Undercut Banks
- 00 Other _____

SAMPLING CONSID.: (2 NUM. ANODES)

STREAM WIDTH (m): 0 m: 23 | 75 m: 22

v. 2009

MBSS SPRING FAUNA DATA SHEET

SITE Watershed Code [ ][ ][M][P] Segment [ ][3][1] Type [3] Year [2][0][1][6]

Reviewer: First KB / Second CR

HERPETOFAUNA

☐ None Observed

Species	Lifestage (Adult / Juv. / Larval / Egg)	SEEN (Y/N)	HEARD (Y/N)	NUMBER RETAINED	NUMBER PHOTOS TAKEN
1 FROG SPP. DOWNSTREAM	☒ ☐ ☐ ☐	☒	☒	0	0
	☐ ☐ ☐ ☐	☐	☐	☐	☐
	☐ ☐ ☐ ☐	☐	☐	☐	☐
	☐ ☐ ☐ ☐	☐	☐	☐	☐
	☐ ☐ ☐ ☐	☐	☐	☐	☐
	☐ ☐ ☐ ☐	☐	☐	☐	☐
	☐ ☐ ☐ ☐	☐	☐	☐	☐

MUSSELS

☒ None Observed

Species	LIVE	DEAD	NUMBER RETAINED	NUMBER PHOTOS TAKEN
0	☐	☐	☐☐	☐
	☐	☐	☐☐	☐
	☐	☐	☐☐	☐
	☐	☐	☐☐	☐
	☐	☐	☐☐	☐

Corbicula LIVE ☐ DEAD ☐ NONE ☒

CRAYFISHES

☑ None Observed

Species	NUMBER RETAINED
~~NONE OBSERVED~~	☐☐
	☐☐
	☐☐
	☐☐
	☐☐

Crayfish Burrows [A]
(Absent, Present, Extensive)

COMMENTS

Physical Habitat Assessment and Water Quality Data Sheet

Site ID: MP31
Subwatershed: ~~HH~~ CABIN BRANCH 4
Length of Reach: 75m Date: 4/4/16
Team Members: KB/CR Time: 10:10

Stream Character

- [P] Meandering
- [A] Braided
- [P] Riffle
- [A] Deep Pool >.5m
- [P] Shallow Pool <.5m
- [P] Gravel
- [A] Boulder >2m
- [A] Concrete/Gabion
- [P] Undercut Bank
- [E] Overhead Cover
- [A] Effluent Discharge
- [P] Emergent Vegetation
- [A] Floating Vegetation
- [A] Channelized
- [E] Straight
- [E] Run/Glide
- [E] Silt/Clay
- [E] Sand
- [A] Cobble
- [A] Boulder <2m
- [A] Bedrock
- [P] Rootwad
- [A] Storm Drain
- [A] Human Refuse
- [A] Beaver Pond

A=Absent P=Present E=Extensive

Bar Formation

- [ ] None
- [ ] Minor
- [ ] Moderate
- [X] Extensive

Bank Erosion (see guidance sheet)

	Left Bank	Right Bank
Extent (m)	75	75
Severity	3	3
Avg. Height	1.2	1.0

Severity: 0=none 1=min 2=mod 3=severe

Maximum stream depth (cm) 45

Benthic Habitat Sampled (20 total)	Sq. ft.
Riffle	1
Rootwad/Woody Debris	13
Leaf Pack	6
Submerged Vegetation	0
Undercut Banks	0
Other: N/A	0

Rootwads/Woody Debris

# Instream Woody Debris	11
# Dewatered Woody Debris	~~X~~ 13
# Instream Rootwads	8
# Dewatered Rootwads	1

Stream Gradient

Location (ft)	Height (ft)	Water Depth (ft)

Weather

Current: CLOUDY 60°F
Past 24hrs: WINDY/OVERCAST 40°F
Past 48hrs: RAIN/OVERCAST 60°F

Parameter	Down-stream	Mid-stream	Up-stream
Description	—	—	—
pH	6.71	6.90	6.88
Temperature (°C)	11.1	11.1	11.8
DO (mg/l)	11.24	11.69	11.42
Conductivity (uS/cm)	134.7	113.5	138.7
TDS (mg/l)	118.95	100.75	120.25
Turbidity (NTU)	9.99	9.75	9.77

Notes: BARO (mmHg) 756.5 | 756.4 | 756.1

Photographs/Observations:

- MATURE DECIDUOUS FOREST BUFFER (HEALTY)
- LEFT BANK BUFFER NOT 50 m BC OF ADJACENT FARM FIELD.
- SAND/MUD/SILT SUBSTRATE
- ~~MINIMAL~~ SUB-PAR HABITAT
- SEVERE EROSION (BANK)
- SHEER EXPOSED BANKS (1.2 m)
- LARGE QUANTITIES OF DOWNED WOODY DEBRIS W/IN THE CHANNEL.
- MINIMAL HUMAN DISTURBANCE W/IN THE BUFFER
- OLD FARM; REMNANT POSTS & BARBED WIRE NEAR BANKS.

MBSS Physical Habitat Assessment Sheet

Stream Habitat Assessment Guidance Sheet				
Habitat Parameter	Optimal 16-20	Sub-Optimal 11-15	Marginal 6-10	Poor 0-5
1. Instream Habitat[1] SCORE 6	Greater than 50% of a variety of cobble, boulder, submerged logs, undercut banks, snags, rootwads, aquatic plants or other stable habitat	30-50% of stable habitat. Adequate habitat	10-30% mix of stable habitat. Habitat availability less than desireable	Less than 10% stable habitat. Lack of habitat is obvious
2. Epifaunal Substrate[2] SCORE 5	Preferred substrate abundant, stable, and at full colonization potential (riffles well developed and dominated by cobble; and/or woody debris prevalent, not new; and not transient	Abund. of cobble with gravel and/or boulders common; or woody debris, aquatic veg., undercut banks common but not prevalent/suited for full colonization	Large boulders and/or bedrock prevalent; cobble, woody debris, or other preferred surfaces uncommon	Stable substrate lacking; or particles are over 75% surrounded by fine sediment or flocculent material
3. Velocity/Depth Diversity[3] SCORE 5	Slow (<0.3m/s), deep (>0.5m); slow, shallow (<0.5m); fast (>0.3m/s), deep; fast, shallow habitats all present	Only 3 of the 4 habitat categories present	Only 2 of the 4 habitat categories present	Dominated by 1 velocity/depth category (usually pools)
4. Pool/Glide/Eddy Quality[4] SCORE 4	Complex cover/E/or depth >1.5m; both deep (>0.5m)/shallows (<0.2m) present	Deep (>0.5m) areas present; but only moderate cover	Shallows (<0.2m) prevalent in pool/glide/eddy habitat; little cover	Max depth <0.2m in pool/glide/eddy habitat; or absent completely
5. Riffle/Run Quality[5] SCORE 6	Riffle/run depth generally >10cm, with maximum depth greater than 50 cm (maximum score); substrate stable (e.g. cobble, boulder) & variety of current velocities	Riffle/run depth generally 5-10cm, variety of current velocities	Riffle/run depth generally 1-5cm; primarily a single current velocity	Riffle/run depth <1cm; or riffle/run substrates concreted
6. Bank Stability[6] (facing downstream.) Score each bank LB SCORE 3 RB SCORE 3	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected. 10 9	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion. 8 7 6	Moderately unstable; 30-60% of bank in reach as areas of erosion; high erosion potential during floods. 5 4 3	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars. 2 1 0
7. Embeddedness SCORE 50 %	Percentage that gravel, cobble, and boulder particles are surrounded by fine sediment or flocculent material			
8. Shading SCORE 75 %	Percentage of segment that is shaded (duration is considered in scoring); 0% = fully exposed to sunlight all day in summer; 100% = fully and densely shaded all day in summer			
9. Riparian Buffer Zone Width (m)[7] LB 30 RB 50	Zone width in which human activity is not evident. 50m (164ft) is the maximum recorded value.			
10. Remoteness[8] SCORE 11	Roads greater than 400 meters (0.25 mi) from stream	Roads within 400 meters (0.25 mi) of stream; stream NOT accessible by trail. ~200m	Roads within 400 meters (0.25 mi) of stream; stream accessible by trail.	Roads adjacent to stream.
11. Aesthetic (trash) Rating[9] SCORE 17	Little or no human refuse visible from stream channel or riparian zone	Refuse present in minor amounts	Refuse present in moderate amounts	Refuse abundant and unsightly
12. Number of Woody Debris and Rootwads[10] SCORE 11	Count only woody debris and rootwads within the wetted portion of the sampling segment. Count only woody debris >10cm (4in) diameter and >1.5m (5ft) long and rootwads with trunk diameter (at chest height) >15cm (6in) that are functional habitat within the wetted portion of the stream.			

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS (FRONT)

STREAM NAME MP31/CABIN BRANCH	LOCATION AA COUNTY
STATION #_____ RIVERMILE_____	STREAM CLASS III
LAT _____ LONG _____	RIVER BASIN PATUXENT RIVER
STORET #	AGENCY CEI
INVESTIGATORS KB/CR	
FORM COMPLETED BY CR	DATE 4/4/16 TIME 1010 (AM) PM
	REASON FOR SURVEY BMI SAMPLING

Parameters to be evaluated in sampling reach

Habitat Parameter	Condition Category: Optimal	Suboptimal	Marginal	Poor
1. Epifaunal Substrate/ Available Cover MOSTLY SAND & SILT, LITTLE GRAVEL	Greater than 50% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient).	30-50% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale).	10-30% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 10% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
SCORE 5	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
2. Pool Substrate Characterization	Mixture of substrate materials, with gravel and firm sand prevalent; root mats and submerged vegetation common.	Mixture of soft sand, mud, or clay; mud may be dominant; some root mats and submerged vegetation present.	All mud or clay or sand bottom; little or no root mat; no submerged vegetation.	Hard-pan clay or bedrock; no root mat or vegetation.
SCORE 6	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
3. Pool Variability	Even mix of large-shallow, large-deep, small-shallow, small-deep pools present.	Majority of pools large-deep; very few shallow.	Shallow pools much more prevalent than deep pools.	Majority of pools small-shallow or pools absent.
SCORE 4	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
4. Sediment Deposition	Little or no enlargement of islands or point bars and less than <20% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 20-50% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 50-80% of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; more than 80% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
SCORE 6	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
5. Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills >75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
SCORE 7	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS

Parameters to be evaluated broader than sampling reach

Habitat Parameter	Condition Category			
	Optimal	Suboptimal	Marginal	Poor
6. Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr) may be present, but recent channelization is not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.
SCORE 18	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
7. Channel Sinuosity NOT CHANNELIZED BUT RELATIVELY STRAIGHT	The bends in the stream increase the stream length 3 to 4 times longer than if it was in a straight line. (Note - channel braiding is considered normal in coastal plains and other low-lying areas. This parameter is not easily rated in these areas.)	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	Channel straight; waterway has been channelized for a long distance.
SCORE 6	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
8. Bank Stability (score each bank)	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.
SCORE 3 (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE 3 (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0
9. Vegetative Protection (score each bank) Note: determine left or right side by facing downstream.	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining. VIA EROSION	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height. VIA EROSION
SCORE 3 (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE 3 (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0
10. Riparian Vegetative Zone Width (score each bank riparian zone)	Width of riparian zone >18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone.	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6-12 meters; human activities have impacted zone a great deal.	Width of riparian zone <6 meters: little or no riparian vegetation due to human activities.
SCORE 9 (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE 9 (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0

Total Score 82

MP31QC

v. 2009

MBSS SPRING HABITAT DATA SHEET

Page 1 of 7

SITE — Watershed Code: MP | Segment: 031 | Type: 3 | Year: 2016

Reviewer: First KB / Second CR

DATE — Year: 16 | Month: 04 | Day: 04

1150 Dist. from Nearest Road to Site (m)

17 Trash Rating 0 - 20

LANDUSE (Y/N)

Y	Old Field	Y	Residential
Y	Deciduous Forest	N	Commercial/Industrial
N	Coniferous Forest	Y	Cropland
N	Wetland	N	Pasture
N	Surface Mine	N	Orchard/Vineyard/Nursery
N	Landfill	N	Golf Course

RIPARIAN VEGETATION
(facing upstream)

	LEFT BANK	RIGHT BANK
Width (50m max)	30	50
Adjacent Land Cover	CP	LN
Vegetation Type	Y/R/M/L	Y/R/M/L
Buffer Breaks (Y/N)	Y	N

ROAD CULVERT

Present in Segment (Y/N): N

Sampleable? (Y/N): N — N/A

Width of Culvert (m): N/A

Length of Culvert (m): N/A

STREAM GRADIENT

	Elevation (m)	Height (m)
1		
2		
3		

Buffer Breaks

	LEFT BANK	RIGHT BANK
Storm Drain	N	N
Tile Drain	N	N
Impervious Drainage	N	N
Gully	N	N
Orchard	N	N
Crop	N	N
Pasture	N	N
New Construction	N	N
Dirt Road RUNS	N	N
Gravel Road	N	N
Raw Sewage	N	N
Railroad	N	N

Buffer Break Types
(M = minor; S = severe)

CHANNELIZATION

N Evidence of Channel Straightening or Dredging (Y/N)

TYPE	EXTENT (m) N/A		
	LEFT BANK	BOTTOM	RIGHT BANK
Concrete			
Gabion			
Rip-Rap			
Earthen Berm		N/A	
Dredge Spoil Off Channel		N/A	
Pipe Culvert			

Actual Coordinates
(If >30m distance between original coordinates and stream)

Lat

Lon

Stream Block Ht. (m)

Stream Block Type

Lat

Lon

MP31 QC

v. 2009

MBSS SPRING INDEX PERIOD DATA SHEET

Page 2 of 7

SITE Watershed Code: MP | Segment: 031 | Type: 3 | Year: 2016

Reviewer: First: KB / Second: CR

DATE Year: 16 Month: 04 Day: 04

CREW: KB|CR

STREAM: MP31 QC SITE - CABIN BRANCH

TIME: 1200 (Military)

LOCALITY: , AA Co., MD

SAMPLEABILITY

- [Y] Benthos
- [Y] Habitat Assessment
- [Y] Water Quality
- [N] Vernal Pool [N/A] (PRESENT/ABSENT)

OTHER (SPECIFY): N/A

SITE ACCESS ROUTE

DARK @ 4850 (ONTO DR, WALK NW (~250m) TO STREAM — WALK APPRX 150m TO REACH DS PORTION OF REACH, ADJACENT TO CROP FIELD ACCESS & DIRT PATH

SAMPLE LABELS

Verified by: CR

QC LABEL

Watershed Code: MP | Segment: 31 (Letters only) | Type: 3 | Year: 2016

Dup. (D) or Blank (B): D Verified by: CR

TEMP. LOGGER N/A

	(Y/N)	(TIME - Military)	#
WATER			#
AIR			#

LOCATION

PHOTODOCUMENTATION

Number	Title	Voucher (Y/N)
	DS - US, DS, BURROWS	
	MP - US, DS,	
	US - US, DS	

BENTHIC HABITAT SAMPLED

- [03] Riffle
- [11] Rootwad/Woody Debris
- [06] Leaf Pack
- [ ] Macrophytes
- [ ] Undercut Banks
- [ ] Other

SAMPLING CONSID.: (2 NUM. ANODES)

STREAM WIDTH (m): 0 m: 16 | 75 m: 10

MP310C

v. 2009

MBSS SPRING FAUNA DATA SHEET

Page 3 of 7

SITE Watershed Code [ ][ ][MP] Segment [ ][3][1] Type [3] Year [2][0][1][0]

Reviewer: First KB / Second CR

HERPETOFAUNA

☐ None Observed

Species	Lifestage (Adult, Juv., Larval, Egg)	SEEN (Y/N)	HEARD (Y/N)	NUMBER RETAINED	NUMBER PHOTOS TAKEN
ONE (1) GREEN FROG	☒	☐	☐	☐	☐
	☐	☐	☐	☐	☐
	☐	☐	☐	☐	☐
	☐	☐	☐	☐	☐
	☐	☐	☐	☐	☐
	☐	☐	☐	☐	☐
	☐	☐	☐	☐	☐

MUSSELS

☒ None Observed

Species	LIVE	DEAD	NUMBER RETAINED	NUMBER PHOTOS TAKEN
	☐	☐	☐☐	☐
	☐	☐	☐☐	☐
	☐	☐	☐☐	☐
	☐	☐	☐☐	☐
	☐	☐	☐☐	☐

Corbicula LIVE ☐ DEAD ☐ NONE ☒

CRAYFISHES

☑ None Observed

Species	NUMBER RETAINED
~~MANY JUVENILES RETAINED~~	☐☐
	☐☐
	☐☐
	☐☐
	☐☐

Crayfish Burrows [P] (Absent, Present, Extensive) ~ PICTURE TAKEN @ DS POINT

COMMENTS

Physical Habitat Assessment and Water Quality Data Sheet

Site ID: MP31 - QC
Subwatershed: CABIN BRANCH #4
Length of Reach: 75 m **Date:** 4/4/16
Team Members: KB/CR **Time:** 12:00 PM

Stream Character

- [P] Meandering
- [A] Braided
- [P] Riffle
- [A] Deep Pool >.5m
- [P] Shallow Pool <.5m
- [P] Gravel
- [A] Boulder >2m
- [A] Concrete/Gabion
- [P] Undercut Bank
- [E] Overhead Cover
- [A] Effluent Discharge
- [P] Emergent Vegetation
- [A] Floating Vegetation
- [A] Channelized
- [P] Straight
- [P] Run/Glide
- [P] Silt/Clay
- [E] Sand
- [P] Cobble
- [A] Boulder <2m
- [A] Bedrock
- [P] Rootwad
- [A] Storm Drain
- [P] Human Refuse
- [A] Beaver Pond

A=Absent *P=Present* *E=Extensive*

Bar Formation

- [ ] None
- [ ] Minor
- [ ] Moderate
- [x] Extensive

Bank Erosion (see guidance sheet)

	Left Bank	Right Bank
Extent (m)	60	70
Severity	3	3
Avg. Height	2.0	1.3

Severity: 0=none 1=min 2=mod 3=severe

Maximum stream depth (cm) 45

Benthic Habitat Sampled (20 total)	Sq. ft.
Riffle	3
Rootwad/Woody Debris	11
Leaf Pack	6
Submerged Vegetation	0
Undercut Banks	0
Other: N/A	0

Rootwads/Woody Debris

# Instream Woody Debris	5
# Dewatered Woody Debris	3
# Instream Rootwads	1
# Dewatered Rootwads	1

Stream Gradient

Location (ft)	Height (ft)	Water Depth (ft)

Weather
Current: CLOUDY 60° F
Past 24hrs: WINDY/OVERCAST 40° F
Past 48hrs: RAIN/OVERCAST 60° F

Parameter	Down-stream	Mid-stream	Up-stream
Description	—	—	—
pH	6.95	6.87	6.85
Temperature (°C)	14.7	14.8	15.2
DO (mg/l)	11.16	10.8	10.36
Conductivity (uS/cm)	137.3	117.6	136.1
TDS (mg/l)	111.15	93.6	109.55
Turbidity (NTU)	9.04	8.92	9.12
Notes: BARO	755.0	754.8	754.6

Photographs/Observations:

- IMMEDIATE RIPARIAN BUFFER CONSISTS OF HEALTHY MID-SUCCESSIONAL DECIDUOUS FOREST
- CROPLAND ADJACENT TO FOREST ON L. BANK
- DIRT PATH RUNS PARALLEL TO LEFT BANK OF STREAM
- LARGE QUANTITY OF DOWNED WOODY DEBRIS
- SUB-OPTIMAL HABITAT
- BANKS RANGING FROM 1.3-3.1m
- SOME SHEER & EXPOSED BANKS
- INCISION IS APPARENT
- MOSTLY SAND SUBSTRATE W/ MILD SILT FRINGE

MP31 QC
5 OF 7

MBSS Physical Habitat Assessment Sheet

Stream Habitat Assessment Guidance Sheet

Habitat Parameter	Optimal 16-20	Sub-Optimal 11-15	Marginal 6-10	Poor 0-5
1. Instream Habitat* SCORE 16	Greater than 50% of a variety of cobble, boulder, submerged logs, undercut banks, snags, rootwads, aquatic plants or other stable habitat	30-50% of stable habitat. Adequate habitat	10-30% mix of stable habitat. Habitat availability less than desireable	Less than 10% stable habitat. Lack of habitat is obvious
2. Epifaunal Substrate* SCORE 5	Preferred substrate abundant, stable, and at full colonization potential (riffles well developed and dominated by cobble; and/or woody debris prevalent, not new; and not transient	Abund. of cobble with gravel and/or boulders common; or woody debris, aquatic veg., undercut banks common but not prevalent/suited for full colonization	Large boulders and/or bedrock prevalent; cobble, woody debris, or other preferred surfaces uncommon	Stable substrate lacking; or particles are over 75% surrounded by fine sediment or flocculent material
3. Velocity/Depth Diversity* SCORE 5	Slow (<0.3m/s), deep (>0.5m); slow, shallow (<0.5m); fast (>0.3m/s), deep; fast, shallow habitats all present	Only 3 of the 4 habitat categories present	Only 2 of the 4 habitat categories present	Dominated by 1 velocity/depth category (usually pools)
4. Pool/Glide/Eddy Quality* SCORE 4	Complex cover/&/or depth >1.5m; both deep (>0.5m)/shallows (<0.2m) present	Deep (>0.5m) areas present; but only moderate cover	Shallows (<0.2m) prevalent in pool/glide/eddy habitat; little cover	Max depth <0.2m in pool/glide/eddy habitat; or absent completely
5. Riffle/Run Quality* SCORE 6	Riffle/run depth generally >10cm, with maximum depth greater than 50 cm (maximum score); substrate stable (e.g. cobble, boulder) & variety of current velocities	Riffle/run depth generally 5-10cm, variety of current velocities	Riffle/run depth generally 1-5cm; primarily a single current velocity	Riffle/run depth <1cm; or riffle/run substrates concreted
6. Bank Stability* (facing downstream.) Score each bank LB SCORE 4 RB SCORE 2	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected. 10 9	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion. 8 7 6	Moderately unstable; 30-60% of bank in reach as areas of erosion; high erosion potential during floods. 5 4 3	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars. 2 1 0
7. Embeddedness SCORE 50 %	Percentage that gravel, cobble, and boulder particles are surrounded by fine sediment or flocculent material			
8. Shading SCORE 75 %	Percentage of segment that is shaded (duration is considered in scoring). 0% = fully exposed to sunlight all day in summer; 100% = fully and densely shaded all day in summer			
9. Riparian Buffer Zone Width (m)* LB 8 RB 50	Zone width in which human activity is not evident. 50m (164ft) is the maximum recorded value.			
10. Remoteness* SCORE 16	Roads greater than 400 meters (0.25 mi) from stream	Roads within 400 meters (0.25 mi) of stream; stream NOT accessible by trail.	Roads within 400 meters (0.25 mi) of stream; stream accessible by trail.	Roads adjacent to stream.
11. Aesthetic (trash) Rating* SCORE 17	Little or no human refuse visible from stream channel or riparian zone	Refuse present in minor amounts	Refuse present in moderate amounts	Refuse abundant and unsightly
12. Number of Woody Debris and Rootwads* SCORE 6	Count only woody debris and rootwads within the wetted portion of the sampling segment. Count only woody debris >10cm (4in) diameter and >1.5m (5ft) long and rootwads with trunk diameter (at chest height) >15cm (6in) that are functional habitat within the wetted portion of the stream.			

NISOM FROM RESIDENTIAL AREA – DIRT PATH PARALLEL TO LEFT BANK.

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS

QC

STREAM NAME MP31 / CABIN BRANCH	LOCATION AA County
STATION # _____ REACH ID# _____	STREAM CLASS III
UTM N _____ UTM E	RIVER BASIN PATUXENT RIVER
STORET #	AGENCY CEI
INVESTIGATORS KB/CR	
FORM COMPLETED BY CR	DATE 4/4/16 TIME ~12:00 AM PM
REASON FOR SURVEY BMI SAMPLING QC	

Parameters to be evaluated in sampling reach

Habitat Parameter	Condition Category			
	Optimal	Suboptimal	Marginal	Poor
1. Epifaunal Substrate/ Available Cover MOSTLY SAND & SILT – LITTLE COBBLE/GRAVEL SCORE 5	Greater than 50% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient). 20 19 18 17 16	30-50% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale). 15 14 13 12 11	10-30% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed. 10 9 8 7 6	Less than 10% stable habitat; lack of habitat is obvious; substrate unstable or lacking. 5 4 3 2 1 0
2. Pool Substrate Characterization SCORE 6	Mixture of substrate materials, with gravel and firm sand prevalent; root mats and submerged vegetation common. 20 19 18 17 16	Mixture of soft sand, mud, or clay; mud may be dominant; some root mats and submerged vegetation present. 15 14 13 12 11	All mud or clay or sand bottom; little or no root mat; no submerged vegetation. 10 9 8 7 6	Hard-pan clay or bedrock; no root mat or vegetation. 5 4 3 2 1 0
3. Pool Variability SCORE 3	Even mix of large-shallow, large-deep, small-shallow, small-deep pools present. 20 19 18 17 16	Majority of pools large-deep; very few shallow. 15 14 13 12 11	Shallow pools much more prevalent than deep pools. 10 9 8 7 6	Majority of pools small-shallow or pools absent. 5 4 3 2 1 0
4. Sediment Deposition SCORE 6	Little or no enlargement of islands or point bars and less than <20% of the bottom affected by sediment deposition. 20 19 18 17 16	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 20-50% of the bottom affected; slight deposition in pools. 15 14 13 12 11	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 50-80% of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent. 10 9 8 7 6	Heavy deposits of fine material, increased bar development; more than 80% of the bottom changing frequently; pools almost absent due to substantial sediment deposition. 5 4 3 2 1 0
5. Channel Flow Status SCORE 7	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed. 20 19 18 17 16	Water fills >75% of the available channel; or <25% of channel substrate is exposed. 15 14 13 12 11	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed. 10 9 8 7 6	Very little water in channel and mostly present as standing pools. 5 4 3 2 1 0

MP31 - QC

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS

Parameters to be evaluated broader than sampling reach

Habitat Parameter	Condition Category			
	Optimal	Suboptimal	Marginal	Poor
6. Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr) may be present, but recent channelization is not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.
SCORE 18	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
7. Channel Sinuosity NOT CHANNELIZED BUT RELATIVELY STRAIGHT	The bends in the stream increase the stream length 3 to 4 times longer than if it was in a straight line. (Note - channel braiding is considered normal in coastal plains and other low-lying areas. This parameter is not easily rated in these areas.)	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	Channel straight; waterway has been channelized for a long distance.
SCORE 7	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
8. Bank Stability (score each bank)	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.
SCORE 5 (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE 3 (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0
9. Vegetative Protection (score each bank) Note: determine left or right side by facing downstream.	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
SCORE 4 (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE 3 (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0
10. Riparian Vegetative Zone Width (score each bank riparian zone)	Width of riparian zone >18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone.	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6-12 meters; human activities have impacted zone a great deal.	Width of riparian zone <6 meters: little or no riparian vegetation due to human activities.
SCORE 3 (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE 9 (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0

Total Score 79

Form # EL2 - _____

v. 2009

MBSS SPRING HABITAT DATA SHEET

Page 1 of 71

SITE — Watershed Code: MA | Segment: 04 | Type: | Year: 2016

Reviewer: First JT / Second JS

DATE — Year: 16 | Month: 04 | Day: 04

400 Dist. from Nearest Road to Site (m)

14 Trash Rating 0 - 20

LANDUSE (Y/N)

N	Old Field	N	Residential
Y	Deciduous Forest	N	Commercial/Industrial
Y	Coniferous Forest	N	Cropland
Y	Wetland	N	Pasture
N	Surface Mine	N	Orchard/Vineyard/Nursery
N	Landfill	Y	Golf Course

RIPARIAN VEGETATION
(facing upstream)

	LEFT BANK	RIGHT BANK
Width (50m max)	50	30
Adjacent Land Cover	FR	FR
Vegetation Type	Y M B C	Y M B C
Buffer Breaks (Y/N)	N	N

ROAD CULVERT

Present in Segment (Y/N):

Sampleable? (Y/N):

Width of Culvert (m):

Length of Culvert (m):

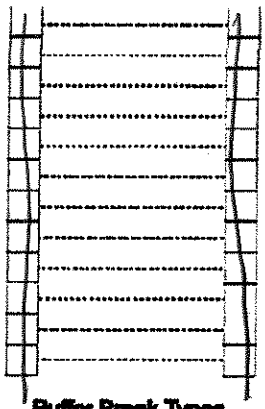
STREAM GRADIENT

	Location (m)	Height (m)
1		
2		
3		

Buffer Breaks

LEFT BANK / RIGHT BANK

Storm Drain
Tile Drain
Impervious Drainage
Gully
Orchard
Crop
Pasture
New Construction
Dirt Road
Gravel Road
Raw Sewage
Railroad



Buffer Break Types
(M = minor; S = severe)

CHANNELIZATION

N Evidence of Channel Straightening or Dredging (Y/N)

TYPE	EXTENT (m) LEFT BANK	BOTTOM	RIGHT BANK
Concrete			
Gebion			
Rip-Rap			
Earthen Berm		N/A	
Dredge Spoil Off Channel		N/A	
Pipe Culvert			

Actual Coordinates
(If >30m distance between original coordinates and stream)

Lat
Lon

Stream Block Ht. (m)

Stream Block Type

Lat
Lon

v. 2009

MBSS SPRING INDEX PERIOD DATA SHEET

SITE (Watershed Code) MP (Segment) 04 (Type) 1 (Year) 2016

Reviewer: (First) JT / (Second) JS

DATE (Year) 16 (Month) 04 (Day) 04

CREW: JS + JT

STREAM: MP04

TIME 1200 (Military)

LOCALITY: Lothian, AA Co

SAMPLEABILITY

- [X] Benthos
- [Y] Habitat Assessment
- [Y] Water Quality
- [N] Vernal Pool [A] (PRESENT/ABSENT)

OTHER (SPECIFY)

SITE ACCESS ROUTE

Access via golf course from Polling House Rd

SAMPLE LABELS

Verified by: JS

QC LABEL

(Watershed Code) MP (Segment) 04 (Letters only) (Type) 1 (Year) 2016

Dup. (D) or Blank (B): [ ] Verified by: JS

TEMP. LOGGER

	(Y/N)	(TIME - Military)	#
WATER			
AIR			#

LOCATION

PHOTODOCUMENTATION

Number	Title	Voucher (Y/N)
	Midpoint US/DS	
	Upstream US/DS	
	Downstream US/DS	

BENTHIC HABITAT SAMPLED

- [12] Riffle
- [03] Rootwad/Woody Debris
- [03] Leaf Pack
- [ ] Macrophytes
- [03] Undercut Banks
- [ ] Other

SAMPLING CONSID.: ([ ] NUM. ANODES)

STREAM WIDTH (m): 15 (0 m); 15 (75 m)

v. 2009

MBSS SPRING FAUNA DATA SHEET

SITE Watershed Code: MP | Segment: 04 | Type: | Year: 2016

Reviewer: First: JT / Second: JS

HERPETOFAUNA

☐ None Observed

Species	Lifestage: Adult	Juv.	Larval	Egg	SEEN (Y/N)	HEARD (Y/N)	NUMBER RETAINED	NUMBER PHOTOS TAKEN
Frog (unknown)	☐	☒	☐	☐	Y	Y		
Grey Tree Frog	☐	☐	☐	☐		Y		
Salamander Pic	☑	☐	☐	☐	Y			2
Salamander Pic	☐	☒	☐	☐	Y			2
	☐	☐	☐	☐				
	☐	☐	☐	☐				
	☐	☐	☐	☐				

MUSSELS

☒ None Observed

Species	LIVE	DEAD	NUMBER RETAINED	NUMBER PHOTOS TAKEN
	☐	☐		
	☐	☐		
	☐	☐		
	☐	☐		
	☐	☐		

Corbicula: LIVE ☐ DEAD ☐ NONE ☐

CRAYFISHES

☒ None Observed

Species	NUMBER RETAINED
1 Burrow	0

Crayfish Burrows ☑
(Absent, Present, Extensive)

COMMENTS: 1 Fish Caught 1 Photo

Physical Habitat Assessment and Water Quality Data Sheet

Site ID: MP04
Subwatershed: Rock Branch 1
Length of Reach: 75 m Date: 9/8/16
Team Members: JS/JT Time: 11:45am

Weather
Current: clear, warm
Past 24hrs: clear
Past 48hrs: clear windy

Stream Character

- [M] Meandering
- [A] Braided
- [P] Riffle
- [A] Deep Pool >.5m
- [P] Shallow Pool <.5m
- [P] Gravel
- [A] Boulder >2m
- [A] Concrete/Gabion
- [E] Undercut Bank
- [P] Overhead Cover
- [P] Effluent Discharge
- [P] Emergent Vegetation
- [A] Floating Vegetation
- [A] Channelized
- [A] Straight
- [A] Run/Glide
- [A] Silt/Clay
- [P] Sand
- [P] Cobble
- [A] Boulder <2m
- [A] Bedrock
- [P] Rootwad
- [A] Storm Drain
- [A] Human Refuse
- [A] Beaver Pond

A=Absent P=Present E=Extensive

Bar Formation
- [ ] None
- [X] Minor
- [ ] Moderate
- [ ] Extensive

Bank Erosion (see guidance sheet)

	Left Bank	Right Bank
Extent (m)	75	75
Severity	2	3
Avg. Height	120cm	120cm

Severity: 0=none 1=min 2=mod 3=severe

Maximum stream depth (cm): 20

Benthic Habitat Sampled (20 total)

	Sq. ft.
Riffle	12
Rootwad/Woody Debris	3
Leaf Pack	3
Submerged Vegetation	
Undercut Banks	2
Other:	

Rootwads/Woody Debris

# Instream Woody Debris	3
# Dewatered Woody Debris	2
# Instream Rootwads	
# Dewatered Rootwads	

Stream Gradient

Location (ft)	Height (ft)	Water Depth (ft)

Parameter	Down-stream	Mid-stream	Up-stream
Description			
pH	6.32	6.76	6.31
Temperature (°C)	11.40	11.35	11.60
DO (mg/l)	10.37	10.70	10.40
Conductivity (uS/cm)	85	80	81
TDS (mg/l)	74	70	71
Turbidity (NTU)	1.7	0.1	0.5

Notes:

Photographs/Observations:

MBSS Physical Habitat Assessment Sheet

Stream Habitat Assessment Guidance Sheet				
Habitat Parameter	Optima: 16-20	Sub-Optimal 11-15	Marginal 6-10	Poor 0-5
1. Instream Habitat* SCORE 11	Greater than 50% of a variety of cobble, boulder, submerged logs, undercut banks, snags, rootwads, aquatic plants or other stable habitat	30-50% of stable habitat. Adequate habitat	10-30% mix of stable habitat. Habitat availability less than desireable	Less than 10% stable habitat. Lack of habitat is obvious
2. Epifaunal Substrate* SCORE 11	Preferred substrate abundant, stable, and at full colonization potential (riffles well developed and dominated by cobble; and/or woody debris prevalent, not new, and not transient	Abund. of cobble with gravel and/or boulders common; or woody debris, aquatic veg., undercut banks common but not prevalent/suited for full colonization	Large boulders and/or bedrock prevalent; cobble, woody debris, or other preferred surfaces uncommon	Stable substrate lacking; or particles are over 75% surrounded by fine sediment or flocculent material
3. Velocity/Depth Diversity* SCORE 7	Slow (<0.3m/s), deep (>0.5m); slow, shallow (<0.5m); fast (>0.3m/s), deep; fast, shallow habitats all present	Only 3 of the 4 habitat categories present	Only 2 of the 4 habitat categories present	Dominated by 1 velocity/depth category (usually pools)
4. Pool/Glide/Eddy Quality* SCORE 16	Complex cover&/or depth >1.5m; both deep (>0.5m)/shallows (<0.2m) present	Deep (>0.5m) areas present; but only moderate cover	Shallows (<0.2m) prevalent in pool/glide/eddy habitat; little cover	Max depth <0.2m in pool/glide/eddy habitat; or absent completely
5. Riffle/Run Quality* SCORE 7	Riffle/run depth generally >10cm, with maximum depth greater than 50 cm (maximum score); substrate stable (e.g. cobble, boulder) & variety of current velocities	Riffle/run depth generally 5-10cm, variety of current velocities	Riffle/run depth generally 1-5cm; primarily a single current velocity	Riffle/run depth <1cm; or riffle/run substrates concreted
6. Bank Stability* (facing downstream.) Score each bank LB SCORE 4 RB SCORE 4	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected. 10 9	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion. 8 7 6	Moderately unstable; 30-60% of bank in reach as areas of erosion; high erosion potential during floods. 5 4 3	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars. 2 1 0
7. Embeddedness SCORE 60 %	Percentage that gravel, cobble, and boulder particles are surrounded by fine sediment or flocculent material			
8. Shading SCORE 90 %	Percentage of segment that is shaded (duration is considered in scoring). 0% = fully exposed to sunlight all day in summer; 100% = fully and densely shaded all day in summer			
9. Riparian Buffer Zone Width (m)* LB 30 RB 50	Zone width in which human activity is not evident. 50m (164ft) is the maximum recorded value.			
10. Remoteness* SCORE 16	Roads greater than 400 meters (0.25 mi) from stream	Roads within 400 meters (0.25 mi) of stream; stream NOT accessible by trail.	Roads within 400 meters (0.25 mi) of stream; stream accessible by trail.	Roads adjacent to stream.
11. Aesthetic (trash) Rating* SCORE 17	Little or no human refuse visible from stream channel or riparian zone	Refuse present in minor amounts	Refuse present in moderate amounts	Refuse abundant and unsightly
12. Number of Woody Debris and Rootwads* SCORE 3	Count only woody debris and rootwads within the wetted portion of the sampling segment. Count only woody debris >10cm (4in) diameter and >1.5m (5ft) long and rootwads with trunk diameter (at chest height) >15cm (6in) that are functional habitat within the wetted portion of the stream.			

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS

STREAM NAME MP04	LOCATION Lothian, AA Co
STATION # REACH ID#	STREAM CLASS III
UTM N UTM E	RIVER BASIN Patuxent River
STORET #	AGENCY CEI
INVESTIGATORS JS / JT	
FORM COMPLETED BY JT	DATE 4/4/16 TIME 12:00 PM (AM)
REASON FOR SURVEY Bioassessment	

Parameters to be evaluated in sampling reach

Habitat Parameter	Condition Category			
	Optimal	Suboptimal	Marginal	Poor
1. Epifaunal Substrate/ Available Cover	Greater than 50% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient).	30-50% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale).	10-30% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 10% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
SCORE 13	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
2. Pool Substrate Characterization	Mixture of substrate materials, with gravel and firm sand prevalent; root mats and submerged vegetation common.	Mixture of soft sand, mud, or clay; mud may be dominant; some root mats and submerged vegetation present.	All mud or clay or sand bottom; little or no root mat; no submerged vegetation.	Hard-pan clay or bedrock; no root mat or vegetation.
SCORE 13	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
3. Pool Variability	Even mix of large-shallow, large-deep, small-shallow, small-deep pools present.	Majority of pools large-deep; very few shallow.	Shallow pools much more prevalent than deep pools.	Majority of pools small-shallow or pools absent.
SCORE 10	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
4. Sediment Deposition	Little or no enlargement of islands or point bars and less than <20% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 20-50% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 50-80% of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; more than 80% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
SCORE 10	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
5. Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills >75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
SCORE 10	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS

Parameters to be evaluated broader than sampling reach

Habitat Parameter	Condition Category			
	Optimal	Suboptimal	Marginal	Poor
6. Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr) may be present, but recent channelization is not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.
SCORE 20	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
7. Channel Sinuosity	The bends in the stream increase the stream length 3 to 4 times longer than if it was in a straight line. (Note - channel braiding is considered normal in coastal plains and other low-lying areas. This parameter is not easily rated in these areas.)	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	Channel straight; waterway has been channelized for a long distance.
SCORE 17	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
8. Bank Stability (score each bank)	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.
SCORE 7 (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE 4 (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0
9. Vegetative Protection (score each bank) Note: determine left or right side by facing downstream.	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
SCORE 8 (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE 8 (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0
10. Riparian Vegetative Zone Width (score each bank riparian zone)	Width of riparian zone >18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone.	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6-12 meters; human activities have impacted zone a great deal.	Width of riparian zone <6 meters: little or no riparian vegetation due to human activities.
SCORE 4 (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE 10 (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0

Total Score 134

56
78

v. 2009

MBSS SPRING HABITAT DATA SHEET

Page 1 of 7

SITE Watershed Code: MP | Segment: 05 | Type: III | Year: 2016

Reviewer: First: JT / Second: CR

DATE: Year: 16 | Month: 04 | Day: 15

2900 Dist. from Nearest Road to Site (m)

18 Trash Rating 0 - 20

LANDUSE (Y/N)

N	Old Field	N	Residential
Y	Deciduous Forest	N	Commercial/Industrial
N	Coniferous Forest	N	Cropland
N	Wetland	N	Pasture
N	Surface Mine	N	Orchard/Vineyard/Nursery
N	Landfill	N	Golf Course

RIPARIAN VEGETATION
(facing upstream)

	LEFT BANK	RIGHT BANK
Width (50m max)	50	50
Adjacent Land Cover	~~OF~~ FR	~~OF~~ FR
Vegetation Type	G Y R M	G Y R M
Buffer Breaks (Y/N)	X	N

ROAD CULVERT

Present in Segment (Y/N): N

Sampleable? (Y/N):

Width of Culvert (m):

Length of Culvert (m):

STREAM GRADIENT

~~Location (m) | Height (m)~~

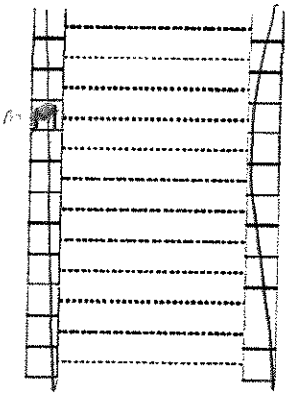
1

2

3

LEFT BANK / RIGHT BANK

Storm Drain
Tile Drain
Impervious Drainage
Gully
Orchard
Crop
Pasture
New Construction
Dirt Road
Gravel Road
Raw Sewage
Railroad



Buffer Break Types
(M = minor; S = severe)

CHANNELIZATION

N Evidence of Channel Straightening or Dredging (Y/N)

TYPE	EXTENT (m)		
	LEFT BANK	BOTTOM	RIGHT BANK
Concrete			
Gabion			
Rip-Rap			
Earthen Berm		N/A	
Dredge Spoil Off Channel		N/A	
Pipe Culvert			

Actual Coordinates
(If >30m distance between original coordinates and stream)

Lat

Lon

Stream Block Ht. (m)

Stream Block Type

Lat

Lon

v. 2009

MBSS SPRING INDEX PERIOD DATA SHEET

SITE Watershed Code MP | Segment 05 | Type | Year 2016

Reviewer: First JT / Second CR

DATE Year 16 | Month 04 | Day 16

CREW: CR/JT

STREAM: MD05

TIME 0830 (Military)

LOCALITY: Harwood, MD

SAMPLEABILITY

- [7] Benthos
- [X] Habitat Assessment
- [X] Water Quality
- [ ] Vernal Pool [A] (PRESENT/ABSENT)

OTHER (SPECIFY)

SITE ACCESS ROUTE

Farm property off Lankford Road. Access back behind fields

SAMPLE LABELS

Verified by: _____

QC LABEL

Watershed Code MP | Segment 05 (Letters only) | Type | Year 2016

Dup. (D) or Blank (B): [ ] Verified by: _____

TEMP. LOGGER

	(Y/N)	(TIME - Military)	#
WATER			#
AIR			#

LOCATION _____

PHOTODOCUMENTATION

Number	Title	Voucher (Y/N)
	M. Upstream US/DS	
	Upstream US/DS	
	Downstream US/DS	

BENTHIC HABITAT SAMPLED

- [16] Riffle
- [04] Leaf Pack
- [ ] Undercut Banks
- [ ] Rootwad/Woody Debris
- [ ] Macrophytes
- [ ] Other _____

SAMPLING CONSID.: ([ ] NUM. ANODES)

STREAM WIDTH (m) 0 m | 75 m

v. 2009

MBSS SPRING FAUNA DATA SHEET

SITE Watershed Code MP | Segment 05 | Type | Year 2016

Reviewer: First JT / Second CR

HERPETOFAUNA

☐ None Observed

Species	Lifestage (Adult / Juv. / Larval / Egg)	SEEN (Y/N)	HEARD (Y/N)	NUMBER RETAINED	NUMBER PHOTOS TAKEN
Salamander - adult northern two-lined	☒ ☐ ☐ ☐	☒	☐	☐	☐
	☐ ☐ ☐ ☐	☐	☐	☐	☐
	☐ ☐ ☐ ☐	☐	☐	☐	☐
	☐ ☐ ☐ ☐	☐	☐	☐	☐
	☐ ☐ ☐ ☐	☐	☐	☐	☐
	☐ ☐ ☐ ☐	☐	☐	☐	☐
	☐ ☐ ☐ ☐	☐	☐	☐	☐

MUSSELS

☒ None Observed

Species	LIVE	DEAD	NUMBER RETAINED	NUMBER PHOTOS TAKEN
	☐	☐	☐☐	☐
	☐	☐	☐☐	☐
	☐	☐	☐☐	☐
	☐	☐	☐☐	☐
	☐	☐	☐☐	☐

Corbicula LIVE ☐ DEAD ☐ NONE ☐

CRAYFISHES

☒ None Observed

Species	NUMBER RETAINED
	☐☐
	☐☐
	☐☐
	☐☐
	☐☐

Crayfish Burrows [A]
(Absent, Present, Extensive)

COMMENTS

Physical Habitat Assessment and Water Quality Data Sheet

Site ID: MPOS
Subwatershed: Patapsco Tidal 3
Length of Reach: 75m **Date:** 4/15/16
Team Members: CR/TT **Time:** 08:30

Weather
Current: clear, ~50°F
Past 24hrs: clear
Past 48hrs: clear

Parameter	Down-stream	Mid-stream	Up-stream
Description			
pH	8.41	8.35	8.44
Temperature (°C)	15.2	15.1	15.2
DO (mg/l)	13.24	13.58	13.23
Conductivity (uS/cm)	154	154.3	156.3
TDS (mg/l)	123.5	124.15	124.6
Turbidity (NTU)	5.73	6.56	16.6

Notes:

Stream Character

[P] Meandering		[A] Channelized	
[A] Braided		[A] Straight	
[P] Riffle		[P] Run/Glide	
[A] Deep Pool >.5m		[P] Silt/Clay	
[P] Shallow Pool <.5m		[P] Sand	
[P] Gravel		[P] Cobble	
[P] Boulder >2m		[P] Boulder <2m	
[A] Concrete/Gabion		[P] Bedrock	
[P] Undercut Bank		[P] Rootwad	
[P] Overhead Cover		[A] Storm Drain	
[A] Effluent Discharge		[A] Human Refuse	
[P] Emergent Vegetation		[A] Beaver Pond	
[P] Floating Vegetation			

A=Absent P=Present E=Extensive

Bar Formation
☐ None ☒ Minor ☐ Moderate ☐ Extensive

Bank Erosion (see guidance sheet)

	Left Bank	Right Bank	Severity:
Extent (m)	75m	75m	
Severity	2	2	0=none
Avg. Height	7ft	7ft	1=min
			2=mod
Maximum stream depth (cm)			3=severe

Benthic Habitat Sampled (20 total)

	Sq. ft.
Riffle	16
Rootwad/Woody Debris	0
Leaf Pack	4
Submerged Vegetation	0
Undercut Banks	0
Other:	

Rootwads/Woody Debris

# Instream Woody Debris	1
# Dewatered Woody Debris	1
# Instream Rootwads	1
# Dewatered Rootwads	1

Stream Gradient

Location (ft)	Height (ft)	Water Depth (ft)

Photographs/Observations:
Midpoint US/DS
Upstream US/DS
Downstream US/DS
Groundwater seepage in RB
↳ 2 pics
Picturesque river trib

MBSS Physical Habitat Assessment Sheet

Stream Habitat Assessment Guidance Sheet				
Habitat Parameter	Optimal 16-20	Sub-Optimal 11-15	Marginal 6-10	Poor 0-5
1. Instream Habitat[1] SCORE 7	Greater than 50% of a variety of cobble, boulder, submerged logs, undercut banks, snags, rootwads, aquatic plants or other stable habitat	30-50% of stable habitat. Adequate habitat	10-30% mix of stable habitat. Habitat availability less than desireable	Less than 10% stable habitat. Lack of habitat is obvious
2. Epifaunal Substrate[1] SCORE 7	Preferred substrate abundant, stable, and at full colonization potential (riffles well developed and dominated by cobble; and/or woody debris prevalent, not new, and not transient	Abund. of cobble with gravel and/or boulders common; or woody debris, aquatic veg., undercut banks common but not prevalent/suited for full colonization	Large boulders and/or bedrock prevalent; cobble, woody debris, or other preferred surfaces uncommon	Stable substrate lacking; or particles are over 75% surrounded by fine sediment or flocculent material
3. Velocity/Depth Diversity[1] SCORE 11	Slow (<0.3m/s), deep (>0.5m); slow, shallow (<0.5m); fast (>0.3m/s), deep; fast, shallow habitats all present	Only 3 of the 4 habitat categories present	Only 2 of the 4 habitat categories present	Dominated by 1 velocity/depth category (usually pools)
4. Pool/Glide/Eddy Quality[1] SCORE 8	Complex cover/& for depth >1.5m; both deep (>0.5m)/shallows (<0.2m) present	Deep (>0.5m) areas present; but only moderate cover	Shallows (<0.2m) prevalent in pool/glide/eddy habitat; little cover	Max depth <0.2m in pool/glide/eddy habitat; or absent completely
5. Riffle/Run Quality[1] SCORE 8	Riffle/run depth generally >10cm, with maximum depth greater than 50 cm (maximum score); substrate stable (e.g. cobble, boulder) & variety of current velocities	Riffle/run depth generally 5-10cm, variety of current velocities	Riffle/run depth generally 1-5cm; primarily a single current velocity	Riffle/run depth <1cm; or riffle/run substrates concreted
6. Bank Stability[2] (facing downstream.) Score each bank LB SCORE 5 RB SCORE 5	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected. 10 9	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion. 8 7 6	Moderately unstable; 30-60% of bank in reach as areas of erosion; high erosion potential during floods. 5 4 3	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars. 2 1 0
7. Embeddedness SCORE 30 %	Percentage that gravel, cobble, and boulder particles are surrounded by fine sediment or flocculent material			
8. Shading SCORE 50 %	Percentage of segment that is shaded (duration is considered in scoring). 0% = fully exposed to sunlight all day in summer, 100% = fully and densely shaded all day in summer			
9. Riparian Buffer Zone Width (m)[3] LB 50 RB 50	Zone width in which human activity is not evident. 50m (164ft) is the maximum recorded value.			
10. Remoteness SCORE 20	Roads greater than 400 meters (0.25 mi) from stream	Roads within 400 meters (0.25 mi) of stream; stream NOT accessible by trail.	Roads within 400 meters (0.25 mi) of stream; stream accessible by trail.	Roads adjacent to stream.
11. Aesthetic (trash) Rating[4] SCORE 19	Little or no human refuse visible from stream channel or riparian zone	Refuse present in minor amounts	Refuse present in moderate amounts	Refuse abundant and unsightly
12. Number of Woody Debris and Rootwads[5] SCORE 2	Count only woody debris and rootwads within the wetted portion of the sampling segment. Count only woody debris >10cm (4in) diameter and >1.5m (5ft) long and rootwads with trunk diameter (at chest height) >15cm (6in) that are functional habitat within the wetted portion of the stream.			

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS

STREAM NAME NPDS		LOCATION Harwood, MD	
STATION # _____ REACH ID# _____		STREAM CLASS III	
UTM N _____ UTM E		RIVER BASIN Patuxent	
STORET #		AGENCY CEI	
INVESTIGATORS CR/JT			
FORM COMPLETED BY JT	DATE 4/15/16 TIME ~8:30 PM	REASON FOR SURVEY MBSS	

Parameters to be evaluated in sampling reach

Habitat Parameter	Condition Category			
	Optimal	Suboptimal	Marginal	Poor
1. Epifaunal Substrate/ Available Cover	Greater than 50% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient).	30-50% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale).	10-30% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 10% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
SCORE 7	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
2. Pool Substrate Characterization	Mixture of substrate materials, with gravel and firm sand prevalent; root mats and submerged vegetation common.	Mixture of soft sand, mud, or clay; mud may be dominant; some root mats and submerged vegetation present.	All mud or clay or sand bottom; little or no root mat; no submerged vegetation.	Hard-pan clay or bedrock; no root mat or vegetation.
SCORE 11	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
3. Pool Variability	Even mix of large-shallow, large-deep, small-shallow, small-deep pools present.	Majority of pools large-deep; very few shallow.	Shallow pools much more prevalent than deep pools.	Majority of pools small-shallow or pools absent.
SCORE 10	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
4. Sediment Deposition	Little or no enlargement of islands or point bars and less than <20% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 20-50% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 50-80% of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; more than 80% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
SCORE 13	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
5. Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills >75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
SCORE 7	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS

Parameters to be evaluated broader than sampling reach

Habitat Parameter	Condition Category			
	Optimal	Suboptimal	Marginal	Poor
6. Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr) may be present, but recent channelization is not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.
SCORE 20	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
7. Channel Sinuosity	The bends in the stream increase the stream length 3 to 4 times longer than if it was in a straight line. (Note - channel braiding is considered normal in coastal plains and other low-lying areas. This parameter is not easily rated in these areas.)	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	Channel straight; waterway has been channelized for a long distance.
SCORE 7	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
8. Bank Stability (score each bank)	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.
SCORE 4 (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE 4 (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0
9. Vegetative Protection (score each bank) Note: determine left or right side by facing downstream.	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
SCORE 6 (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE 6 (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0
10. Riparian Vegetative Zone Width (score each bank riparian zone)	Width of riparian zone >18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone.	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6-12 meters; human activities have impacted zone a great deal.	Width of riparian zone <6 meters: little or no riparian vegetation due to human activities.
SCORE 10 (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE 10 (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0

Total Score 115

v. 2009

MBSS SPRING HABITAT DATA SHEET

Page 1 of 7

SITE — Watershed Code: MP | Segment: 016 | Type: 2 | Year: 2016

Reviewer: First KB / Second JT

DATE — Year: 16 | Month: 03 | Day: 30

400 Dist. from Nearest Road to Site (m)

17 Trash Rating 0 - 20

LANDUSE (Y/N)

N	Old Field	Y	Residential
Y	Deciduous Forest	N	Commercial/Industrial
N	Coniferous Forest	N	Cropland
N	Wetland	Y	Pasture
N	Surface Mine	N	Orchard/Vineyard/Nursery
N	Landfill	N	Golf Course

RIPARIAN VEGETATION
(facing upstream)

	LEFT BANK	RIGHT BANK
Width (50m max)	50	40
Adjacent Land Cover	FR	FR
Vegetation Type	HYRB	MYRL
Buffer Breaks (Y/N)	N	Y

ROAD CULVERT

Present in Segment (Y/N): N

Sempleable? (Y/N):

Width of Culvert (m):

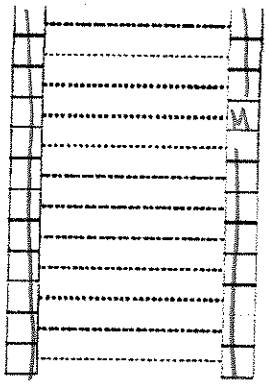
Length of Culvert (m):

STREAM GRADIENT

	Upstream (m)	Height (m)
1		
2		
3		

Buffer Breaks

	LEFT BANK	RIGHT BANK
Storm Drain		
Tile Drain		
Impervious Drainage		
Gully		M
Orchard		
Crop		
Pasture		
New Construction		
Dirt Road		
Gravel Road		
Raw Sewage		
Railroad		



Int. trib.

Buffer Break Types
(M = minor; S = severe)

CHANNELIZATION

N Evidence of Channel Straightening or Dredging (Y/N)

TYPE	EXTENT (m)		
	LEFT BANK	BOTTOM	RIGHT BANK
Concrete			
Gabion			
Rip-Rap			
Earthen Berm		N/A	
Dredge Spoil Off Channel		N/A	
Pipe Culvert			

Actual Coordinates
(If >30m distance between original coordinates and stream)

Lat

Lon

Stream Block Ht. (m)

Stream Block Type

Lat

Lon

v. 2009

MBSS SPRING INDEX PERIOD DATA SHEET

Page 2 of 7

SITE: Watershed Code MP | Segment 06 | Type 2 | Year 2016

Reviewer: First KB / Second JT

DATE: Year 16 | Month 03 | Day 30

CREW: KB JT

STREAM: MP06

TIME: 1330 (Military)

LOCALITY: Lothian MD

SAMPLEABILITY

- [x] Benthos
- [ ] Habitat Assessment
- [x] Water Quality
- [ ] Vernal Pool [A] (PRESENT/ABSENT)

OTHER (SPECIFY)

SITE ACCESS ROUTE

Cobert Drive, access through 4431 through woods to stream

SAMPLE LABELS

Verified by: JT

QC LABEL

Watershed Code: MP | Segment: 06 (Letters only) | Type: 2 | Year: 2016

Dup. (D) or Blank (B): ____ Verified by: ____

TEMP. LOGGER

	(Y/N)	(TIME - Military)	#
WATER			#
AIR			#

LOCATION

PHOTODOCUMENTATION

Number	Title	Voucher (Y/N)
	M - US/DS	
	D - US/DS	
	U - US/DS	

BENTHIC HABITAT SAMPLED

- [01] Riffle
- [06] Rootwad/Woody Debris
- [13] Leaf Pack
- [ ] Macrophytes
- [ ] Undercut Banks
- [ ] Other

SAMPLING CONSID.: (____ NUM. ANODES)

STREAM WIDTH (m): 0 m ____ 75 m ____

v. 2009

MBSS SPRING FAUNA DATA SHEET

SITE Watershed Code MP | Segment 06 | Type 2 | Year 2011

Reviewer: First KB / Second JT

HERPETOFAUNA

☐ None Observed

Species	Lifestage (Adult, Juv., Larval, Egg)	SEEN (Y/N)	HEARD (Y/N)	NUMBER RETAINED	NUMBER PHOTOS TAKEN
1 Salamander juvenile	☐ ☑ ☐ ☐	Y	N	0	0
tadpole	☐ ☐ ☐ ☐	☐	☐	☐	☐
	☐ ☐ ☐ ☐	☐	☐	☐	☐
	☐ ☐ ☐ ☐	☐	☐	☐	☐
	☐ ☐ ☐ ☐	☐	☐	☐	☐
	☐ ☐ ☐ ☐	☐	☐	☐	☐
	☐ ☐ ☐ ☐	☐	☐	☐	☐

MUSSELS

☒ None Observed

Species	LIVE	DEAD	NUMBER RETAINED	NUMBER PHOTOS TAKEN
	☐	☐	☐☐	☐
	☐	☐	☐☐	☐
	☐	☐	☐☐	☐
	☐	☐	☐☐	☐
	☐	☐	☐☐	☐

Corbicula — LIVE ☐ DEAD ☐ NONE ☐

CRAYFISHES

☐ None Observed

Species	NUMBER RETAINED
[redacted]	☐☐
	☐☐
	☐☐
	☐☐
	☐☐

Crayfish Burrows ☐

(Absent, Present, Extensive)

COMMENTS

Physical Habitat Assessment and Water Quality Data Sheet

Site ID: MD06
Subwatershed: Middle Patuxent
Length of Reach: 75m **Date:** 3/30/16
Team Members: KBLTT **Time:** 1330

Weather
Current: Sunny, 60°F
Past 24hrs: Sunny, windy, 60°F
Past 48hrs: Am rain

Stream Character

P Meandering	A Channelized
A Braided	A Straight
P Riffle	P Run/Glide
A Deep Pool >.5m	P Silt/Clay
P Shallow Pool <.5m	A Sand
A Gravel	P Cobble
A Boulder >2m	A Boulder <2m
A Concrete/Gabion	A Bedrock
A Undercut Bank	A Rootwad
P Overhead Cover	A Storm Drain
A Effluent Discharge	A Human Refuse
P Emergent Vegetation	A Beaver Pond
A Floating Vegetation	

A=Absent P=Present E=Extensive

Bar Formation
☐ None ☑ Minor ☐ Moderate ☐ Extensive

Bank Erosion (see guidance sheet)

	Left Bank	Right Bank
Extent (m)	75	75
Severity	2	2
Avg. Height	2.5'	2.5'

Severity: 0=none 1=min 2=mod 3=severe

Maximum stream depth (cm) 10

Benthic Habitat Sampled (20 total)

	Sq. ft.
Riffle	1
Rootwad/Woody Debris	6
Leaf Pack	13
Submerged Vegetation	
Undercut Banks	
Other:	

Rootwads/Woody Debris

# Instream Woody Debris	3
# Dewatered Woody Debris	4
# Instream Rootwads	3
# Dewatered Rootwads	6

Stream Gradient

Location (ft)	Height (ft)	Water Depth (ft)

Parameter	Down-stream	Mid-stream	Up-stream
Description			
pH	7.25	7.26	7.1
Temperature (°C)	13.3	13.1	13.2
DO (mg/l)	11.96	12.13	12.39
Conductivity (uS/cm)	206.1	204.9	42.2
TDS (mg/l)	172.25	172.85	119.6
Turbidity (NTU)	5.18	6.37	5.92

Notes: Barometer 30.237

Photographs/Observations:

M - US/DS
D - US/DS
U - US/DS

MBSS Physical Habitat Assessment Sheet

Stream Habitat Assessment Guidance Sheet				
Habitat Parameter	Optimal 16-20	Sub-Optimal 11-15	Marginal 6-10	Poor 0-5
1. Instream Habitat* SCORE 9	Greater than 50% of a variety of cobble, boulder, submerged logs, undercut banks, snags, rootwads, aquatic plants or other stable habitat	30-50% of stable habitat. Adequate habitat	10-30% mix of stable habitat. Habitat availability less than desireable	Less than 10% stable habitat. Lack of habitat is obvious
2. Epifaunal Substrate* SCORE 5	Preferred substrate abundant, stable, and at full colonization potential (riffles well developed and dominated by cobble; and/or woody debris prevalent, not new, and not transient	Abund. of cobble with gravel and/or boulders common; or woody debris, aquatic veg., undercut banks common but not prevalent/suited for full colonization	Large boulders and/or bedrock prevalent; cobble, woody debris, or other preferred surfaces uncommon	Stable substrate lacking; or particles are over 75% surrounded by fine sediment or flocculent material
3. Velocity/Depth Diversity* SCORE 8	Slow (<0.3m/s), deep (>0.5m); slow, shallow (<0.5m); fast (>0.3m/s), deep; fast, shallow habitats all present	Only 3 of the 4 habitat categories present	Only 2 of the 4 habitat categories present	Dominated by 1 velocity/depth category (usually pools)
4. Pool/Glide/Eddy Quality* SCORE 7	Complex cover/&/or depth >1.5m; both deep (>0.5m)/shallows (<0.2m) present	Deep (>0.5m) areas present; but only moderate cover	Shallows (<0.2m) prevalent in pool/glide/eddy habitat; little cover	Max depth <0.2m in pool/glide/eddy habitat; or absent completely
5. Riffle/Run Quality* SCORE 8	Riffle/run depth generally >10cm, with maximum depth greater than 50 cm (maximum score); substrate stable (e.g. cobble, boulder) & variety of current velocities	Riffle/run depth generally 5-10cm, variety of current velocities	Riffle/run depth generally 1-5cm; primarily a single current velocity	Riffle/run depth <1cm; or riffle/run substrates concreted
6. Bank Stability* (facing downstream.) Score each bank LB SCORE 5 RB SCORE 5	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected. 10 9	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion. 8 7 6	Moderately unstable; 30-60% of bank in reach as areas of erosion; high erosion potential during floods. 5 4 3	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars. 2 1 0
7. Embeddedness SCORE 75 %	Percentage that gravel, cobble, and boulder particles are surrounded by fine sediment or flocculent material			
8. Shading SCORE 80 %	Percentage of segment that is shaded (duration is considered in scoring). 0% = fully exposed to sunlight all day in summer; 100% = fully and densely shaded all day in summer			
9. Riparian Buffer Zone Width (m)* LB 40 RB 50	Zone width in which human activity is not evident. 50m (164ft) is the maximum recorded value.			
10. Remoteness* SCORE 13	Roads greater than 400 meters (0.25 mi) from stream	Roads within 400 meters (0.25 mi) of stream; stream NOT accessible by trail.	Roads within 400 meters (0.25 mi) of stream; stream accessible by trail.	Roads adjacent to stream.
11. Aesthetic (trash) Rating* SCORE 16	Little or no human refuse visible from stream channel or riparian zone	Refuse present in minor amounts	Refuse present in moderate amounts	Refuse abundant and unsightly
12. Number of Woody Debris and Rootwads* SCORE 6	Count only woody debris and rootwads within the wetted portion of the sampling segment. Count only woody debris >10cm (4in) diameter and >1.5m (5ft) long and rootwads with trunk diameter (at chest height) >15cm (6in) that are functional habitat within the wetted portion of the stream.			

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS

STREAM NAME MP06	LOCATION Lothian, MD	
STATION # _____ REACH ID# _____	STREAM CLASS Perennial	
UTM N _____ UTM E	RIVER BASIN Patuxent	
STORET #	AGENCY CEI	
INVESTIGATORS KB/JT		
FORM COMPLETED BY KB	DATE 3/30/16 TIME ~1130 PM	REASON FOR SURVEY MBSS

Parameters to be evaluated in sampling reach

Habitat Parameter	Condition Category			
	Optimal	Suboptimal	Marginal	Poor
1. Epifaunal Substrate/ Available Cover SCORE 8	Greater than 50% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient). 20 19 18 17 16	30-50% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale). 15 14 13 12 11	10-30% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed. 10 9 8 7 6	Less than 10% stable habitat; lack of habitat is obvious; substrate unstable or lacking. 5 4 3 2 1 0
2. Pool Substrate Characterization SCORE 11	Mixture of substrate materials, with gravel and firm sand prevalent; root mats and submerged vegetation common. 20 19 18 17 16	Mixture of soft sand, mud, or clay; mud may be dominant; some root mats and submerged vegetation present. 15 14 13 12 11	All mud or clay or sand bottom; little or no root mat; no submerged vegetation. 10 9 8 7 6	Hard-pan clay or bedrock; no root mat or vegetation. 5 4 3 2 1 0
3. Pool Variability SCORE 5	Even mix of large-shallow, large-deep, small-shallow, small-deep pools present. 20 19 18 17 16	Majority of pools large-deep; very few shallow. 15 14 13 12 11	Shallow pools much more prevalent than deep pools. 10 9 8 7 6	Majority of pools small-shallow or pools absent. 5 4 3 2 1 0
4. Sediment Deposition SCORE 6	Little or no enlargement of islands or point bars and less than <20% of the bottom affected by sediment deposition. 20 19 18 17 16	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 20-50% of the bottom affected; slight deposition in pools. 15 14 13 12 11	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 50-80% of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent. 10 9 8 7 6	Heavy deposits of fine material, increased bar development; more than 80% of the bottom changing frequently; pools almost absent due to substantial sediment deposition. 5 4 3 2 1 0
5. Channel Flow Status SCORE 12	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed. 20 19 18 17 16	Water fills >75% of the available channel; or <25% of channel substrate is exposed. 15 14 13 12 11	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed. 10 9 8 7 6	Very little water in channel and mostly present as standing pools. 5 4 3 2 1 0

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS

Parameters to be evaluated broader than sampling reach

Habitat Parameter	Condition Category			
	Optimal	Suboptimal	Marginal	Poor
6. Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr) may be present, but recent channelization is not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.
SCORE 19	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
7. Channel Sinuosity	The bends in the stream increase the stream length 3 to 4 times longer than if it was in a straight line. (Note - channel braiding is considered normal in coastal plains and other low-lying areas. This parameter is not easily rated in these areas.)	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	Channel straight; waterway has been channelized for a long distance.
SCORE 11	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
8. Bank Stability (score each bank)	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.
SCORE 4 (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE 4 (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0
9. Vegetative Protection (score each bank) Note: determine left or right side by facing downstream.	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
SCORE 2 (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE 2 (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0
10. Riparian Vegetative Zone Width (score each bank riparian zone)	Width of riparian zone >18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone.	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6-12 meters; human activities have impacted zone a great deal.	Width of riparian zone <6 meters: little or no riparian vegetation due to human activities.
SCORE 6 (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE 6 (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0

Total Score 99

Form # EL2 - _____

v. 2009

MBSS SPRING HABITAT DATA SHEET

Page 1 of 7

SITE — Watershed Code: MP | Segment: 08 | Type: 3 | Year: 2016

Reviewer: First EW / Second CR

DATE — Year: 16 | Month: 04 | Day: 06

1100 Dist. from Nearest Road to Site (m)

18 Trash Rating 0 - 20

LANDUSE (Y/N)

N	Old Field	Y	Residential
Y	Deciduous Forest	N	Commercial/Industrial
N	Coniferous Forest	N	Cropland
Y	Wetland	N	Pasture
N	Surface Mine	N	Orchard/Vineyard/Nursery
N	Landfill	N	Golf Course

RIPARIAN VEGETATION
(facing upstream)

	LEFT BANK	RIGHT BANK
Width (50m max)	50	50
Adjacent Land Cover	FR	LN
Vegetation Type	MYRG	MYRG
Buffer Breaks (Y/N)	N	Y

ROAD CULVERT

Present in Segment (Y/N): N

Sampleable? (Y/N): N/A — N

Width of Culvert (m): N/A

Length of Culvert (m): N/A

STREAM GRADIENT

	Location (m)	Height (m)
1		
2		
3		

BUFFER BREAKS

	LEFT BANK	RIGHT BANK
Storm Drain	N	N
Tile Drain	N	N
Impervious Drainage	N	N
Gully	N	M
Orchard	N	N
Crop	N	N
Pasture	N	N
New Construction	N	N
Dirt Road	N	N
Gravel Road	N	N
Raw Sewage	N	N
Railroad	N	N

(CANOPY COVER OVER GULLY)

Buffer Break Types
(M = minor; S = severe)

CHANNELIZATION

N Evidence of Channel Straightening or Dredging (Y/N)

TYPE	EXTENT (m) N/A		
	LEFT BANK	BOTTOM	RIGHT BANK
Concrete			
Gebion			
Rip-Rap			
Earthen Berm		N/A	
Dredge Spoil Off Channel		N/A	
Pipe Culvert			

Actual Coordinates
(If >30m distance between original coordinates and stream)

Lat

Lon

Stream Block HL (m)

Stream Block Type

Lat

Lon

v. 2009

MBSS SPRING HABITAT DATA SHEET

Page 11 of 71

SITE Watershed Code: MP | Segment: 07 | Type: R | Year: 2016

Reviewer: First: JS / Second: JT

DATE: Year: 16 | Month: 04 | Day: 04

150 Dist. from Nearest Road to Site (m)

16 Trash Rating 0 - 20

LANDUSE (Y/N)

N	Old Field	N	Residential
Y	Deciduous Forest	N	Commercial/Industrial
N	Coniferous Forest	N	Cropland
N	Wetland	N	Pasture
N	Surface Mine	N	Orchard/Vineyard/Nursery
N	Landfill	Y	Golf Course

ROAD CULVERT

Present in Segment (Y/N): N

Sampleable? (Y/N): N

Width of Culvert (m): N

Length of Culvert (m): N

STREAM GRADIENT

	Elevation (m)	Height (m)
1		
2		
3		

RIPARIAN VEGETATION
(facing upstream)

	LEFT BANK	RIGHT BANK
Width (50m max)	25	15
Adjacent Land Cover	Golf	
Vegetation Type	GRAM	CAYM
Buffer Breaks (Y/N)	Y	Y golf

	LEFT BANK	RIGHT BANK
Storm Drain		
Tile Drain		
Impervious Drainage		
Gully		
Orchard		
Crop		
Pasture	S	S
New Construction		
Dirt Road		
Gravel Road		
Raw Sewage		
Railroad		

Buffer Break Types
(M = minor; S = severe)

CHANNELIZATION

N Evidence of Channel Straightening or Dredging (Y/N)

TYPE	EXTENT (m) LEFT BANK	BOTTOM	RIGHT BANK
Concrete			
Gabion			
Rip-Rap			
Earthen Berm		N/A	
Dredge Spoil Off Channel		N/A	
Pipe Culvert			

Actual Coordinates
(If >30m distance between original coordinates and stream)

Lat

Lon

Stream Block Ht. (m)

Stream Block Type

Lat

Lon

v. 2009

MBSS SPRING INDEX PERIOD DATA SHEET

Page 1 of 1

SITE: Watershed Code MP | Segment 07 | Type 2 | Year 2016

Reviewer: First JS / Second JT

DATE: Year 16 Month 04 Day 04

CREW: JS/JT

STREAM: MP07

TIME: 1330 (Military)

LOCALITY: AA Co. MD

SAMPLEABILITY

- Y Benthos
- Y Habitat Assessment
- Y Water Quality
- N Vernal Pool — PERCENTAGE/AMOUNT

OTHER (SPECIFY):

SITE ACCESS ROUTE

Golf Course & Park at Golf Cart entrance

SAMPLE LABELS

Verified by: JS

QC LABEL

Watershed Code MP | Segment 07 (Letters only) | Type 2 | Year 2016

Dup. (D) or Blank (B): | Verified by:

TEMP. LOGGER

	(Y/N)	(TIME - Military)	#
WATER			
AIR			

LOCATION

PHOTODOCUMENTATION

Number	Title	Voucher (Y/N)

BENTHIC HABITAT SAMPLED

- 18 Riffle
- 1 Rootwad/Woody Debris
- 1 Leaf Pack
- 0 Macrophytes
- 2 Undercut Banks
- 2 Other

SAMPLING CONSID.: (NUM. ANODES)

STREAM WIDTH (m): 10 (0 m) | 15 (75 m)

v. 2009

MBSS SPRING FAUNA DATA SHEET

SITE Watershed Code MP | Segment 07 | Type 2 | Year 2016

Reviewer: First JS / Second ST

HERPETOFAUNA

☐ None Observed

Species	Lifestage (Adult, Juv, Larval, Egg)	SEEN (Y/N)	HEARD (Y/N)	NUMBER RETAINED	NUMBER PHOTOS TAKEN
Pickerel Frog	☒	☒	☐	0	1
Green Frog	☒	☒	☐	0	1
	☐	☐	☐	☐	☐
	☐	☐	☐	☐	☐
	☐	☐	☐	☐	☐
	☐	☐	☐	☐	☐
	☐	☐	☐	☐	☐

MUSSELS

☒ None Observed

Species	LIVE	DEAD	NUMBER RETAINED	NUMBER PHOTOS TAKEN
	☐	☐	☐☐	☐
	☐	☐	☐☐	☐
	☐	☐	☐☐	☐
	☐	☐	☐☐	☐
	☐	☐	☐☐	☐

Corbicula — LIVE ☐ DEAD ☐ NONE ☐

CRAYFISHES

☒ None Observed

Species	NUMBER RETAINED
	0
	☐☐
	☐☐
	☐☐
	☐☐

Crayfish Burrows ☐

(Absent, Present, Extensive)

COMMENTS

4/7

Physical Habitat Assessment and Water Quality Data Sheet

Site ID: MP07
Subwatershed: Rock Branch 2
Length of Reach: 75m **Date:** 4/4/2016
Team Members: JS/ST **Time:** 1:30

Weather
Current: Sunny
Past 24hrs: Windy
Past 48hrs: Sunny

Parameter	Down-stream	Mid-stream	Up-stream
Description			
pH	6.92	6.97	6.89
Temperature (°C)	14.73	14.47	14.47
DO (mg/l)	11.31	11.60	11.36
Conductivity (uS/cm)	158	157	157
TDS (mg/l)	128	128	128
Turbidity (NTU)	3.7	3.5	3.5

Notes: _____

Stream Character

[P] Meandering	[A] Channelized	
[A] Braided	[P] Straight	
[P] Riffle	[P] Run/Glide	
[P] Deep Pool >.5m	[P] Silt/Clay	
[P] Shallow Pool <.5m	[P] Sand	
[P] Gravel	[A] Cobble	
[A] Boulder >2m	[A] Boulder <2m	
[A] Concrete/Gabion	[A] Bedrock	
[A] Undercut Bank	[A] Rootwad	
[P] Overhead Cover	[A] Storm Drain	
[A] Effluent Discharge	[A] Human Refuse	
[A] Emergent Vegetation	[A] Beaver Pond	
[A] Floating Vegetation		

A=Absent P=Present E=Extensive

Bar Formation
[ ] None [X] Moderate
[X] Minor [ ] Extensive

Bank Erosion (see guidance sheet)

	Left Bank	Right Bank
Extent (m)	10	30
Severity	1	2
Avg. Height	1	6

Severity: 0=none 1=min 2=mod 3=severe

Maximum stream depth (cm) 60

Benthic Habitat Sampled (20 total)

	Sq. ft.
Riffle	18
Rootwad/Woody Debris	1
Leaf Pack	1
Submerged Vegetation	0
Undercut Banks	0
Other:	0

Rootwads/Woody Debris

# Instream Woody Debris	1
# Dewatered Woody Debris	1
# Instream Rootwads	0
# Dewatered Rootwads	0

Stream Gradient

Location (ft)	Height (ft)	Water Depth (ft)

Photographs/Observations:

MP07 JS/JT 4/4/2016 13:30

MBSS Physical Habitat Assessment Sheet

Stream Habitat Assessment Guidance Sheet				
Habitat Parameter	Optima 16-20	Sub-Optimal 11-15	Marginal 6-10	Poor 0-5
1. Instream Habitat[1] SCORE 10	Greater than 50% of a variety of cobble, boulder, submerged logs, undercut banks, snags, rootwads, aquatic plants or other stable habitat	30-50% of stable habitat. Adequate habitat	10-30% mix of stable habitat. Habitat availability less than desireable	Less than 10% stable habitat. Lack of habitat is obvious
2. Epifaunal Substrate[1] SCORE 10	Preferred substrate abundant, stable, and at full colonization potential (riffles well developed and dominated by cobble; and/or woody debris prevalent, not new, and not transient	Abund. of cobble with gravel and/or boulders common; or woody debris, aquatic veg., undercut banks common but not prevalent/suited for full colonization	Large boulders and/or bedrock prevalent; cobble, woody debris, or other preferred surfaces uncommon	Stable substrate lacking; or particles are over 75% surrounded by fine sediment or flocculent material
3. Velocity/Depth Diversity[2] SCORE 15	Slow (<0.3m/s), deep (>0.5m); slow, shallow (<0.5m); fast (>0.3m/s), deep; fast, shallow habitats all present	Only 3 of the 4 habitat categories present	Only 2 of the 4 habitat categories present	Dominated by 1 velocity/depth category (usually pools)
4. Pool/Glide/Eddy Quality[2] SCORE 15	Complex cover/&/or depth >1.5m; both deep (>0.5m)/shallows (<0.2m) present	Deep (>0.5m) areas present; but only moderate cover	Shallows (<0.2m) prevalent in pool/glide/eddy habitat; little cover	Max depth <0.2m in pool/glide/eddy habitat; or absent completely
5. Riffle/Run Quality[2] SCORE 15	Riffle/run depth generally >10cm, with maximum depth greater than 50 cm (maximum score); substrate stable (e.g. cobble, boulder) & variety of current velocities	Riffle/run depth generally 5-10cm, variety of current velocities	Riffle/run depth generally 1-5cm; primarily a single current velocity	Riffle/run depth <1cm; or riffle/run substrates concreted
6. Bank Stability[1] (facing downstream.) Score each bank LB SCORE 8 RB SCORE 6	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected. 10 9	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion. 8 7 6	Moderately unstable; 30-60% of bank in reach as areas of erosion; high erosion potential during floods. 5 4 3	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars. 2 1 0
7. Embeddedness SCORE 60 %	Percentage that gravel, cobble, and boulder particles are surrounded by fine sediment or flocculent material			
8. Shading SCORE 35 %	Percentage of segment that is shaded (duration is considered in scoring). 0% = fully exposed to sunlight all day in summer; 100% = fully and densely shaded all day in summer			
9. Riparian Buffer Zone Width (m)[3] LB 25 RB 15	Zone width in which human activity is not evident. 50m (164ft) is the maximum recorded value.			
10. Remoteness[3] SCORE 8	Roads greater than 400 meters (0.25 mi) from stream	Roads within 400 meters (0.25 mi) of stream; stream NOT accessible by trail.	Roads within 400 meters (0.25 mi) of stream; stream accessible by trail.	Roads adjacent to stream.
11. Aesthetic (trash) Rating[3] SCORE 16	Little or no human refuse visible from stream channel or riparian zone	Refuse present in minor amounts	Refuse present in moderate amounts	Refuse abundant and unsightly
12. Number of Woody Debris and Rootwads[4] SCORE	Count only woody debris and rootwads within the wetted portion of the sampling segment. Count only woody debris >10cm (4in) diameter and >1.5m (5ft) long and rootwads with trunk diameter (at chest height) >15cm (6in) that are functional habitat within the wetted portion of the stream.			

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS

STREAM NAME MP07	LOCATION AA County
STATION # _____ REACH ID# _____	STREAM CLASS II
UTM N _____ UTM E	RIVER BASIN Patuxent River
STORET #	AGENCY CFI
INVESTIGATORS JS / JT	
FORM COMPLETED BY JS	DATE 04/04/2016 TIME 13:30 PM
	REASON FOR SURVEY BMI

Parameters to be evaluated in sampling reach

Habitat Parameter	Condition Category			
	Optimal	Suboptimal	Marginal	Poor
1. Epifaunal Substrate/ Available Cover	Greater than 50% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient).	30-50% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale).	10-30% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 10% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
SCORE 15	20 19 18 17 16	(15) 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
2. Pool Substrate Characterization	Mixture of substrate materials, with gravel and firm sand prevalent; root mats and submerged vegetation common.	Mixture of soft sand, mud, or clay; mud may be dominant; some root mats and submerged vegetation present.	All mud or clay or sand bottom; little or no root mat; no submerged vegetation.	Hard-pan clay or bedrock; no root mat or vegetation.
SCORE 10	20 19 18 17 16	15 14 13 12 11	(10) 9 8 7 6	5 4 3 2 1 0
3. Pool Variability	Even mix of large-shallow, large-deep, small-shallow, small-deep pools present.	Majority of pools large-deep; very few shallow.	Shallow pools much more prevalent than deep pools.	Majority of pools small-shallow or pools absent.
SCORE 11	20 19 18 17 16	15 14 13 12 (11)	(10) 9 8 7 6	5 4 3 2 1 0
4. Sediment Deposition	Little or no enlargement of islands or point bars and less than <20% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 20-50% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 50-80% of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; more than 80% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
SCORE 10	20 19 18 17 16	15 14 13 12 11	(10) 9 8 7 6	5 4 3 2 1 0
5. Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills >75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
SCORE 16	20 19 18 17 (16)	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0

MP07 JS/JT 4/4/2016 13:30

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HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS

Parameters to be evaluated broader than sampling reach

Habitat Parameter	Condition Category			
	Optimal	Suboptimal	Marginal	Poor
6. Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr) may be present, but recent channelization is not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.
SCORE 16	20 19 18 17 **(16)**	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
7. Channel Sinuosity	The bends in the stream increase the stream length 3 to 4 times longer than if it was in a straight line. (Note - channel braiding is considered normal in coastal plains and other low-lying areas. This parameter is not easily rated in these areas.)	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	Channel straight; waterway has been channelized for a long distance.
SCORE 9	20 19 18 17 16	15 14 13 12 11	10 **(9)** 8 7 6	5 4 3 2 1 0
8. Bank Stability (score each bank)	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.
SCORE 8 (LB)	**Left Bank** 10 9	8 7 6	5 4 3	2 1 0
SCORE 7 (RB)	**Right Bank** 10 9	8 7 6	5 4 3	2 1 0
9. Vegetative Protection (score each bank) Note: determine left or right side by facing downstream.	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
SCORE 8 (LB)	**Left Bank** 10 9	8 7 6	5 4 3	2 1 0
SCORE 8 (RB)	**Right Bank** 10 9	8 7 6	5 4 3	2 1 0
10. Riparian Vegetative Zone Width (score each bank riparian zone)	Width of riparian zone >18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone.	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6-12 meters; human activities have impacted zone a great deal.	Width of riparian zone <6 meters: little or no riparian vegetation due to human activities.
SCORE 5 (LB)	**Left Bank** 10 9	8 7 6	**(5)** 4 3	2 1 0
SCORE 2 (RB)	**Right Bank** 10 9	8 7 6	5 4 3	**(2)** 1 0

Total Score 125

62
63

Form # EL2 - _____

v. 2009

MBSS SPRING HABITAT DATA SHEET

SITE — Watershed Code: MP | Segment: 04 | Type: 3 | Year: 2016

Reviewer: First: EW / Second: CR

DATE — Year: 16 | Month: 04 | Day: 06

#100 Dist. from Nearest Road to Site (m)

18 Trash Rating 0 - 20

LANDUSE (Y/N)

N	Old Field	Y	Residential
Y	Deciduous Forest	N	Commercial/Industrial
N	Coniferous Forest	N	Cropland
Y	Wetland	N	Pasture
N	Surface Mine	N	Orchard/Vineyard/Nursery
N	Landfill	N	Golf Course

RIPARIAN VEGETATION
(facing upstream)

	LEFT BANK	RIGHT BANK
Width (50m max)	50	50
Adjacent Land Cover	FR	LN
Vegetation Type	MYRG	MYRG
Buffer Breaks (Y/N)	N	Y

ROAD CULVERT

Present in Segment (Y/N): N

Samplesable? (Y/N): N/A — N

Width of Culvert (m): N/A

Length of Culvert (m): N/A

STREAM GRADIENT

	Elevation (m)	Height (m)
1		
2		
3		

Buffer Breaks

	LEFT BANK	RIGHT BANK
Storm Drain	N	N
Tile Drain	N	N
Impervious Drainage	N	N
Gully	N	M (CANOPY COVER OVER GULLY)
Orchard	N	N
Crop	N	N
Pasture	N	N
New Construction	N	N
Dirt Road	N	N
Gravel Road	N	N
Raw Sewage	N	N
Railroad	N	N

Buffer Break Types
(M = minor; S = severe)

CHANNELIZATION

N Evidence of Channel Straightening or Dredging (Y/N)

TYPE	EXTENT (m) N/A		
	LEFT BANK	BOTTOM	RIGHT BANK
Concrete			
Gabion			
Rip-Rap			
Earthen Berm		N/A	
Dredge Spoil Off Channel		N/A	
Pipe Culvert			

Actual Coordinates
(If >30m distance between original coordinates and stream)

Lat

Lon

Stream Block Ht. (m)

Stream Block Type

Lat

Lon

v. 2009

MBSS SPRING INDEX PERIOD DATA SHEET

Page 2 Of 7

SITE Watershed Code MP | Segment 08 | Type 3 | Year 2016

Reviewer: First EW / Second CR

DATE Year 16 Month 04 Day 06

CREW: ELEANOR WILSON & CARISSA REH

STREAM: MP08

TIME 0945 (Military)

LOCALITY: , AA Co., MARYLAND

SAMPLEABILITY

- [Y] Benthos
- [Y] Habitat Assessment
- [Y] Water Quality
- [Y] Vernal Pool [P] (PRESENT/ABSENT)

OTHER (SPECIFY) N/A

SITE ACCESS ROUTE

PARK ALONG LYTHAM CT - WALK DOWN STEEP ACCESS TO TREELINE THEN 400M N TO UPSTREAM POINT OF REACH

SAMPLE LABELS

Verified by: EW

QC LABEL

Watershed Code MP | Segment 08 (Letters only) | Type | Year 2016

Dup. (D) or Blank (B): | Verified by:

TEMP. LOGGER

N/A

	(Y/N)	(TIME - Military)	#
WATER			#
AIR			#

LOCATION

PHOTODOCUMENTATION

Number	Title	Voucher (Y/N)
	DS - US, DS,	
	MP - US, DS, TRIB (US VIEW)	
	DS - US, DS, TRIB (US VIEW)	

BENTHIC HABITAT SAMPLED

- [12] Riffle
- [62] Rootwad/Woody Debris
- [06] Leaf Pack
- [00] Macrophytes
- [ ] Undercut Banks
- [ ] Other

SAMPLING CONSID.: (2 NUM. ANODES)

STREAM WIDTH (m): 12 (0 m) | 0014 (75 m)

v. 2009

MBSS SPRING FAUNA DATA SHEET

SITE Watershed Code: [ ][ ][NP] Segment: [ ][ ][08] Type: [IN] Year: [2016]

Reviewer: First: EW / Second: CC

HERPETOFAUNA

☐ None Observed

Species	Lifestage (Adult, Juv., Larval, Egg)	SEEN (Y/N)	HEARD (Y/N)	NUMBER RETAINED	NUMBER PHOTOS TAKEN
ADULT GREEN FROG (2)	☒ ☐ ☐ ☑	Y	Y	0	0
MANY EGGS.	☐ ☐ ☐ ☐	☐	☐	☐	☐
	☐ ☐ ☐ ☐	☐	☐	☐	☐
	☐ ☐ ☐ ☐	☐	☐	☐	☐
	☐ ☐ ☐ ☐	☐	☐	☐	☐
	☐ ☐ ☐ ☐	☐	☐	☐	☐
	☐ ☐ ☐ ☐	☐	☐	☐	☐

MUSSELS

☒ None Observed

Species	LIVE	DEAD	NUMBER RETAINED	NUMBER PHOTOS TAKEN
	☐	☐	☐☐	☐
	☐	☐	☐☐	☐
	☐	☐	☐☐	☐
	☐	☐	☐☐	☐
	☐	☐	☐☐	☐

Corbicula: LIVE ☐ DEAD ☐ NONE ☒

CRAYFISHES

☒ None Observed

Species	NUMBER RETAINED
	☐☐
	☐☐
	☐☐
	☐☐
	☐☐

Crayfish Burrows: ☐

(Absent, Present, Extensive)

COMMENTS

Physical Habitat Assessment and Water Quality Data Sheet

Site ID: MR08
Subwatershed: Rock Branch 2
Length of Reach: 75m **Date:** 4/6/16
Team Members: BW/CR **Time:** 09:45

Weather
Current: SUNNY 40°
Past 24hrs: SUNNY 35° WINDY
Past 48hrs: RAIN/CLOUDY 50°

Stream Character

[P] Meandering	[A] Channelized
[P] Braided	[P] Straight
[P] Riffle	[P] Run/Glide
[A] Deep Pool >.5m	[E] Silt/Clay
[P] Shallow Pool <.5m	[P] Sand
[P] Gravel	[P] Cobble
[A] Boulder >2m	[A] Boulder <2m
[A] Concrete/Gabion	[A] Bedrock
[P] Undercut Bank	[P] Rootwad
[E] Overhead Cover	[A] Storm Drain
[A] Effluent Discharge	[A] Human Refuse
[P] Emergent Vegetation	[A] Beaver Pond
[A] Floating Vegetation	

A=Absent P=Present E=Extensive

Parameter	Downstream	Midstream	Upstream
Description			
pH	6.19	5.69	5.48
Temperature (°C)	6.26	6.64	7.24
DO (mg/l)	12.28	12.34	11.87
Conductivity (uS/cm)	204	149	234
TDS (mg/l)	133	149	152
Turbidity (NTU)	5.16	1.2	1.2
Notes: Baro	768.6	769.1	767.4 mmHg

Bar Formation
☐ None ☐ Moderate
☒ Minor ☐ Extensive

Bank Erosion (see guidance sheet)

	Left Bank	Right Bank	Severity
Extent (m)	75	75	
Severity	2	2	0=none
Avg. Height	2.3m	2.3m	1=min
	1.0m	1.0m	2=mod
Maximum stream depth (cm)	91		3=severe

TOP OF GULLY
TOP OF ACTIVE CHANNEL
3 ← Maximum stream depth (cm)

Benthic Habitat Sampled (20 total)

	Sq. ft.
Riffle	12
Rootwad/Woody Debris	2
Leaf Pack	6
Submerged Vegetation	0
Undercut Banks	0
Other: N/A	0

Rootwads/Woody Debris

# Instream Woody Debris	7
# Dewatered Woody Debris	5
# Instream Rootwads	2
# Dewatered Rootwads	1

Stream Gradient

Location (ft)	Height (ft)	Water Depth (ft)

Photographs/Observations:
- STREAM BUFFER IS DOMINATED BY HEALTHY MID SUCCESSIONAL DECIDUOUS FOREST
- HUMAN DISRUPTION APPARENT (HOUSING >100m AWAY) NONE @ REACH ALONG HIKE
- 2 TRIBS (BEVERLY FED) FED BY GROUND WATER SEEP ON RIGHT BANK W/IN 75m REACH
- SUBSTRATE CONSISTS OF A HETEROGENEOUS MIXTURE OF SILT, CLAY, COBBLE/GRAVEL
- FAIR-GOOD HABITAT PRESENT TO STIMULATE
- VERNAL PODS FED BY GROUNDWATER
- IRON DEPOSITS PRESENT

MBSS Physical Habitat Assessment Sheet

Stream Habitat Assessment Guidance Sheet

Habitat Parameter	Optima 16-20	Sub-Optimal 11-15	Marginal 6-10	Poor 0-5
1. Instream Habitat[a] SCORE 11	Greater than 50% of a variety of cobble, boulder, submerged logs, undercut banks, snags, rootwads, aquatic plants or other stable habitat	30-50% of stable habitat. Adequate habitat	10-30% mix of stable habitat. Habitat availability less than desireable	Less than 10% stable habitat. Lack of habitat is obvious
2. Epifaunal Substrate[a] SCORE 10	Preferred substrate abundant, stable, and at full colonization potential (riffles well developed and dominated by cobble; and/or woody debris prevalent, not new; and not transient	Abund. of cobble with gravel and/or boulders common; or woody debris, aquatic veg., undercut banks common but not prevalent/suited for full colonization	Large boulders and/or bedrock prevalent; cobble, woody debris, or other preferred surfaces uncommon	Stable substrate lacking; or particles are over 75% surrounded by fine sediment or flocculent material
3. Velocity/Depth Diversity[a] SCORE 13	Slow (<0.3m/s), deep (>0.5m); slow, shallow (<0.5m); fast (>0.3m/s), deep; fast, shallow habitats all present	Only 3 of the 4 habitat categories present	Only 2 of the 4 habitat categories present	Dominated by 1 velocity/depth category (usually pools)
4. Pool/Glide/Eddy Quality[a] SCORE 12	Complex cover/&/or depth >1.5m; both deep (>0.5m)/shallows (<0.2m) present	Deep (>0.5m) areas present; but only moderate cover	Shallows (<0.2m) prevalent in pool/glide/eddy habitat; little cover	Max depth <0.2m in pool/glide/eddy habitat; or absent completely
5. Riffle/Run Quality[a] SCORE 8	Riffle/run depth generally >10cm, with maximum depth greater than 50 cm (maximum score); substrate stable (e.g. cobble, boulder) & variety of current velocities	Riffle/run depth generally 5-10cm, variety of current velocities	Riffle/run depth generally 1-5cm; primarily a single current velocity	Riffle/run depth <1cm; or riffle/run substrates concreted
6. Bank Stability[a] (facing downstream.) Score each bank LB SCORE 1 RB SCORE 1	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected. 10 9	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion. 8 7 6	Moderately unstable; 30-60% of bank in reach as areas of erosion; high erosion potential during floods. 5 4 3	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars. 2 1 0
7. Embeddedness SCORE 60 %	Percentage that gravel, cobble, and boulder particles are surrounded by fine sediment or flocculent material			
8. Shading SCORE 80 %	Percentage of segment that is shaded (duration is considered in scoring). 0% = fully exposed to sunlight at day in summer; 100% = fully and densely shaded all day in summer			
9. Riparian Buffer Zone Width (m)[a] LB 50 RB 50	Zone width in which human activity is not evident. 50m (164ft) is the maximum recorded value.			
10. Remoteness SCORE 11	Roads greater than 400 meters (0.25 mi) from stream	Roads within 400 meters (0.25 mi) of stream; stream NOT accessible by trail	Roads within 400 meters (0.25 mi) of stream; stream accessible by trail	Roads adjacent to stream.
11. Aesthetic (trash) Rating[a] SCORE 18	Little or no human refuse visible from stream channel or riparian zone	Refuse present in minor amounts	Refuse present in moderate amounts	Refuse abundant and unsightly
12. Number of Woody Debris and Rootwads[a] SCORE 9	Count only woody debris and rootwads within the wetted portion of the sampling segment. Count only woody debris >10cm (4in) diameter and >1.5m (5ft) long and rootwads with trunk diameter (at chest height) >15cm (6in) that are functional habitat within the wetted portion of the stream.			

(WINTERGREEN)
* NO TRAIL - RESIDENTIAL DEVELOPMENT ~75m away.

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS

STREAM NAME MPDS	LOCATION , AA CO, MD
STATION # REACH ID#	STREAM CLASS IV
UTM N UTM E	RIVER BASIN PATUXENT RIVER
STORET #	AGENCY CEI
INVESTIGATORS EW/CR	
FORM COMPLETED BY CR	DATE 4/6/16 TIME 9:45 AM PM
REASON FOR SURVEY BMI SAMPLING	

Parameters to be evaluated in sampling reach

Habitat Parameter	Condition Category			
	Optimal	Suboptimal	Marginal	Poor
1. Epifaunal Substrate/ Available Cover	Greater than 50% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient).	30-50% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale).	10-30% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 10% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
SCORE 10	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
2. Pool Substrate Characterization	Mixture of substrate materials, with gravel and firm sand prevalent; root mats and submerged vegetation common.	Mixture of soft sand, mud, or clay; mud may be dominant; some root mats and submerged vegetation present. W/ GRAVEL	All mud or clay or sand bottom; little or no root mat; no submerged vegetation.	Hard-pan clay or bedrock; no root mat or vegetation.
SCORE 12	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
3. Pool Variability	Even mix of large-shallow, large-deep, small-shallow, small-deep pools present.	Majority of pools large-deep; very few shallow.	Shallow pools much more prevalent than deep pools.	Majority of pools small-shallow or pools absent.
SCORE 12	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
4. Sediment Deposition	Little or no enlargement of islands or point bars and less than <20% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 20-50% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 50-80% of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; more than 80% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
SCORE 15	20 19 18 17 16	(15) 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
5. Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills >75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
SCORE 15	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS

Parameters to be evaluated broader than sampling reach

Habitat Parameter	Condition Category: Optimal	Suboptimal	Marginal	Poor
6. Channel Alteration NO CHANNEL-IZATION/ ALTERATION W/IN REACH	Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr) may be present, but recent channelization is not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.
SCORE 20	(20) 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
7. Channel Sinuosity	The bends in the stream increase the stream length 3 to 4 times longer than if it was in a straight line. (Note - channel braiding is considered normal in coastal plains and other low-lying areas. This parameter is not easily rated in these areas.)	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	Channel straight; waterway has been channelized for a long distance.
SCORE 15	20 19 18 17 16	(15) 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
8. Bank Stability (score each bank)	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.
SCORE 7 (LB)	Left Bank 10 9	8 (7) 6	5 4 3	2 1 0
SCORE 6 (RB)	Right Bank 10 9	8 7 (6)	5 4 3	2 1 0
9. Vegetative Protection (score each bank) Note: determine left or right side by facing downstream.	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height. DISRUPTION DUE TO EROSION/FREEZE THAW
SCORE 7 (LB)	Left Bank 10 9	8 (7) 6	5 4 3	2 1 0
SCORE 5 (RB)	Right Bank 10 9	8 7 6	(5) 4 3	2 1 0
10. Riparian Vegetative Zone Width (score each bank riparian zone)	Width of riparian zone >18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone.	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6-12 meters; human activities have impacted zone a great deal.	Width of riparian zone <6 meters: little or no riparian vegetation due to human activities.
SCORE 9 (LB)	Left Bank 10 (9)	8 7 6	5 4 3	2 1 0
SCORE 7 (RB)	Right Bank 10 9	8 (7) 6	5 4 3	2 1 0

Total Score 140

Form # EL2 - _____

v. 2009

MBSS SPRING HABITAT DATA SHEET

Page 1 of 2

SITE — Watershed Code: MP | Segment: 09 | Type: 2 | Year: 2016

Reviewer: First: MB / Second: JT

DATE — Year: 16 | Month: 04 | Day: 06

10 Dist. from Nearest Road to Site (m)

15 Trash Rating 0 - 20

LANDUSE (Y/N)

N	Old Field	Y	Residential
Y	Deciduous Forest	N	Commercial/Industrial
Y	Coniferous Forest	N	Cropland
N	Wetland	N	Pasture
N	Surface Mine	N	Orchard/Vineyard/Nursery
N	Landfill	N	Golf Course

RIPARIAN VEGETATION
(facing upstream)

	LEFT BANK	RIGHT BANK
Width (50m max)	SC	SC
Adjacent Land Cover	FR	M V
Vegetation Type	Y M R	Y M R
Buffer Breaks (Y/N)	N	N

ROAD CULVERT

Present in Segment (Y/N): N

Sampleable? (Y/N):

Width of Culvert (m):

Length of Culvert (m):

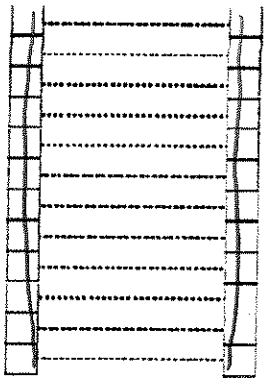
STREAM GRADIENT

	Location (m)	Height (m)
1		
2		
3		

Buffer Breaks

LEFT BANK / RIGHT BANK

Storm Drain
Tile Drain
Impervious Drainage
Gully
Orchard
Crop
Pasture
New Construction
Dirt Road
Gravel Road
Raw Sewage
Railroad



Buffer Break Types
(M = minor; S = severe)

CHANNELIZATION

N Evidence of Channel Straightening or Dredging (Y/N)

TYPE	EXTENT (m)		
	LEFT BANK	BOTTOM	RIGHT BANK
Concrete			
Gabion			
Rip-Rap			
Earthen Berm		N/A	
Dredge Spoil Off Channel		N/A	
Pipe Culvert			

Actual Coordinates
(If >30m distance between original coordinates and stream)

Lat
Lon

Stream Block Ht. (m)

Stream Block Type

Lat

Lon

v. 2009

MBSS SPRING INDEX PERIOD DATA SHEET

Page 2 of 7

SITE: Watershed Code MP | Segment 09 | Type 2 | Year 2016

Reviewer: First NB / Second JT

DATE: Year 16 | Month 04 | Day 06

CREW: NB/JT

STREAM: Rock Branch

TIME: 1045 (Military)

LOCALITY: Harwood, MD

SAMPLEABILITY

- ☑ Benthos
- ☑ Habitat Assessment
- ☑ Water Quality
- ☐ Vernal Pool [A] (PRESENT/ABSENT)

OTHER (SPECIFY)

SITE ACCESS ROUTE

S. Polling house Rd, South of Sigma Dr, cut into woods to stream

SAMPLE LABELS

Verified by: NB

QC LABEL

Watershed Code: MP | Segment: 09 (Letters only) | Type: 2 | Year: 2016

Dup. (D) or Blank (B): ☐ Verified by: _____

TEMP. LOGGER

	(Y/N)	(TIME - Military)	#
WATER	☐		#
AIR	☐		#

LOCATION: _____

PHOTODOCUMENTATION

Number	Title	Voucher (Y/N)
	M - US/DS	☐
	D - US/DS	☐
	U - US/DS	☐
	First trib @ midpoint LB	☐
		☐
		☐
		☐
		☐

BENTHIC HABITAT SAMPLED

- ☐☐ Riffle
- 10 Rootwad/Woody Debris
- 09 Leaf Pack
- ☐☐ Macrophytes
- 01 Undercut Banks
- ☐☐ Other _____

SAMPLING CONSID.: (☐ NUM. ANODES) _____

STREAM WIDTH (m): 0 m ☐☐☐ 75 m ☐☐☐

v. 2009

MBSS SPRING FAUNA DATA SHEET

SITE Watershed Code: MP | Segment: 09 | Type: 2 | Year: 2016

Reviewer: First: KB / Second: JT

HERPETOFAUNA

☒ None Observed

Species	Lifestage (Adult, Juv., Larval, Egg)	SEEN (Y/N)	HEARD (Y/N)	NUMBER RETAINED	NUMBER PHOTOS TAKEN

MUSSELS

☒ None Observed

Species	LIVE	DEAD	NUMBER RETAINED	NUMBER PHOTOS TAKEN

Corbicula: LIVE ☐ DEAD ☐ NONE ☐

CRAYFISHES

☑ None Observed

Species	NUMBER RETAINED
Juvenile	

Crayfish Burrows ☑

(Absent, Present, Extensive)

COMMENTS

Physical Habitat Assessment and Water Quality Data Sheet

Site ID: MP09
Subwatershed: Rock Branch
Length of Reach: 75m **Date:** 4/6/16
Team Members: KB/JT **Time:** 1045

Weather
Current: Sunny, 55°F
Past 24hrs: Sunny, 50°F
Past 48hrs: Rain showers, 65°F

Stream Character

- [M] Meandering
- [A] Braided
- [A] Riffle
- [A] Deep Pool >.5m
- [P] Shallow Pool <.5m
- [A] Gravel
- [A] Boulder >2m
- [A] Concrete/Gabion
- [P] Undercut Bank
- [P] Overhead Cover
- [A] Effluent Discharge
- [P] Emergent Vegetation
- [A] Floating Vegetation
- [A] Channelized
- [A] Straight
- [A] Run/Glide
- [P] Silt/Clay
- [P] Sand
- [P] Cobble
- [A] Boulder <2m
- [A] Bedrock
- [P] Rootwad
- [A] Storm Drain
- [A] Human Refuse
- [A] Beaver Pond

A=Absent P=Present E=Extensive

Parameter	Down-stream	Mid-stream	Up-stream
Description			
pH	6.81	6.82	6.7
Temperature (°C)	5.6	5.7	5.6
DO (mg/l)	13.07	13.13	13.05
Conductivity (uS/cm)	135.6	134.2	134.3
TDS (mg/l)	139.1	138.45	137.6
Turbidity (NTU)	10.1	11.5	9.6

Notes:

Bar Formation

- [x] None
- [ ] Minor
- [ ] Moderate
- [ ] Extensive

Bank Erosion (see guidance sheet)

	Left Bank	Right Bank
Extent (m)	75	75
Severity	1	1
Avg. Height	0.5m	0.5m

Severity: 0=none 1=min 2=mod 3=severe

Maximum stream depth (cm) 60

Photographs/Observations:
M - US/DS
U - US/DS
D - US/DS

Just from a midpoint LB

Benthic Habitat Sampled (20 total)

	Sq. ft.
Riffle	12
Rootwad/Woody Debris	10
Leaf Pack	9
Submerged Vegetation	0
Undercut Banks	1
Other:	0

Rootwads/Woody Debris

# Instream Woody Debris	0
# Dewatered Woody Debris	3
# Instream Rootwads	1
# Dewatered Rootwads	1

Stream Gradient

Location (ft)	Height (ft)	Water Depth (ft)

MBSS Physical Habitat Assessment Sheet

Stream Habitat Assessment Guidance Sheet				
Habitat Parameter	Optimal 16-20	Sub-Optimal 11-15	Marginal 6-10	Poor 0-5
1. Instream Habitat* SCORE 6	Greater than 50% of a variety of cobble, boulder, submerged logs, undercut banks, snags, rootwads, aquatic plants or other stable habitat	30-50% of stable habitat. Adequate habitat	10-30% mix of stable habitat. Habitat availability less than desireable	Less than 10% stable habitat. Lack of habitat is obvious
2. Epifaunal Substrate* SCORE 5	Preferred substrate abundant, stable, and at full colonization potential (riffles well developed and dominated by cobble; and/or woody debris prevalent, not new, and not transient	Abund. of cobble with gravel and/or boulders common; or woody debris, aquatic veg., undercut banks common but not prevalent/suited for full colonization	Large boulders and/or bedrock prevalent; cobble, woody debris, or other preferred surfaces uncommon	Stable substrate lacking; or particles are over 75% surrounded by fine sediment or flocculent material
3. Velocity/Depth Diversity* SCORE 7	Slow (<0.3m/s), deep (>0.5m); slow, shallow (<0.5m); fast (>0.3m/s), deep; fast, shallow habitats all present	Only 3 of the 4 habitat categories present	Only 2 of the 4 habitat categories present	Dominated by 1 velocity/depth category (usually pools)
4. Pool/Glide/Eddy Quality* SCORE 6	Complex cover&/or depth >1.5m; both deep (>0.5m)/shallows (<0.2m) present	Deep (>0.5m) areas present; but only moderate cover	Shallows (<0.2m) prevalent in pool/glide/eddy habitat; little cover	Max depth <0.2m in pool/glide/eddy habitat; or absent completely
5. Riffle/Run Quality* SCORE 2	Riffle/run depth generally >10cm, with maximum depth greater than 50 cm (maximum score); substrate stable (e.g. cobble, boulder) & variety of current velocities	Riffle/run depth generally 5-10cm, variety of current velocities	Riffle/run depth generally 1-5cm; primarily a single current velocity	Riffle/run depth <1cm; or riffle/run substrates concreted
6. Bank Stability* (facing downstream.) Score each bank LB SCORE 3 RB SCORE 3	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected. 10 9	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion. 8 7 6	Moderately unstable; 30-60% of bank in reach as areas of erosion; high erosion potential during floods. 5 4 3	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars. 2 1 0
7. Embeddedness SCORE 75 %	Percentage that gravel, cobble, and boulder particles are surrounded by fine sediment or flocculent material			
8. Shading SCORE 75 %	Percentage of segment that is shaded (duration is considered in scoring). 0% = fully exposed to sunlight all day in summer; 100% = fully and densely shaded all day in summer			
9. Riparian Buffer Zone Width (m)* LB 50 RB 15	Zone width in which human activity is not evident. 50m (164ft) is the maximum recorded value.			
10. Remoteness* SCORE 2	Roads greater than 400 meters (0.25 mi) from stream	Roads within 400 meters (0.25 mi) of stream; stream NOT accessible by trail.	Roads within 400 meters (0.25 mi) of stream; stream accessible by trail.	Roads adjacent to stream.
11. Aesthetic (trash) Rating* SCORE 11	Little or no human refuse visible from stream channel or riparian zone	Refuse present in minor amounts	Refuse present in moderate amounts	Refuse abundant and unsightly
12. Number of Woody Debris and Rootwads* SCORE	Count only woody debris and rootwads within the wetted portion of the sampling segment. Count only woody debris >10cm (4in) diameter and >1.5m (5ft) long and rootwads with trunk diameter (at chest height) >15cm (6in) that are functional habitat within the wetted portion of the stream.			

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS

STREAM NAME	MD09	LOCATION	Harwood, MD
STATION #	REACH ID#	STREAM CLASS	Perennial - II
UTM N	UTM E	RIVER BASIN	Patuxent
STORET #		AGENCY	CG
INVESTIGATORS	KB/JT		
FORM COMPLETED BY	KB	DATE / TIME	4/6/16 1045 AM PM
		REASON FOR SURVEY	MBSS

Parameters to be evaluated in sampling reach

Habitat Parameter	Condition Category			
	Optimal	Suboptimal	Marginal	Poor
1. Epifaunal Substrate/ Available Cover	Greater than 50% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient).	30-50% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale).	10-30% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 10% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
SCORE 7	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
2. Pool Substrate Characterization	Mixture of substrate materials, with gravel and firm sand prevalent; root mats and submerged vegetation common.	Mixture of soft sand, mud, or clay; mud may be dominant; some root mats and submerged vegetation present.	All mud or clay or sand bottom; little or no root mat; no submerged vegetation.	Hard-pan clay or bedrock; no root mat or vegetation.
SCORE 7	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
3. Pool Variability	Even mix of large-shallow, large-deep, small-shallow, small-deep pools present.	Majority of pools large-deep; very few shallow.	Shallow pools much more prevalent than deep pools.	Majority of pools small-shallow or pools absent.
SCORE 6	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
4. Sediment Deposition	Little or no enlargement of islands or point bars and less than <20% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 20-50% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 50-80% of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; more than 80% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
SCORE 8	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
5. Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills >75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
SCORE 16	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS

Parameters to be evaluated broader than sampling reach

Habitat Parameter	Condition Category			
	Optimal	Suboptimal	Marginal	Poor
6. Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr) may be present, but recent channelization is not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.
SCORE 16	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
7. Channel Sinuosity	The bends in the stream increase the stream length 3 to 4 times longer than if it was in a straight line. (Note - channel braiding is considered normal in coastal plains and other low-lying areas. This parameter is not easily rated in these areas.)	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	Channel straight; waterway has been channelized for a long distance.
SCORE 7	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
8. Bank Stability (score each bank)	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.
SCORE 4 (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE 4 (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0
9. Vegetative Protection (score each bank) Note: determine left or right side by facing downstream.	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
SCORE 2 (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE 2 (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0
10. Riparian Vegetative Zone Width (score each bank riparian zone)	Width of riparian zone >18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone.	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6-12 meters; human activities have impacted zone a great deal.	Width of riparian zone <6 meters: little or no riparian vegetation due to human activities.
SCORE 10 (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE 5 (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0

Total Score 94

v. 2009

MBSS SPRING HABITAT DATA SHEET

SITE — Watershed Code: mp | Segment: 1109 A | Type: 2 | Year: 2016

Reviewer: First: JS / Second: DV

DATE — Year: 16 | Month: 04 | Day: 19

760 Dist. from Nearest Road to Site (m)

17 Trash Rating 0 - 20

LANDUSE (Y/N)

N	Old Field	N	Residential
Y	Deciduous Forest	N	Commercial/Industrial
N	Coniferous Forest	N	Cropland
N	Wetland	N	Pasture
N	Surface Mine	N	Orchard/Vineyard/Nursery
N	Landfill	N	Golf Course

ROAD CULVERT

Present in Segment (Y/N): N

Sampleable? (Y/N):

Width of Culvert (m):

Length of Culvert (m):

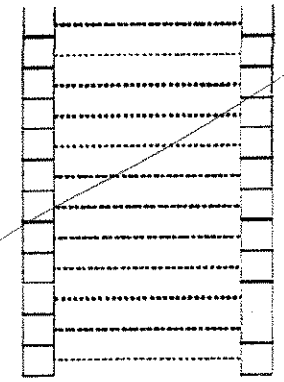
STREAM GRADIENT

	Elevation (m)	Height (m)
1		
2		
3		

RIPARIAN VEGETATION
(facing upstream)

	LEFT BANK	RIGHT BANK
Width (50m max)	50	50
Adjacent Land Cover	FR	FR
Vegetation Type	MYRO	MYRO
Buffer Breaks (Y/N)	N	N

Storm Drain
Tile Drain
Impervious Drainage
Gully
Orchard
Crop
Pasture
New Construction
Dirt Road
Gravel Road
Raw Sewage
Railroad



Buffer Break Types
(M = minor; S = severe)

CHANNELIZATION

N Evidence of Channel Straightening or Dredging (Y/N)

TYPE	EXTENT (m) LEFT BANK	BOTTOM	RIGHT BANK
Concrete			
Gebion			
Rip-Rap			
Earthen Berm		N/A	
Dredge Spoil Off Channel		N/A	
Pipe Culvert			

Actual Coordinates
(If >30m distance between original coordinates and stream)

Lat 38 79 38 1 H

Lon 76 64 99 40

Stream Block Ht. (m):

Stream Block Type:

Lat:

Lon:

v. 2009

MBSS SPRING INDEX PERIOD DATA SHEET

Page 2 Of 2

SITE Watershed Code MP | Segment 109 | Type A | Year 2016

Reviewer: First JS / Second DV

DATE Year 16 Month 04 Day 19

CREW: JS / DV

STREAM: Cabin Branch

TIME 1030 (Military)

LOCALITY: Bristol

SAMPLEABILITY

- [✓] Benthos
- [✓] Habitat Assessment
- [✓] Water Quality
- [N] Vernal Pool [ ] (PRESENT/ABSENT)

OTHER (SPECIFY)

SITE ACCESS ROUTE

BAYFRONT RD, PERMISSION FROM PROP OWNER. DROVE THROUGH GATE

SAMPLE LABELS

Verified by: DV

QC LABEL

Watershed Code MP | Segment 109 (Letters only) A | Type 2 | Year 2016

Dup. (D) or Blank (B): [ ] Verified by: DV

TEMP. LOGGER

	(Y/N)	(TIME - Military)	#
WATER			
AIR			

LOCATION

PHOTODOCUMENTATION

Number	Title	Voucher (Y/N)

BENTHIC HABITAT SAMPLED

13	Riffle	06	Leaf Pack	00	Undercut Banks
01	Rootwad/Woody Debris	00	Macrophytes	00	Other

SAMPLING CONSID.: ([ ] NUM. ANODES)

STREAM WIDTH (m): 10 (0 m) 10 (75 m)

v. 2009

MBSS SPRING FAUNA DATA SHEET

SITE — Watershed Code: MA | Segment: 109A | Type: 2 | Year: 2016

Reviewer: First: JS / Second: OK

HERPETOFAUNA

☐ None Observed

Species	Lifestage: Adult	Juv.	Larval	Egg	SEEN (Y/N)	HEARD (Y/N)	NUMBER RETAINED	NUMBER PHOTOS TAKEN
GREEN FROGS	✓				✓	N	N	1
SALAMANDER (JUVINILE ?)		✓			✓	N	N	1

MUSSELS

☑ None Observed

Species	LIVE	DEAD	NUMBER RETAINED	NUMBER PHOTOS TAKEN

Corbicula — LIVE ☐ DEAD ☐ NONE ☐

CRAYFISHES

☑ None Observed

Species	NUMBER RETAINED

Crayfish Burrows: P
(Absent, Present, Extensive)

COMMENTS

Physical Habitat Assessment and Water Quality Data Sheet

Site ID: MP 109A
Subwatershed: CABIN BRANCH
Length of Reach: 75 M **Date:** 4/19
Team Members: JS + DV **Time:** 10:04

Stream Character

P Meandering	A Channelized
A Braided	A Straight
P Riffle	P Run/Glide
A Deep Pool >.5m	P Silt/Clay
P Shallow Pool <.5m	P Sand
P Gravel	A Cobble
A Boulder >2m	A Boulder <2m
A Concrete/Gabion	A Bedrock
P Undercut Bank	P Rootwad
P Overhead Cover	A Storm Drain
A Effluent Discharge	P Human Refuse
A Emergent Vegetation	A Beaver Pond
A Floating Vegetation	

A=Absent P=Present E=Extensive

Bar Formation
☐ None ☑ Moderate
☐ Minor ☐ Extensive

Bank Erosion (see guidance sheet)

	Left Bank	Right Bank	Severity:
Extent (m)	10	260	
Severity	2	2	0=none
Avg. Height	3'	4.5'	1=min
			2=mod
			3=severe

Maximum stream depth (cm) 20

Benthic Habitat Sampled (20 total)	Sq. ft.
Riffle	13
Rootwad/Woody Debris	1
Leaf Pack	6
Submerged Vegetation	
Undercut Banks	
Other:	

Rootwads/Woody Debris

# Instream Woody Debris	9
# Dewatered Woody Debris	4
# Instream Rootwads	1
# Dewatered Rootwads	4

Stream Gradient

Location (ft)	Height (ft)	Water Depth (ft)

Weather
Current: 70's SUNNY
Past 24hrs: SUNNY
Past 48hrs: SUNNY

Parameter	Down-stream	Mid-stream	Up-stream
Description			
pH	6.05	6.17	6.19
Temperature (°C)	13.92	14.31	14.68
DO (mg/l)	10.83	10.59	10.05
Conductivity (uS/cm)	22	105	107
TDS (mg/l) g/L	18	87	87
Turbidity (NTU)	11.6	4.9	1.7

Notes: _____

Photographs/Observations:

MP 109A

MBSS Physical Habitat Assessment Sheet

Stream Habitat Assessment Guidance Sheet				
Habitat Parameter	Optimal 16-20	Sub-Optimal 11-15	Marginal 6-10	Poor 0-5
1. Instream Habitat* SCORE 14	Greater than 50% of a variety of cobble, boulder, submerged logs, undercut banks, snags, rootwads, aquatic plants or other stable habitat	30-50% of stable habitat. Adequate habitat	10-30% mix of stable habitat. Habitat availability less than desireable	Less than 10% stable habitat. Lack of habitat is obvious
2. Epifaunal Substrate* SCORE 13	Preferred substrate abundant, stable, and at full colonization potential (riffles well developed and dominated by cobble; and/or woody debris prevalent, not new, and not transient	Abund. of cobble with gravel and/or boulders common; or woody debris, aquatic veg., undercut banks common but not prevalent/suited for full colonization	Large boulders and/or bedrock prevalent; cobble, woody debris, or other preferred surfaces uncommon	Stable substrate lacking; or particles are over 75% surrounded by fine sediment or flocculent material
3. Velocity/Depth Diversity* SCORE 12	Slow (<0.3m/s), deep (>0.5m); slow, shallow (<0.5m); fast (>0.3m/s), deep; fast, shallow habitats all present	Only 3 of the 4 habitat categories present	Only 2 of the 4 habitat categories present	Dominated by 1 velocity/depth category (usually pools)
4. Pool/Glide/Eddy Quality* SCORE 10	Complex cover&/or depth >1.5m; both deep (>0.5m)/shallows (<0.2m) present	Deep (>0.5m) areas present; but only moderate cover	Shallows (<0.2m) prevalent in pool/glide/eddy habitat; little cover	Max depth <0.2m in pool/glide/eddy habitat; or absent completely
5. Riffle/Run Quality* SCORE 10	Riffle/run depth generally >10cm, with maximum depth greater than 50 cm (maximum score); substrate stable (e.g. cobble, boulder) & variety of current velocities	Riffle/run depth generally 5-10cm, variety of current velocities	Riffle/run depth generally 1-5cm; primarily a single current velocity	Riffle/run depth <1cm; or riffle/run substrates concreted
6. Bank Stability* (facing downstream.) Score each bank LB SCORE 5 RB SCORE 5	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected. 10 9	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion. 8 7 6	Moderately unstable; 30-60% of bank in reach as areas of erosion; high erosion potential during floods. 5 4 3	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars. 2 1 0
7. Embeddedness SCORE 70 %	Percentage that gravel, cobble, and boulder particles are surrounded by fine sediment or flocculent material			
8. Shading* SCORE 65 %	Percentage of segment that is shaded (duration is considered in scoring). 0% = fully exposed to sunlight all day in summer, 100% = fully and densely shaded all day in summer			
9. Riparian Buffer Zone Width (m)* LB 50 RB 50	Zone width in which human activity is not evident. 50m (164ft) is the maximum recorded value.			
10. Remoteness* SCORE 18	Roads greater than 400 meters (0.25 mi) from stream	Roads within 400 meters (0.25 mi) of stream; stream NOT accessible by trail.	Roads within 400 meters (0.25 mi) of stream; stream accessible by trail.	Roads adjacent to stream.
11. Aesthetic (trash) Rating* SCORE 17	Little or no human refuse visible from stream channel or riparian zone	Refuse present in minor amounts	Refuse present in moderate amounts	Refuse abundant and unsightly
12. Number of Woody Debris and Rootwads* SCORE 9	Count only woody debris and rootwads within the wetted portion of the sampling segment. Count only woody debris >10cm (4in) diameter and >1.5m (5ft) long and rootwads with trunk diameter (at chest height) >15cm (6in) that are functional habitat within the wetted portion of the stream.			

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HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS

STREAM NAME MP109A		LOCATION Bristol	
STATION #	REACH ID#	STREAM CLASS 2	
UTM N	UTM E	RIVER BASIN middle Patuxent	
STORET #		AGENCY Century	
INVESTIGATORS SS/DV			
FORM COMPLETED BY DV	DATE 4/19/16 TIME - 10:30 PM	REASON FOR SURVEY BMI	

Parameters to be evaluated in sampling reach

Habitat Parameter	Condition Category			
	Optimal	Suboptimal	Marginal	Poor
1. Epifaunal Substrate/ Available Cover SCORE 13	Greater than 50% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient). 20 19 18 17 16	30-50% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale). 15 14 13 12 11	10-30% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed. 10 9 8 7 6	Less than 10% stable habitat; lack of habitat is obvious; substrate unstable or lacking. 5 4 3 2 1 0
2. Pool Substrate Characterization SCORE 16	Mixture of substrate materials, with gravel and firm sand prevalent; root mats and submerged vegetation common. 20 19 18 17 16	Mixture of soft sand, mud, or clay; mud may be dominant; some root mats and submerged vegetation present. 15 14 13 12 11	All mud or clay or sand bottom; little or no root mat; no submerged vegetation. 10 9 8 7 6	Hard-pan clay or bedrock; no root mat or vegetation. 5 4 3 2 1 0
3. Pool Variability SCORE 8	Even mix of large-shallow, large-deep, small-shallow, small-deep pools present. 20 19 18 17 16	Majority of pools large-deep; very few shallow. 15 14 13 12 11	Shallow pools much more prevalent than deep pools. 10 9 8 7 6	Majority of pools small-shallow or pools absent. 5 4 3 2 1 0
4. Sediment Deposition SCORE 13	Little or no enlargement of islands or point bars and less than <20% of the bottom affected by sediment deposition. 20 19 18 17 16	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 20-50% of the bottom affected; slight deposition in pools. 15 14 13 12 11	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 50-80% of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent. 10 9 8 7 6	Heavy deposits of fine material, increased bar development; more than 80% of the bottom changing frequently; pools almost absent due to substantial sediment deposition. 5 4 3 2 1 0
5. Channel Flow Status SCORE 11	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed. 20 19 18 17 16	Water fills >75% of the available channel; or <25% of channel substrate is exposed. 15 14 13 12 11	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed. 10 9 8 7 6	Very little water in channel and mostly present as standing pools. 5 4 3 2 1 0

Form # EL - _____

MP109A

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HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS

Parameters to be evaluated broader than sampling reach

Habitat Parameter	Condition Category			
	Optimal	Suboptimal	Marginal	Poor
6. Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr) may be present, but recent channelization is not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.
SCORE 19	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
7. Channel Sinuosity	The bends in the stream increase the stream length 3 to 4 times longer than if it was in a straight line. (Note - channel braiding is considered normal in coastal plains and other low-lying areas. This parameter is not easily rated in these areas.)	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	Channel straight; waterway has been channelized for a long distance.
SCORE 7	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
8. Bank Stability (score each bank)	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.
SCORE 5 (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE 6 (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0
9. Vegetative Protection (score each bank) Note: determine left or right side by facing downstream.	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
SCORE 8 (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE 8 (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0
10. Riparian Vegetative Zone Width (score each bank riparian zone)	Width of riparian zone >18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone.	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6-12 meters; human activities have impacted zone a great deal.	Width of riparian zone <6 meters: little or no riparian vegetation due to human activities.
SCORE 10 (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE 10 (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0

Total Score 134

v. 2009

MBSS SPRING HABITAT DATA SHEET

SITE — Watershed Code: MP | Segment: 111 | Type: 1 | Year: 2016

Reviewer: First: JT / Second: KB

DATE — Year: 16 | Month: 03 | Day: 31

300 Dist. from Nearest Road to Site (m)

11 Trash Rating 0 - 20

LANDUSE (Y/N)

N	Old Field	N	Residential
Y	Deciduous Forest	N	Commercial/Industrial
N	Coniferous Forest	N	Cropland
Y	Wetland	N	Pasture
N	Surface Mine	N	Orchard/Vineyard/Nursery
N	Landfill	N	Golf Course

ROAD CULVERT

Present in Segment (Y/N): N

Sampleable? (Y/N):

Width of Culvert (m):

Length of Culvert (m):

STREAM GRADIENT

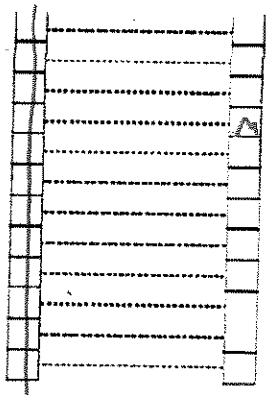
	Location (m)	Height (m)
1		
2		
3		

RIPARIAN VEGETATION

(facing upstream)

	LEFT BANK	RIGHT BANK
Width (50m max)	50	40
Adjacent Land Cover	FK	FR
Vegetation Type	RYMO	RYMO
Buffer Breaks (Y/N)	N	Y

	LEFT BANK	RIGHT BANK
Storm Drain		
Tile Drain		
Impervious Drainage		
Gully		
Orchard		
Crop		
Pasture		
New Construction		
Dirt Road		
Gravel Road		
Raw Sewage		
Railroad		



Buffer Break Types
(M = minor; S = severe)

CHANNELIZATION

N Evidence of Channel Straightening or Dredging (Y/N)

TYPE	EXTENT (m)		
	LEFT BANK	BOTTOM	RIGHT BANK
Concrete			
Gabion			
Rip-Rap			
Earthen Berm		N/A	
Dredge Spoil Off Channel		N/A	
Pipe Culvert			

Actual Coordinates
(If >30m distance between original coordinates and stream)

Lat

Lon

Stream Block Ht. (m)

Stream Block Type

Lat

Lon

v. 2009

MBSS SPRING INDEX PERIOD DATA SHEET

Page 2 Of 7

SITE Watershed Code MP | Segment 11 | Type 1 | Year 2016

Reviewer: First JT / Second KB

DATE Year 16 Month 03 Day 31

CREW: KB + JT

STREAM: MP11

TIME 1349 (Military)

LOCALITY: Lothian

SAMPLEABILITY

- [V] Benthos
- [V] Habitat Assessment
- [V] Water Quality
- [ ] Vernal Pool [A] (PRESENT/ABSENT)

OTHER (SPECIFY)

SITE ACCESS ROUTE

Park along Sands Rd, hike beyond large beaver created wetland.

SAMPLE LABELS

Verified by: KB

QC LABEL

Watershed Code MP | Segment 11 (Letters only) | Type 1 | Year 2016

Dup. (D) or Blank (B): [ ] Verified by: _____

TEMP. LOGGER

	(Y/N)	(TIME - Military)	#
WATER	[ ]		#
AIR	[ ]		#

LOCATION _____

PHOTODOCUMENTATION

Number	Title	Voucher (Y/N)
	Midpoint US/DS	[ ]
	Downstream US/DS	[ ]
	Upstream US/DS	[ ]
	Trib in left Bank	[ ]
	Beaver dam stopping up wetland	[ ]
		[ ]
		[ ]
		[ ]

BENTHIC HABITAT SAMPLED

- [14] Riffle
- [4] Rootwad/Woody Debris
- [2] Leaf Pack
- [ ] Macrophytes
- [ ] Undercut Banks
- [ ] Other _____

SAMPLING CONSID.: ([ ] NUM. ANODES)

STREAM WIDTH (m): 0 m _____ 75 m _____

v. 2009

MBSS SPRING FAUNA DATA SHEET

SITE Watershed Code [ ][ ][M][P] Segment [0][1][1] Type [1] Year [2][0][1][6]

Reviewer: First JT / Second KB

HERPETOFAUNA

☒ None Observed

Species	Lifestage (Adult, Juv., Larval, Egg)	SEEN (Y/N)	HEARD (Y/N)	NUMBER RETAINED	NUMBER PHOTOS TAKEN
	☐☐☐☐	☐	☐	☐	☐
	☐☐☐☐	☐	☐	☐	☐
	☐☐☐☐	☐	☐	☐	☐
	☐☐☐☐	☐	☐	☐	☐
	☐☐☐☐	☐	☐	☐	☐
	☐☐☐☐	☐	☐	☐	☐
	☐☐☐☐	☐	☐	☐	☐

MUSSELS

☒ None Observed

Species	LIVE	DEAD	NUMBER RETAINED	NUMBER PHOTOS TAKEN
	☐	☐	☐☐	☐
	☐	☐	☐☐	☐
	☐	☐	☐☐	☐
	☐	☐	☐☐	☐
	☐	☐	☐☐	☐

Corbicula LIVE ☐ DEAD ☐ NONE ☐

CRAYFISHES

☐ None Observed

Species	NUMBER RETAINED
~~[illegible]~~	2
	☐☐
	☐☐
	☐☐
	☐☐

Crayfish Burrows [A]
(Absent, Present, Extensive)

COMMENTS

fish observed, caught, & released

Physical Habitat Assessment and Water Quality Data Sheet

Site ID: MP11
Subwatershed: Middle Patuxent
Length of Reach: 75m **Date:** 3/31/16
Team Members: KR/JT **Time:** 1:48

Weather
Current: cloudy ~50°F
Past 24hrs: clear
Past 48hrs: clear

Stream Character

- [P] Meandering
- [A] Braided
- [P] Riffle
- [P] Deep Pool >.5m
- [P] Shallow Pool <.5m
- [P] Gravel
- [A] Boulder >2m
- [A] Concrete/Gabion
- [P] Undercut Bank
- [P] Overhead Cover
- [A] Effluent Discharge
- [P] Emergent Vegetation
- [A] Floating Vegetation

- [P] Channelized
- [A] Straight
- [P] Run/Glide
- [P] Silt/Clay
- [P] Sand
- [P] Cobble
- [A] Boulder <2m
- [A] Bedrock
- [P] Rootwad
- [A] Storm Drain
- [A] Human Refuse
- [A] Beaver Pond

A=Absent *P=Present* *E=Extensive*

Parameter	Down-stream	Mid-stream	Up-stream
Description			
pH	6.93	7.06	6.99
Temperature (°C)	13.9	13.7	13.7
DO (mg/l)	11.05	10.92	11.11
Conductivity (uS/cm)	147.1	146.2	146
TDS (mg/l)	121.55	121.55	120.9
Turbidity (NTU)	12.1	9.29	9.18

Notes: present upstream, large

Bar Formation

- [ ] None
- [x] Minor
- [ ] Moderate
- [ ] Extensive

Bank Erosion (see guidance sheet)

	Left Bank	Right Bank
Extent (m)	75	75
Severity	2	2
Avg. Height	1m	1m

Severity: *0=none* *1=min* *2=mod* *3=severe*

Maximum stream depth (cm): 75cm

Benthic Habitat Sampled (20 total)

	Sq. ft.
Riffle	14
Rootwad/Woody Debris	4
Leaf Pack	2
Submerged Vegetation	
Undercut Banks	
Other:	

Rootwads/Woody Debris

# Instream Woody Debris	1
# Dewatered Woody Debris	2
# Instream Rootwads	4
# Dewatered Rootwads	2

Stream Gradient

Location (ft)	Height (ft)	Water Depth (ft)

Photographs/Observations:
Midpoint US/DS
Upstream US/DS
Downstream US/DS
Trib in left bank

MBSS Physical Habitat Assessment Sheet

Stream Habitat Assessment Guidance Sheet

Habitat Parameter	Optima: 16-20	Sub-Optimal 11-15	Marginal 6-10	Poor 0-5
1. Instream Habitat* SCORE 15	Greater than 50% of a variety of cobble, boulder, submerged logs, undercut banks, snags, rootwads, aquatic plants or other stable habitat	30-50% of stable habitat. Adequate habitat	10-30% mix of stable habitat. Habitat availability less than desireable	Less than 10% stable habitat. Lack of habitat is obvious
2. Epifaunal Substrate* SCORE 5	Preferred substrate abundant, stable, and at full colonization potential (riffles well developed and dominated by cobble; and/or woody debris prevalent, not new, and not transient	Abund. of cobble with gravel and/or boulders common; or woody debris, aquatic veg., undercut banks common but not prevalent/suited for full colonization	Large boulders and/or bedrock prevalent; cobble, woody debris, or other preferred surfaces uncommon	Stable substrate lacking; or particles are over 75% surrounded by fine sediment or flocculent material
3. Velocity/Depth Diversity* SCORE 15	Slow (<0.3m/s), deep (>0.5m); slow, shallow (<0.5m); fast (>0.3m/s), deep; fast, shallow habitats all present	Only 3 of the 4 habitat categories present	Only 2 of the 4 habitat categories present	Dominated by 1 velocity/depth category (usually pools)
4. Pool/Glide/Eddy Quality* SCORE 14	Complex cover&/or depth >1.5m; both deep (>0.5m)/shallows (<0.2m) present	Deep (>0.5m) areas present; but only moderate cover	Shallows (<0.2m) prevalent in pool/glide/eddy habitat; little cover	Max depth <0.2m in pool/glide/eddy habitat; or absent completely
5. Riffle/Run Quality* SCORE 16	Riffle/run depth generally >10cm, with maximum depth greater than 50 cm (maximum score); substrate stable (e.g. cobble, boulder) & variety of current velocities	Riffle/run depth generaly 5-10cm, variety of current velocities	Riffle/run depth generally 1-5cm; primarily a single current velocity	Riffle/run depth <1cm; or riffle/run substrates concreted
6. Bank Stability* (facing downstream.) Score each bank LB SCORE 6 RB SCORE 6	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected. 10 9	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion. 8 7 6	Moderately unstable; 30-60% of bank in reach as areas of erosion; high erosion potential during floods. 5 4 3	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars. 2 1 0
7. Embeddedness SCORE 75 %	Percentage that gravel, cobble, and boulder particles are surrounded by fine sediment or flocculent material			
8. Shading SCORE 90 %	Percentage of segment that is shaded (duration is considered in scoring). 0% = fully exposed to sunlight all day in summer. 100% = fully and densely shaded all day in summer			
9. Riparian Buffer Zone Width (m)* LB 50 RB 50	Zone width in which human activity is not evident. 50m (164ft) is the maximum recorded value.			
10. Remoteness SCORE 20	Roads greater than 400 meters (0.25 mi) from stream	Roads within 400 meters (0.25 mi) of stream; stream NOT accessible by trail.	Roads within 400 meters (0.25 mi) of stream; stream accessible by trail.	Roads adjacent to stream.
11. Aesthetic (trash) Rating* SCORE 11	Little or no human refuse visible from stream channel or riparian zone	Refuse present in minor amounts	Refuse present in moderate amounts	Refuse abundant and unsightly
12. Number of Woody Debris and Rootwads* SCORE 5	Count only woody debris and rootwads within the wetted portion of the sampling segment. Count only woody debris >10cm (4in) diameter and >1.5m (5ft) long and rootwads with trunk diameter (at chest height) >15cm (6in) that are functional habitat within the wetted portion of the stream.			

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS

STREAM NAME MP 11	LOCATION Lothian, MD
STATION # _____ REACH ID# _____	STREAM CLASS PERENNIAL
UTM N _____ UTM E	RIVER BASIN Patuxent River
STORET #	AGENCY CEI
INVESTIGATORS KB/JT	
FORM COMPLETED BY JT	DATE 3/31/16 TIME ~1:42 (PM)
REASON FOR SURVEY BMI Sampling	

Parameters to be evaluated in sampling reach

Habitat Parameter	Condition Category			
	Optimal	Suboptimal	Marginal	Poor
1. Epifaunal Substrate/ Available Cover SCORE 10	Greater than 50% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient). 20 19 18 17 16	30-50% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale). 15 14 13 12 11	10-30% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed. 10 9 8 7 6	Less than 10% stable habitat; lack of habitat is obvious; substrate unstable or lacking. 5 4 3 2 1 0
2. Pool Substrate Characterization SCORE 9	Mixture of substrate materials, with gravel and firm sand prevalent; root mats and submerged vegetation common. 20 19 18 17 16	Mixture of soft sand, mud, or clay; mud may be dominant; some root mats and submerged vegetation present. 15 14 13 12 11	All mud or clay or sand bottom; little or no root mat; no submerged vegetation. 10 9 8 7 6	Hard-pan clay or bedrock; no root mat or vegetation. 5 4 3 2 1 0
3. Pool Variability SCORE 16	Even mix of large-shallow, large-deep, small-shallow, small-deep pools present. 20 19 18 17 16	Majority of pools large-deep; very few shallow. 15 14 13 12 11	Shallow pools much more prevalent than deep pools. 10 9 8 7 6	Majority of pools small-shallow or pools absent. 5 4 3 2 1 0
4. Sediment Deposition SCORE 9	Little or no enlargement of islands or point bars and less than <20% of the bottom affected by sediment deposition. 20 19 18 17 16	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 20-50% of the bottom affected; slight deposition in pools. 15 14 13 12 11	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 50-80% of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent. 10 9 8 7 6	Heavy deposits of fine material, increased bar development; more than 80% of the bottom changing frequently; pools almost absent due to substantial sediment deposition. 5 4 3 2 1 0
5. Channel Flow Status SCORE 8	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed. 20 19 18 17 16	Water fills >75% of the available channel; or <25% of channel substrate is exposed. 15 14 13 12 11	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed. 10 9 8 7 6	Very little water in channel and mostly present as standing pools. 5 4 3 2 1 0

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS

Parameters to be evaluated broader than sampling reach

Habitat Parameter	Condition Category			
	Optimal	Suboptimal	Marginal	Poor
6. Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr) may be present, but recent channelization is not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.
SCORE 18	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
7. Channel Sinuosity	The bends in the stream increase the stream length 3 to 4 times longer than if it was in a straight line. (Note - channel braiding is considered normal in coastal plains and other low-lying areas. This parameter is not easily rated in these areas.)	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	Channel straight; waterway has been channelized for a long distance.
SCORE 11	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
8. Bank Stability (score each bank)	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.
SCORE 5 (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE 5 (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0
9. Vegetative Protection (score each bank) Note: determine left or right side by facing downstream.	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
SCORE 5 (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE 5 (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0
10. Riparian Vegetative Zone Width (score each bank riparian zone)	Width of riparian zone >18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone.	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6-12 meters; human activities have impacted zone a great deal.	Width of riparian zone <6 meters: little or no riparian vegetation due to human activities.
SCORE 10 (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE 10 (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0

Total Score 121

Form # EL2 - _____

v. 2009

MBSS SPRING HABITAT DATA SHEET

Page 1 of 7

SITE — Watershed Code: MP | Segment: 112 | Type: 20 | Year: 2016

Reviewer: First: JS / Second: CR

DATE — Year: 16 | Month: 09 | Day: 14 A

800 Dist. from Nearest Road to Site (m)

19 Trash Rating 0 - 20

LANDUSE (Y/N)

N	Old Field	N	Residential
Y	Deciduous Forest	N	Commercial/Industrial
N	Coniferous Forest	N	Cropland
Y	Wetland	N	Pasture
N	Surface Mine	N	Orchard/Vineyard/Nursery
N	Landfill	N	Golf Course

ROAD CULVERT

Present in Segment (Y/N): N

Sampleable? (Y/N): N

Width of Culvert (m): N/A

Length of Culvert (m): N/A

STREAM GRADIENT

	Elevation (m)	Height (m)
1		
2		
3		

RIPARIAN VEGETATION

(facing upstream)

	LEFT BANK	RIGHT BANK
Width (50m max)	50	50
Adjacent Land Cover	DF	DF
Vegetation Type	MYRG	MYRG
Buffer Breaks (Y/N)	N	N

	LEFT BANK	RIGHT BANK
Storm Drain		
Tile Drain		
Impervious Drainage		
Gully		
Orchard		
Crop		
Pasture		
New Construction		
Dirt Road		
Gravel Road		
Raw Sewage		
Railroad		

Buffer Break Types
(M = minor; S = severe)

CHANNELIZATION

N Evidence of Channel Straightening or Dredging (Y/N)

TYPE	EXTENT (m)		
	LEFT BANK	BOTTOM	RIGHT BANK
Concrete			
Gabion			
Rip-Rap			
Earthen Berm		N/A	
Dredge Spoil Off Channel		N/A	
Pipe Culvert			

Actual Coordinates
(If >30m distance between original coordinates and stream)

Lat

Lon

Stream Block Ht. (m)

Stream Block Type

Lat

Lon

v. 2009

MBSS SPRING INDEX PERIOD DATA SHEET

Page 2 of 7

SITE: Watershed Code MP | Segment 1121 | Type 3 | Year 2016

Reviewer: First SS / Second CR

DATE: Year 16 | Month 04 | Day 17

CREW: Carissa Reh / Sue Smith

STREAM: Lyons Creek

TIME: 1330 (Military)

LOCALITY: Lothian, AA Co., MD

SAMPLEABILITY

- Y Benthos
- Y Habitat Assessment
- Y Water Quality
- N Vernal Pool — N (PRESENT/ABSENT)

OTHER (SPECIFY):

SITE ACCESS ROUTE

SAMPLE LABELS

Verified by: CR

QC LABEL

Watershed Code MP | Segment 1121 (Letters only) | Type 3 | Year 2016

Dup. (D) or Blank (B): | Verified by:

TEMP. LOGGER

	(Y/N)	(TIME - Military)	#
WATER			
AIR			

LOCATION

PHOTODOCUMENTATION

Number	Title	Voucher (Y/N)

BENTHIC HABITAT SAMPLED

10	Riffle
19	Rootwad/Woody Debris
6	Leaf Pack
0	Macrophytes
0	Undercut Banks
0	Other

SAMPLING CONSID.: (NUM. ANODES)

STREAM WIDTH (m): 10 at 0 m | 10 at 75 m

v. 2009

MBSS SPRING FAUNA DATA SHEET

SITE Watershed Code [ ][ ][M][P] Segment [1][1][2][A] Type [3] Year [2][0][1][6]

Reviewer: First SJ / Second CR

HERPETOFAUNA

☐ None Observed

Species	Lifestage (Adult, Juv, Larval, Egg)	SEEN (Y/N)	HEARD (Y/N)	NUMBER RETAINED	NUMBER PHOTOS TAKEN
Salamander	[X]	[Y]	[N]	[0]	[3]

MUSSELS

☐ None Observed

Species	LIVE	DEAD	NUMBER RETAINED	NUMBER PHOTOS TAKEN

Corbicula LIVE ☐ DEAD ☐ NONE ☐

CRAYFISHES

☐ None Observed

Species	NUMBER RETAINED
Crayfish	[0]

Crayfish Burrows [P]
(Absent, Present, Extensive)

COMMENTS

MP112A 4 of 7

Physical Habitat Assessment and Water Quality Data Sheet

Site ID: MP112A
Subwatershed: LYONS CREEK
Length of Reach: 75m **Date:** 4/14/16
Team Members: JS/CR **Time:** 13:18

Weather
Current: SUNNY 55° F
Past 24hrs: SUNNY 50° F
Past 48hrs: OVERCAST RAIN 50° F

Stream Character

P Meandering	A Channelized
A Braided	E Straight
P Riffle	E Run/Glide
A Deep Pool >.5m	P Silt/Clay
P Shallow Pool <.5m	E Sand
P Gravel	P Cobble
A Boulder >2m	A Boulder <2m
A Concrete/Gabion	A Bedrock
A Undercut Bank	A Rootwad
E Overhead Cover	A Storm Drain
A Effluent Discharge	A Human Refuse
A Emergent Vegetation	A Beaver Pond
A Floating Vegetation	

A=Absent P=Present E=Extensive

Parameter	Downstream	Midstream	Upstream
Description	—	—	—
pH	6.37	6.36	6.33
Temperature (°C)	15.02	15.00	15.09
DO (mg/l)	11.09	10.76	11.08
Conductivity (uS/cm)	180	206	205
TDS (mg/l)	144	165	165
Turbidity (NTU)	15.3	15.6	5.1
Notes: BARO	769.6	769.1	768.7
mmHg			

Bar Formation
☐ None ☐ Minor ☒ Moderate ☐ Extensive

Bank Erosion (see guidance sheet)

	Left Bank	Right Bank
Extent (m)	10	10
Severity	1	1
Avg. Height	0.2m	0.2m

Severity: 0=none 1=min 2=mod 3=severe

Maximum stream depth (cm): 20

Benthic Habitat Sampled (20 total)

	Sq. ft.
Riffle	0
Rootwad/Woody Debris	14
Leaf Pack	6
Submerged Vegetation	0
Undercut Banks	0
Other: N/A	

Rootwads/Woody Debris

# Instream Woody Debris	5
# Dewatered Woody Debris	8
# Instream Rootwads	0
# Dewatered Rootwads	0

Stream Gradient

Location (ft)	Height (ft)	Water Depth (ft)

Photographs/Observations:
- IMMEDIATE BUFFER DOMINATED BY MID-SUCCESSIONAL DECIDUOUS FOREST - HEALTHY
- WETLANDS L + R BANKS
- TREE CUTTING APPARENT
- SAND SUBSTRATE

MP112A 5 of 7

MBSS Physical Habitat Assessment Sheet

Stream Habitat Assessment Guidance Sheet				
Habitat Parameter	Optimal 16-20	Sub-Optimal 11-15	Marginal 6-10	Poor 0-5
1. Instream Habitat[a] SCORE 17	Greater than 50% of a variety of cobble, boulder, submerged logs, undercut banks, snags, rootwads, aquatic plants or other stable habitat	30-50% of stable habitat. Adequate habitat	10-30% mix of stable habitat. Habitat availability less than desireable	Less than 10% stable habitat. Lack of habitat is obvious
2. Epifaunal Substrate[a] SCORE 5	Preferred substrate abundant, stable, and at full colonization potential (riffles well developed and dominated by cobble; and/or woody debris prevalent, not new, and not transient	Abund. of cobble with gravel and/or boulders common; or woody debris, aquatic veg., undercut banks common but not prevalent/suited for full colonization	Large boulders and/or bedrock prevalent; cobble, woody debris, or other preferred surfaces uncommon	Stable substrate lacking; or particles are over 75% surrounded by fine sediment or flocculent material
3. Velocity/Depth Diversity[a] SCORE 6	Slow (<0.3m/s), deep (>0.5m); slow, shallow (<0.5m); fast (>0.3m/s), deep; fast, shallow habitats all present	Only 3 of the 4 habitat categories present	Only 2 of the 4 habitat categories present	Dominated by 1 velocity/depth category (usually pools)
4. Pool/Glide/Eddy Quality[a] SCORE 5	Complex cover/l/or depth >1.5m; both deep (>0.5m)/shallows (<0.2m) present	Deep (>0.5m) areas present; but only moderate cover	Shallows (<0.2m) prevalent in pool/glide/eddy habitat; little cover	Max depth <0.2m in pool/glide/eddy habitat; or absent completely
5. Riffle/Run Quality[a] SCORE 5	Riffle/run depth generally >10cm, with maximum depth greater than 50 cm (maximum score); substrate stable (e.g. cobble, boulder) & variety of current velocities	Riffle/run depth generally 5-10cm, variety of current velocities	Riffle/run depth generally 1-5cm; primarily a single current velocity	Riffle/run depth <1cm; or riffle/run substrates concreted
6. Bank Stability[a] (facing downstream.) Score each bank LB SCORE 9 RB SCORE 9	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected. 10 9	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion. 8 7 6	Moderately unstable; 30-60% of bank in reach as areas of erosion; high erosion potential during floods. 5 4 3	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars. 2 1 0
7. Embeddedness SCORE 75 %	Percentage that gravel, cobble, and boulder particles are surrounded by fine sediment or flocculent material			
8. Shading SCORE 60 %	Percentage of segment that is shaded (duration is considered in scoring). 0% = fully exposed to sunlight all day in summer, 100% = fully and densely shaded all day in summer			
9. Riparian Buffer Zone Width (m)[a] LB 50 RB 50	Zone width in which human activity is not evident. 50m (164ft) is the maximum recorded value.			
10. Remoteness SCORE 20	Roads greater than 400 meters (0.25 mi) from stream	Roads within 400 meters (0.25 mi) of stream; stream NOT accessible by trail.	Roads within 400 meters (0.25 mi) of stream; stream accessible by trail.	Roads adjacent to stream.
11. Aesthetic (trash) Rating[a] SCORE 17	Little or no human refuse visible from stream channel or riparian zone	Refuse present in minor amounts	Refuse present in moderate amounts	Refuse abundant and unsightly
12. Number of Woody Debris and Rootwads[a] SCORE 5	Count only woody debris and rootwads within the wetted portion of the sampling segment. Count only woody debris >10cm (4in) diameter and >1.5m (5ft) long and rootwads with trunk diameter (at chest height) >15cm (6in) that are functional habitat within the wetted portion of the stream.			

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS

STREAM NAME Lyons Creek Trib		LOCATION MP112A Lyons, MO	
STATION #	REACH ID#	STREAM CLASS 2	
UTM N	UTM E	RIVER BASIN Middle Patuxent	
STORET #		AGENCY CEI	
INVESTIGATORS JS/CR			
FORM COMPLETED BY JS	DATE 4/13/2006 TIME 1330 PM	REASON FOR SURVEY BMI	

Parameters to be evaluated in sampling reach

Habitat Parameter	Condition Category			
	Optimal	Suboptimal	Marginal	Poor
1. Epifaunal Substrate/ Available Cover	Greater than 50% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient).	30-50% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale).	10-30% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 10% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
SCORE 7	20 19 18 17 16	15 14 13 12 11	10 9 8 (7) 6	5 4 3 2 1 0
2. Pool Substrate Characterization	Mixture of substrate materials, with gravel and firm sand prevalent; root mats and submerged vegetation common.	Mixture of soft sand, mud, or clay; mud may be dominant; some root mats and submerged vegetation present.	All mud or clay or sand bottom; little or no root mat; no submerged vegetation.	Hard-pan clay or bedrock; no root mat or vegetation.
SCORE 7	20 19 18 17 16	15 14 13 12 11	10 9 8 (7) 6	5 4 3 2 1 0
3. Pool Variability	Even mix of large-shallow, large-deep, small-shallow, small-deep pools present.	Majority of pools large-deep; very few shallow.	Shallow pools much more prevalent than deep pools.	Majority of pools small-shallow or pools absent.
SCORE 6	20 19 18 17 16	15 14 13 12 11	10 9 8 7 (6)	5 4 3 2 1 0
4. Sediment Deposition	Little or no enlargement of islands or point bars and less than <20% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 20-50% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 50-80% of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; more than 80% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
SCORE 5	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
5. Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills >75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
SCORE 16	20 19 18 17 (16)	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0

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HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS

Parameters to be evaluated broader than sampling reach

Habitat Parameter	Condition Category			
	Optimal	Suboptimal	Marginal	Poor
6. Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr) may be present, but recent channelization is not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.
SCORE 19	20 (19) 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
7. Channel Sinuosity	The bends in the stream increase the stream length 3 to 4 times longer than if it was in a straight line. (Note - channel braiding is considered normal in coastal plains and other low-lying areas. This parameter is not easily rated in these areas.)	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	Channel straight; waterway has been channelized for a long distance.
SCORE 8	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
8. Bank Stability (score each bank)	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.
SCORE 10 (LB)	Left Bank (10) 9	8 7 6	5 4 3	2 1 0
SCORE 10 (RB)	Right Bank (10) 9	8 7 6	5 4 3	2 1 0
9. Vegetative Protection (score each bank) Note: determine left or right side by facing downstream.	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
SCORE 6 (LB)	Left Bank 10 9	8 7 (6)	5 4 3	2 1 0
SCORE 6 (RB)	Right Bank 10 9	8 7 (6)	5 4 3	2 1 0
10. Riparian Vegetative Zone Width (score each bank riparian zone)	Width of riparian zone >18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone.	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6-12 meters; human activities have impacted zone a great deal.	Width of riparian zone <6 meters: little or no riparian vegetation due to human activities.
SCORE 10 (LB)	Left Bank (10) 9	8 7 6	5 4 3	2 1 0
SCORE 10 (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0

79

Total Score 120

v. 2009

MBSS SPRING HABITAT DATA SHEET

SITE — Watershed Code: MP | Segment: 113 | Type: 2 | Year: 2010

Reviewer: First: JS / Second: JA

DATE — Year: 10 | Month: 04 | Day: 15

400 Dist. from Nearest Road to Site (m)

10 Trash Rating 0 - 20

LANDUSE (Y/N)

N	Old Field	Y	Residential
Y	Deciduous Forest	N	Commercial/Industrial
N	Coniferous Forest	Y	Cropland
N	Wetland	Y	Pasture
N	Surface Mine	N	Orchard/Vineyard/Nursery
N	Landfill	N	Golf Course

ROAD CULVERT

Present in Segment (Y/N): N

Sampleable? (Y/N):

Width of Culvert (m):

Length of Culvert (m):

STREAM GRADIENT

	Location (m)	Height (m)
1		
2		
3		

RIPARIAN VEGETATION
(facing upstream)

	LEFT BANK	RIGHT BANK
Width (50m max)	50	50
Adjacent Land Cover	FR	PA
Vegetation Type	MRYG	MRYG
Buffer Breaks (Y/N)	N	N

	LEFT BANK	RIGHT BANK
Storm Drain		
Tile Drain		
Impervious Drainage		
Gully		
Orchard		
Crop		
Pasture		
New Construction		
Dirt Road		
Gravel Road		
Raw Sewage		
Railroad		

Buffer Break Types
(M = minor; S = severe)

CHANNELIZATION

N Evidence of Channel Straightening or Dredging (Y/N)

TYPE	EXTENT (m)		
	LEFT BANK	BOTTOM	RIGHT BANK
Concrete			
Gabion			
Rip-Rap			
Earthen Berm		N/A	
Dredge Spoil Off Channel		N/A	
Pipe Culvert			

Actual Coordinates
(If >30m distance between original coordinates and stream)

Lat

Lon

Stream Block Ht. (m)

Stream Block Type

Lat

Lon

v. 2009

MBSS SPRING INDEX PERIOD DATA SHEET

SITE — Watershed Code: MP | Segment: 113 | Type: 2 | Year: 2010

Reviewer: First: JS / Second: JA

DATE — Year: 10 | Month: 04 | Day: 15

CREW: JS/JA

STREAM: MP113

TIME 1220 (Military)

LOCALITY: AA Co., MD

SAMPLEABILITY

- [x] Benthos
- [x] Habitat Assessment
- [x] Water Quality
- [ ] Vernal Pool — A (PRESENT/ABSENT)

OTHER (SPECIFY) ______

SITE ACCESS ROUTE

farm road to barn, path behind barn to woods, lightly marked trail

SAMPLE LABELS

Verified by: ______

QC LABEL

Watershed Code: MP | Segment: 113 | Type: 2 | Year: 2016

(Letters only) A

Dup. (D) or Blank (B): ☐ Verified by: ______

TEMP. LOGGER

	(Y/N)	(TIME - Military)	#
WATER			
AIR			

LOCATION ______

PHOTODOCUMENTATION

Number	Title	Voucher (Y/N)
	M - US/DS	
	D - US/DS	
	U - US/DS	

BENTHIC HABITAT SAMPLED

14	Riffle	05	Leaf Pack		Undercut Banks
01	Rootwad/Woody Debris		Macrophytes		Other ______

SAMPLING CONSID.: (☐ NUM. ANODES) ______

STREAM WIDTH (m): 1.2 (0 m) | 1.2 (75 m)

v. 2009

MBSS SPRING FAUNA DATA SHEET

SITE Watershed Code [ ][ ][M][P] Segment [A] [1][1][3] Type [2] Year [2][0][1][6]

Reviewer: First [JS] / Second [JA]

HERPETOFAUNA

☐ None Observed

Species	Lifestage (Adult, Juv., Larval, Egg)	SEEN (Y/N)	HEARD (Y/N)	NUMBER RETAINED	NUMBER PHOTOS TAKEN
	☐☐☐☐	☐	☐	☐	☐
	☐☐☐☐	☐	☐	☐	☐
	☐☐☐☐	☐	☐	☐	☐
	☐☐☐☐	☐	☐	☐	☐
	☐☐☐☐	☐	☐	☐	☐
	☐☐☐☐	☐	☐	☐	☐
	☐☐☐☐	☐	☐	☐	☐

MUSSELS

☐ None Observed

Species	LIVE	DEAD	NUMBER RETAINED	NUMBER PHOTOS TAKEN
	☐	☐	☐☐	☐
	☐	☐	☐☐	☐
	☐	☐	☐☐	☐
	☐	☐	☐☐	☐
	☐	☐	☐☐	☐

Corbicula LIVE ☐ DEAD ☐ NONE ☐

CRAYFISHES

☐ None Observed

Species	NUMBER RETAINED
	☐☐
	☐☐
	☐☐
	☐☐
	☐☐

Crayfish Burrows [A]

(Absent, Present, Extensive)

COMMENTS

4/7

Physical Habitat Assessment and Water Quality Data Sheet

Site ID: MP113A
Subwatershed: Lyons Creek 4
Length of Reach: 75m **Date:** 4/15/16
Team Members: JS/SA **Time:** 12:20

Weather
Current: 60° sunny
Past 24hrs: 60° sunny
Past 48hrs: 60° sunny

Stream Character

P Meandering	A Channelized
A Braided	P Straight
P Riffle	A Run/Glide
A Deep Pool >.5m	P Silt/Clay
P Shallow Pool <.5m	P Sand
P Gravel	P Cobble
A Boulder >2m	A Boulder <2m
A Concrete/Gabion	A Bedrock
P Undercut Bank	A Rootwad
P Overhead Cover	A Storm Drain
A Effluent Discharge	P Human Refuse
P Emergent Vegetation	E Beaver Pond
P Floating Vegetation	

A=Absent P=Present E=Extensive

Bar Formation
☐ None ☐ Moderate
☑ Minor ☐ Extensive

Bank Erosion (see guidance sheet)

	Left Bank	Right Bank
Extent (m)	20	25
Severity	2	2
Avg. Height (m)	1	1

Severity: 0=none 1=min 2=mod 3=severe

Inactive undercuts

Maximum stream depth (cm) 10

Benthic Habitat Sampled (20 total)

	Sq. ft.
Riffle	14
Rootwad/Woody Debris	1
Leaf Pack	5
Submerged Vegetation	0
Undercut Banks	0
Other:	

Rootwads/Woody Debris

# Instream Woody Debris	1
# Dewatered Woody Debris	1
# Instream Rootwads	0
# Dewatered Rootwads	1

Stream Gradient

Location (ft)	Height (ft)	Water Depth (ft)

Parameter	Down-stream	Mid-stream	Up-stream
Description			
pH	6.52	6.53	6.10
Temperature (°C)	12.03	12.48	13.02
DO (mg/l)	12.11	12.19	11.10
Conductivity (uS/cm)	141	139	170
TDS (mg/l)	137	119	143
Turbidity (NTU)	7.3	3.8	6.2

Notes:

Photographs/Observations:

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MP113A JS/JA 4/15/16

MBSS Physical Habitat Assessment Sheet

Stream Habitat Assessment Guidance Sheet				
Habitat Parameter	Optimal 16-20	Sub-Optimal 11-15	Marginal 6-10	Poor 0-5
1. Instream Habitat[1] SCORE 7	Greater than 50% of a variety of cobble, boulder, submerged logs, undercut banks, snags, rootwads, aquatic plants or other stable habitat	30-50% of stable habitat. Adequate habitat	10-30% mix of stable habitat. Habitat availability less than desireable	Less than 10% stable habitat. Lack of habitat is obvious
2. Epifaunal Substrate[2] SCORE 12	Preferred substrate abundant, stable, and at full colonization potential (riffles well developed and dominated by cobble; and/or woody debris prevalent, not new, and not transient	Abund. of cobble with gravel and/or boulders common; or woody debris, aquatic veg., undercut banks common but not prevalent/suited for full colonization	Large boulders and/or bedrock prevalent; cobble, woody debris, or other preferred surfaces uncommon	Stable substrate lacking; or particles are over 75% surrounded by fine sediment or flocculent material
3. Velocity/Depth Diversity[3] SCORE 9	Slow (<0.3m/s), deep (>0.5m); slow, shallow (<0.5m); fast (>0.3m/s), deep; fast, shallow habitats all present	Only 3 of the 4 habitat categories present	Only 2 of the 4 habitat categories present	Dominated by 1 velocity/depth category (usually pools)
4. Pool/Glide/Eddy Quality[4] SCORE 10	Complex cover/& /or depth >1.5m; both deep (>0.5m)/shallows (<0.2m) present	Deep (>0.5m) areas present; but only moderate cover	Shallows (<0.2m) prevalent in pool/glide/eddy habitat; little cover	Max depth <0.2m in pool/glide/eddy habitat; or absent completely
5. Riffle/Run Quality[5] SCORE 10	Riffle/run depth generally >10cm, with maximum depth greater than 50 cm (maximum score); substrate stable (e.g. cobble, boulder) & variety of current velocities	Riffle/run depth generally 5-10cm, variety of current velocities	Riffle/run depth generally 1-5cm; primarily a single current velocity	Riffle/run depth <1cm; or riffle/run substrates concreted
6. Bank Stability[6] (facing downstream.) Score each bank LB SCORE 10 RB SCORE 10	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected. 10 9	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion. 8 7 6	Moderately unstable; 30-60% of bank in reach as areas of erosion; high erosion potential during floods. 5 4 3	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars. 2 1 0
7. Embeddedness SCORE 60 %	Percentage that gravel, cobble, and boulder particles are surrounded by fine sediment or flocculent material			
8. Shading SCORE 80 %	Percentage of segment that is shaded (duration is considered in scoring). 0% = fully exposed to sunlight all day in summer; 100% = fully and densely shaded all day in summer			
9. Riparian Buffer Zone Width (m)[7] LB 40 RB 50	Zone width in which human activity is not evident. 50m (164ft) is the maximum recorded value.			
10. Remoteness SCORE 10	Roads greater than 400 meters (0.25 mi) from stream	Roads within 400 meters (0.25 mi) of stream; stream NOT accessible by trail.	Roads within 400 meters (0.25 mi) of stream; stream accessible by trail.	Roads adjacent to stream.
11. Aesthetic (trash) Rating[8] SCORE 10	Little or no human refuse visible from stream channel or riparian zone	Refuse present in minor amounts	Refuse present in moderate amounts	Refuse abundant and unsightly
12. Number of Woody Debris and Rootwads[9] SCORE 3	Count only woody debris and rootwads within the wetted portion of the sampling segment. Count only woody debris >10cm (4in) diameter and >1.5m (5ft) long and rootwads with trunk diameter (at chest height) >15cm (6in) that are functional habitat within the wetted portion of the stream.			

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HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS

STREAM NAME MP113A		LOCATION AA County	
STATION # 113A	REACH ID#	STREAM CLASS	
UTM N	UTM E	RIVER BASIN Middle Patuxent	
STORET #		AGENCY CEI	
INVESTIGATORS JS/JA			
FORM COMPLETED BY JS/JA		DATE 4/15/16 TIME 12:45 PM	REASON FOR SURVEY BMJ

Parameters to be evaluated in sampling reach

Habitat Parameter	Condition Category			
	Optimal	Suboptimal	Marginal	Poor
1. Epifaunal Substrate/ Available Cover	Greater than 50% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient).	30-50% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale).	10-30% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 10% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
SCORE 10	20 19 18 17 16	15 14 13 12 11	(10) 9 8 7 6	5 4 3 2 1 0
2. Pool Substrate Characterization	Mixture of substrate materials, with gravel and firm sand prevalent; root mats and submerged vegetation common.	Mixture of soft sand, mud, or clay; mud may be dominant; some root mats and submerged vegetation present.	All mud or clay or sand bottom; little or no root mat; no submerged vegetation.	Hard-pan clay or bedrock; no root mat or vegetation.
SCORE 9	20 19 18 17 16	15 14 13 12 11	10 (9) 8 7 6	5 4 3 2 1 0
3. Pool Variability	Even mix of large-shallow, large-deep, small-shallow, small-deep pools present.	Majority of pools large-deep; very few shallow.	Shallow pools much more prevalent than deep pools.	Majority of pools small-shallow or pools absent.
SCORE 8	20 19 18 17 16	15 14 13 12 11	10 9 (8) 7 6	5 4 3 2 1 0
4. Sediment Deposition	Little or no enlargement of islands or point bars and less than <20% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 20-50% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 50-80% of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; more than 80% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
SCORE 9	20 19 18 17 16	15 14 13 12 11	10 (9) 8 7 6	5 4 3 2 1 0
5. Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills >75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
SCORE 10	20 19 18 17 16	15 14 13 12 11	(10) 9 8 7 6	5 4 3 2 1 0

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pg: 7/7 MPIBA JS/JA 4/15/16

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS

Parameters to be evaluated broader than sampling reach

Habitat Parameter	Condition Category			
	Optimal	Suboptimal	Marginal	Poor
6. Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr) may be present, but recent channelization is not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.
SCORE 18	20 19 (18) 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
7. Channel Sinuosity	The bends in the stream increase the stream length 3 to 4 times longer than if it was in a straight line. (Note - channel braiding is considered normal in coastal plains and other low-lying areas. This parameter is not easily rated in these areas.)	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	Channel straight; waterway has been channelized for a long distance.
SCORE 10	20 19 18 17 16	15 14 13 12 11	(10) 9 8 7 6	5 4 3 2 1 0
8. Bank Stability (score each bank)	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.
SCORE 5 (LB)	Left Bank 10 9	8 7 6	(5) 4 3	2 1 0
SCORE 7 (RB)	Right Bank 10 9	8 (7) 6	5 4 3	2 1 0
9. Vegetative Protection (score each bank) Note: determine left or right side by facing downstream.	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
SCORE 9 (LB)	Left Bank 10 (9)	8 7 6	5 4 3	2 1 0
SCORE 9 (RB)	Right Bank 10 (9)	8 7 6	5 4 3	2 1 0
10. Riparian Vegetative Zone Width (score each bank riparian zone)	Width of riparian zone >18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone.	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6-12 meters; human activities have impacted zone a great deal.	Width of riparian zone <6 meters: little or no riparian vegetation due to human activities.
SCORE 9 (LB)	Left Bank 10 (9)	8 7 6	5 4 3	2 1 0
SCORE 8 (RB)	Right Bank 10 9	(8) 7 6	5 4 3	2 1 0

Total Score 121

Form # EL2 - _____

v. 2009

MBSS SPRING HABITAT DATA SHEET

Page 1 of 7

SITE — Watershed Code: MP | Segment: 11179 | Type: 3 | Year: 2016

Reviewer: First: JS / Second: CR

DATE — Year: 16 | Month: 03 | Day: 29

300 Dist. from Nearest Road to Site (m)

19 Trash Rating 0 - 20

LANDUSE (Y/N)

Y	Old Field	Y	Residential
Y	Deciduous Forest	Y	Commercial/Industrial
N	Coniferous Forest	N	Cropland
N	Wetland	N	Pasture
N	Surface Mine	N	Orchard/Vineyard/Nursery
N	Landfill	N	Golf Course

RIPARIAN VEGETATION
(facing upstream)

	LEFT BANK	RIGHT BANK
Width (50m max)	50	50
Adjacent Land Cover	LM from	OF from
Vegetation Type	M Y R F	M Y R F
Buffer Breaks (Y/N)	N	N

ROAD CULVERT
N/A

Present in Segment (Y/N): N

Sampleable? (Y/N): N

Width of Culvert (m):

Length of Culvert (m):

STREAM GRADIENT

	Location (m)	Height (m)
1		
2		
3		

Buffer Breaks

	LEFT BANK	RIGHT BANK
	N/A	
Storm Drain	N	N
Tile Drain	N	N
Impervious Drainage	N	N
Gully	N	N
Orchard	N	N
Crop	N	N
Pasture	N	N
New Construction	N	N
Dirt Road	N	N
Gravel Road	N	N
Raw Sewage	N	N
Railroad	N	N

Buffer Break Types
(M = minor; S = severe)

CHANNELIZATION

N Evidence of Channel Straightening or Dredging (Y/N)

TYPE	EXTENT (m)		
N/A	LEFT BANK	BOTTOM	RIGHT BANK
Concrete			
Gabion			
Rip-Rap			
Earthen Berm		N/A	
Dredge Spoil Off Channel		N/A	
Pipe Culvert			

Actual Coordinates
(If >30m distance between original coordinates and stream)

Lat

Lon

Stream Block Ht. (m)

Stream Block Type

Lat

Lon

v. 2009

MBSS SPRING INDEX PERIOD DATA SHEET

SITE Watershed Code MP | Segment 117A | Type 3 | Year 2016

Reviewer: First JS / Second CR

DATE Year 16 | Month 03 | Day 29

CREW: JOSEPH SMITH / CARISSA REH

STREAM: MP 117A //

TIME 1230 (Military)

LOCALITY: LOTHIAN, AA CO, MD

SAMPLEABILITY

- [Y] Benthos
- [Y] Habitat Assessment
- [Y] Water Quality
- [N] Vernal Pool [N/A] (PRESENT/ABSENT)

OTHER (SPECIFY)

SITE ACCESS ROUTE

SAMPLE LABELS

Verified by: CR

QC LABEL

Watershed Code MP | Segment 117A (Letters only) | Type 3 | Year 2016

Dup. (D) or Blank (B): [ ] Verified by: CR

TEMP. LOGGER N/A

	(Y/N)	(TIME - Military)	#
WATER			
AIR			

LOCATION

PHOTODOCUMENTATION

Number	Title	Voucher (Y/N)
	MP - US/DS	
	DS - US/DS	
	US - US/DS	
	Clam	

BENTHIC HABITAT SAMPLED

04	Riffle	02	Leaf Pack	00	Undercut Banks
14	Rootwad/Woody Debris	00	Macrophytes	00	Other

SAMPLING CONSID.: (2 NUM. ANODES)

STREAM WIDTH (m): 22 (0 m) | 20 (75 m)

v. 2009

MBSS SPRING FAUNA DATA SHEET

SITE Watershed Code [ ][ ][M][P] Segment [1][1][7A] Type [B] Year [2][0][1][6]

Reviewer: First JS / Second CR

HERPETOFAUNA

☐ None Observed

Species	Lifestage (Adult / Juv. / Larval / Egg)	SEEN (Y/N)	HEARD (Y/N)	NUMBER RETAINED	NUMBER PHOTOS TAKEN
SPRING PEEPERS	☐ ☒ ☐ ☐	N	☒	0	0
	☐ ☐ ☐ ☐	☐	☐	☐	☐
	☐ ☐ ☐ ☐	☐	☐	☐	☐
	☐ ☐ ☐ ☐	☐	☐	☐	☐
	☐ ☐ ☐ ☐	☐	☐	☐	☐
	☐ ☐ ☐ ☐	☐	☐	☐	☐
	☐ ☐ ☐ ☐	☐	☐	☐	☐

MUSSELS

☐ None Observed

Species	LIVE	DEAD	NUMBER RETAINED	NUMBER PHOTOS TAKEN
1 CLAM	☒	☐	1	2
	☐	☐		
	☐	☐		
	☐	☐		
	☐	☐		

Corbicula: LIVE ☒ DEAD ☐ NONE ☐

CRAYFISHES

☐ None Observed

Species	NUMBER RETAINED
MULTIPLE BURROWS OBSERVED	0

Crayfish Burrows: P
(Absent, Present, Extensive)

COMMENTS

Physical Habitat Assessment and Water Quality Data Sheet

Site ID: MP 117A
Subwatershed: LYONS CREEK
Length of Reach: 75 m Date: 3/29/16
Team Members: JS/CR Time: 12:47

Weather
Current: SUNNY 57° F
Past 24hrs: OVERCAST
Past 48hrs: RAIN SHOWERS

Stream Character

- [ ] Meandering
- [ ] Braided
- [ ] Riffle
- [ ] Deep Pool >.5m
- [x] Shallow Pool <.5m
- [ ] Gravel
- [ ] Boulder >2m
- [ ] Concrete/Gabion
- [ ] Undercut Bank
- [x] Overhead Cover
- [ ] Effluent Discharge
- [ ] Emergent Vegetation
- [ ] Floating Vegetation

- [ ] Channelized
- [E] Straight
- [ ] Run/Glide
- [E] Silt/Clay
- [ ] Sand
- [ ] Cobble
- [ ] Boulder <2m
- [ ] Bedrock
- [ ] Rootwad
- [ ] Storm Drain
- [ ] Human Refuse
- [ ] Beaver Pond

A=Absent P=Present E=Extensive

Bar Formation

- [x] None
- [ ] Minor
- [ ] Moderate
- [ ] Extensive

Bank Erosion (see guidance sheet)

	Left Bank	Right Bank	Severity: 0=none 1=min 2=mod 3=severe
Extent (m)	55	40	
Severity	3	2	
Avg. Height (cm)	0.65	0.55	

Maximum stream depth (cm) 20

Benthic Habitat Sampled (20 total)

	Sq. ft.
Riffle	4
Rootwad/Woody Debris	14
Leaf Pack	2
Submerged Vegetation	0
Undercut Banks	0
Other:	0

Rootwads/Woody Debris

# Instream Woody Debris	5
# Dewatered Woody Debris	4
# Instream Rootwads	0
# Dewatered Rootwads	0

Stream Gradient

Location (ft)	Height (ft)	Water Depth (ft)

Parameter	Down-stream	Mid-stream	Up-stream
Description			
pH	6.51	6.0	6.55
Temperature (°C)	10.72	15.92	11.91
DO (mg/l)	12.43	12.54	12.66
Conductivity (uS/cm)	131	133	140 mS/cm
TDS (mg/l)	[illegible]	[illegible]	131
Turbidity (NTU)	39.0	41.4	40.8
Notes: BARO	764.9	762.5	765.5 mmHg

Photographs/Observations:

- STREAM HAS A SILT/CLAY SUBSTRATE & IS VERY TURBID W/ MINIMAL HABITAT
- 1 RIFFLE W/IN THE 75 m REACH
- HAS 50 m+ BUFFER OF MID-SUCCESSIONAL DECIDUOUS FOREST
- BANKS ARE SLIGHT BUT INCISED & EXPOSED (L WORSE THAN RIGHT)
- MINIMAL GRASS/MOSS COVER ON BANKS

MP117A

MBSS Physical Habitat Assessment Sheet

Stream Habitat Assessment Guidance Sheet				
Habitat Parameter	Optimal 16-20	Sub-Optimal 11-15	Marginal 6-10	Poor 0-5
1. Instream Habitat[a] SCORE 4	Greater than 50% of a variety of cobble, boulder, submerged logs, undercut banks, snags, rootwads, aquatic plants or other stable habitat	30-50% of stable habitat. Adequate habitat	10-30% mix of stable habitat. Habitat availability less than desireable	Less than 10% stable habitat. Lack of habitat is obvious
2. Epifaunal Substrate[b] SCORE 1	Preferred substrate abundant, stable, and at full colonization potential (riffles well developed and dominated by cobble; and/or woody debris prevalent, not new, and not transient	Abund. of cobble with gravel and/or boulders common; or woody debris, aquatic veg., undercut banks common but not prevalent/suited for full colonization	Large boulders and/or bedrock prevalent; cobble, woody debris, or other preferred surfaces uncommon	Stable substrate lacking; or particles are over 75% surrounded by fine sediment or flocculent material
3. Velocity/Depth Diversity[c] SCORE 3	Slow (<0.3m/s), deep (>0.5m); slow, shallow (<0.5m); fast (>0.3m/s), deep; fast, shallow habitats all present	Only 3 of the 4 habitat categories present	Only 2 of the 4 habitat categories present	Dominated by 1 velocity/depth category (usually pools)
4. Pool/Glide/Eddy Quality[d] SCORE 6	Complex cover/&/or depth >1.5m; both deep (>0.5m)/shallows (<0.2m) present	Deep (>0.5m) areas present; but only moderate cover	Shallows (<0.2m) prevalent in pool/glide/eddy habitat; little cover	Max depth <0.2m in pool/glide/eddy habitat; or absent completely
5. Riffle/Run Quality[e] SCORE 4	Riffle/run depth generally >10cm, with maximum depth greater than 50 cm (maximum score); substrate stable (e.g. cobble, boulder) & variety of current velocities	Riffle/run depth generally 5-10cm, variety of current velocities	Riffle/run depth generally 1-5cm; primarily a single current velocity	Riffle/run depth <1cm; or riffle/run substrates concreted
6. Bank Stability[f] (facing downstream.) Score each bank LB SCORE 2 RB SCORE 3	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected. 10 9	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion. 8 7 6	Moderately unstable; 30-60% of bank in reach as areas of erosion; high erosion potential during floods. 5 4 3	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars. 2 1 0
7. Embeddedness SCORE 95 %	Percentage that gravel, cobble, and boulder particles are surrounded by fine sediment or flocculent material			
8. Shading SCORE 60 %	Percentage of segment that is shaded (duration is considered in scoring). 0% = fully exposed to sunlight all day in summer; 100% = fully and densely shaded all day in summer			
9. Riparian Buffer Zone Width (m)[g] LB 50 RB 50	Zone width in which human activity is not evident. 50m (164ft) is the maximum recorded value.			
10. Remoteness[h] SCORE 13	Roads greater than 400 meters (0.25 mi) from stream	Roads within 400 meters (0.25 mi) of stream; stream NOT accessible by trail.	Roads within 400 meters (0.25 mi) of stream; stream accessible by trail.	Roads adjacent to stream.
11. Aesthetic (trash) Rating[i] SCORE 16	Little or no human refuse visible from stream channel or riparian zone	Refuse present in minor amounts	Refuse present in moderate amounts	Refuse abundant and unsightly
12. Number of Woody Debris and Rootwads[j] SCORE 5	Count only woody debris and rootwads within the wetted portion of the sampling segment. Count only woody debris >10cm (4in) diameter and >1.5m (5ft) long and rootwads with trunk diameter (at chest height) >15cm (6in) that are functional habitat within the wetted portion of the stream.			

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HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS

STREAM NAME	MP117A	LOCATION	Lothian, AA co., MD
STATION #	REACH ID#	STREAM CLASS	3
UTM N	UTM E	RIVER BASIN	Patuxent
STORET #		AGENCY	CEI
INVESTIGATORS	JS/CR		
FORM COMPLETED BY		DATE 3/29/16 TIME 12:30 PM	REASON FOR SURVEY BMI

Parameters to be evaluated in sampling reach

Habitat Parameter	Condition Category			
	Optimal	Suboptimal	Marginal	Poor
1. Epifaunal Substrate/ Available Cover	Greater than 50% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient).	30-50% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale).	10-30% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 10% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
SCORE 1	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 (1) 0
2. Pool Substrate Characterization	Mixture of substrate materials, with gravel and firm sand prevalent; root mats and submerged vegetation common.	Mixture of soft sand, mud, or clay; mud may be dominant; some root mats and submerged vegetation present.	All mud or clay or sand bottom; little or no root mat; no submerged vegetation.	Hard-pan clay or bedrock; no root mat or vegetation.
SCORE 1	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 (1) 0
3. Pool Variability	Even mix of large-shallow, large-deep, small-shallow, small-deep pools present.	Majority of pools large-deep; very few shallow.	Shallow pools much more prevalent than deep pools.	Majority of pools small-shallow or pools absent.
SCORE 6	20 19 18 17 16	15 14 13 12 11	10 9 8 7 (6)	5 4 3 2 1 0
4. Sediment Deposition	Little or no enlargement of islands or point bars and less than <20% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 20-50% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 50-80% of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; more than 80% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
SCORE 1	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 (1) 0
5. Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills >75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
SCORE 17	20 19 18 (17) 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0

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HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS

Parameters to be evaluated broader than sampling reach

Habitat Parameter	Condition Category			
	Optimal	Suboptimal	Marginal	Poor
6. Channel Alteration Relatively Straight SCORE 16	Channelization or dredging absent or minimal; stream with normal pattern. 20 19 18 17 (16)	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr) may be present, but recent channelization is not present. 15 14 13 12 11	Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted. 10 9 8 7 6	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely. 5 4 3 2 1 0
7. Channel Sinuosity RIFFLE SCORE 3	The bends in the stream increase the stream length 3 to 4 times longer than if it was in a straight line. (Note - channel braiding is considered normal in coastal plains and other low-lying areas. This parameter is not easily rated in these areas.) 20 19 18 17 16	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line. 15 14 13 12 11	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line. 10 9 8 7 6	Channel straight; waterway has been channelized for a long distance. 5 4 (3) 2 1 0
8. Bank Stability (score each bank) SCORE 2 (LB) SCORE 3 (RB)	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected. Left Bank 10 9 Right Bank 10 9	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion. 8 7 6 8 7 6	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods. 5 4 3 5 4 (3)	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars. (2) 1 0 2 1 0
9. Vegetative Protection (score each bank) Note: determine left or right side by facing downstream. SCORE 2 (LB) SCORE 2 (RB)	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally. Left Bank 10 9 Right Bank 10 9	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining. 8 7 6 8 7 6	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining. 5 4 3 5 4 3	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height. (2) 1 0 (2) 1 0
10. Riparian Vegetative Zone Width (score each bank riparian zone) SCORE 9 (LB) SCORE 9 (RB)	Width of riparian zone >18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone. Left Bank 10 (9) Right Bank 10 (9)	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally. 8 7 6 8 7 6	Width of riparian zone 6-12 meters; human activities have impacted zone a great deal. 5 4 3 5 4 3	Width of riparian zone <6 meters: little or no riparian vegetation due to human activities. 2 1 0 2 1 0

Total Score 72

v. 2009

MBSS SPRING HABITAT DATA SHEET

Page 1 of 7

SITE — Watershed Code: mP | Segment: 117A | Type: 3 | Year: 2016 — QA/QC site — Reviewer: First: CR / Second: JS

DATE — Year: 16 | Month: 03 | Day: 09 — QA/QC OF MP117A ~100m US

300 Dist. from Nearest Road to Site (m)

19 Trash Rating 0 - 20

LANDUSE (Y/N)

N	Old Field	N	Residential
Y	Deciduous Forest	N	Commercial/Industrial
N	Coniferous Forest	Y	Cropland
N	Wetland	N	Pasture
N	Surface Mine	N	Orchard/Vineyard/Nursery
N	Landfill	N	Golf Course

RIPARIAN VEGETATION
(facing upstream)

	LEFT BANK	RIGHT BANK
Width (50m max)	50	50
Adjacent Land Cover	LN	OF
Vegetation Type	mYRF	mYRF
Buffer Breaks (Y/N)	N	N

ROAD CULVERT

Present in Segment (Y/N): N

Sampleable? (Y/N): Y

Width of Culvert (m):

Length of Culvert (m):

STREAM GRADIENT

	Location (m)	Height (m)
1		
2		
3		

	LEFT BANK	RIGHT BANK
Storm Drain	N	N
Tile Drain	N	N
Impervious Drainage	N	N
Gully	N	N
Orchard	N	N
Crop	N	N
Pasture	N	N
New Construction	N	N
Dirt Road	N	N
Gravel Road	N	N
Raw Sewage	N	N
Railroad	N	N

Buffer Break Types
(M = minor; S = severe)

CHANNELIZATION

N Evidence of Channel Straightening or Dredging (Y/N)

TYPE	EXTENT (m) LEFT BANK	BOTTOM	RIGHT BANK
Concrete			
Gebion			
Rip-Rap			
Earthen Berm		N/A	
Dredge Spoil Off Channel		N/A	
Pipe Culvert			

Actual Coordinates
(If >30m distance between original coordinates and stream)

Lat

Lon

Stream Block Ht. (m)

Stream Block Type

Lat

Lon

v. 2009

MBSS SPRING INDEX PERIOD DATA SHEET

Page 2 of 7

SITE Watershed Code MP | Segment 117A | Type 3 | Year 2016 — QA/QC site

Reviewer: First CR / Second JS

DATE Year 16 Month 03 Day 29

CREW: Joe Smith Corissa Ed

STREAM: MP 117A

TIME 1430 (Military)

LOCALITY: Lothian, AA, MD

SAMPLEABILITY

- Y Benthos
- Y Habitat Assessment
- Y Water Quality
- N Vernal Pool (Y/N) (PRESENT/ABSENT)

OTHER (SPECIFY)

SITE ACCESS ROUTE

SAMPLE LABELS

Verified by: CR

QC LABEL

Watershed Code MP | Segment 117A (Letters only) | Type 3 | Year 2016

Dup. (D) or Blank (B): | Verified by:

TEMP. LOGGER

	(Y/N)	(TIME - Military)	#
WATER			#
AIR			#

LOCATION NA

PHOTODOCUMENTATION

Number	Title	Voucher (Y/N)
	MP - US/DS	
	DS - US/DS	
	US - US/DS	

BENTHIC HABITAT SAMPLED

- 2 Riffle
- 9 Rootwad/Woody Debris
- 4 Leaf Pack
- Macrophytes
- Undercut Banks
- 5 Other fibrous material

SAMPLING CONSID.: (NUM. ANODES)

STREAM WIDTH (m): 20 (0 m) | 20 (75 m)

v. 2009

MBSS SPRING FAUNA DATA SHEET

SITE Watershed Code MP | Segment 1170 | Type 3 | Year 2016 | QA/QC site | First CR / Second JS Reviewer:

HERPETOFAUNA

☒ None Observed

Species	Lifestage (Adult, Juv., Larval, Egg)	SEEN (Y/N)	HEARD (Y/N)	NUMBER RETAINED	NUMBER PHOTOS TAKEN
					6

MUSSELS

☒ None Observed

Species	LIVE	DEAD	NUMBER RETAINED	NUMBER PHOTOS TAKEN

Corbicula: LIVE ☐ DEAD ☐ NONE ☐

CRAYFISHES

☐ None Observed

Species	NUMBER RETAINED
multiple Burrows observed	0

Crayfish Burrows: P
(Absent, Present, Extensive)

COMMENTS

Physical Habitat Assessment and Water Quality Data Sheet

Site ID: MP117A QA/QC
Subwatershed: Lyons Creek
Length of Reach: 75 **Date:** 3/29/2016
Team Members: SS/CR **Time:** 14:30

Weather
Current: Sunny 57°
Past 24hrs: Cloudy
Past 48hrs: Rain

Stream Character

A Meandering	A Channelized
A Braided	P Straight
P Riffle	A Run/Glide
A Deep Pool >.5m	E Silt/Clay
P Shallow Pool <.5m	P Sand
A Gravel	A Cobble
A Boulder >2m	A Boulder <2m
A Concrete/Gabion	A Bedrock
A Undercut Bank	P Rootwad
E Overhead Cover	A Storm Drain
A Effluent Discharge	A Human Refuse
A Emergent Vegetation	A Beaver Pond
A Floating Vegetation	

A=Absent P=Present E=Extensive

Parameter	Down-stream	Mid-stream	Up-stream
Description			
pH	6.73	6.33	6.29
Temperature (°C)	18.24	18.23C	18.3
DO (mg/l)	11.89	12.39	11.96
Conductivity (uS/cm)	123	0169	127 mS/cm
TDS (mg/l)	109.4	97.7	108.6 ORP
Turbidity (NTU)	37.2	36.2	27.9

Notes: TDS NA 158 138

Bar Formation
☒ None ☐ Moderate
☐ Minor ☐ Extensive

Bank Erosion (see guidance sheet)

	Left Bank	Right Bank
Extent (m)	75	75
Severity	2	2
Avg. Height	1.5m	1.5m

Severity: 0=none 1=min 2=mod 3=severe

Maximum stream depth (cm) 20

Benthic Habitat Sampled (20 total)

	Sq. ft.
Riffle	2
Rootwad/Woody Debris	9
Leaf Pack	4
Submerged Vegetation	0
Undercut Banks	0
Other: Fibrous Roots	5

Rootwads/Woody Debris

# Instream Woody Debris	4
# Dewatered Woody Debris	3
# Instream Rootwads	1
# Dewatered Rootwads	1

Stream Gradient

Location (ft)	Height (ft)	Water Depth (ft)

Photographs/Observations:
- Stream is turbid
- the substrate is clay/silt
- The stream banks are mostly bare
- The stream is incised

MP117A QA/QC site

5 of 7

MBSS Physical Habitat Assessment Sheet

Stream Habitat Assessment Guidance Sheet				
Habitat Parameter	Optimal 16-20	Sub-Optimal 11-15	Marginal 6-10	Poor 0-5
1. Instream Habitat[a] SCORE 2	Greater than 50% of a variety of cobble, boulder, submerged logs, undercut banks, snags, rootwads, aquatic plants or other stable habitat	30-50% of stable habitat. Adequate habitat	10-30% mix of stable habitat. Habitat availability less than desireable	Less than 10% stable habitat. Lack of habitat is obvious
2. Epifaunal Substrate[b] SCORE 2	Preferred substrate abundant, stable, and at full colonization potential (riffles well developed and dominated by cobble; and/or woody debris prevalent, not new, and not transient	Abund. of cobble with gravel and/or boulders common; or woody debris, aquatic veg., undercut banks common but not prevalent/suited for full colonization	Large boulders and/or bedrock prevalent; cobble, woody debris, or other preferred surfaces uncommon	Stable substrate lacking; or particles are over 75% surrounded by fine sediment or flocculent material
3. Velocity/Depth Diversity[c] SCORE 4	Slow (<0.3m/s), deep (>0.5m); slow, shallow (<0.5m); fast (>0.3m/s), deep; fast, shallow habitats all present	Only 3 of the 4 habitat categories present	Only 2 of the 4 habitat categories present	Dominated by 1 velocity/depth category (usually pools)
4. Pool/Glide/Eddy Quality[d] SCORE 6	Complex cover/&/or depth >1.5m; both deep (>0.5m)/shallows (<0.2m) present	Deep (>0.5m) areas present; but only moderate cover	Shallows (<0.2m) prevalent in pool/glide/eddy habitat; little cover	Max depth <0.2m in pool/glide/eddy habitat; or absent completely
5. Riffle/Run Quality[e] SCORE 4	Riffle/run depth generally >10cm, with maximum depth greater than 50 cm (maximum score); substrate stable (e.g. cobble, boulder) & variety of current velocities	Riffle/run depth generally 5-10cm, variety of current velocities	Riffle/run depth generally 1-5cm; primarily a single current velocity	Riffle/run depth <1cm; or riffle/run substrates concreted
6. Bank Stability[f] (facing downstream) Score each bank LB SCORE 3 RB SCORE 3	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected. 10 9	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion. 8 7 6	Moderately unstable; 30-60% of bank in reach as areas of erosion; high erosion potential during floods. 5 4 3	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars. 2 1 0
7. Embeddedness SCORE 95 %	Percentage that gravel, cobble, and boulder particles are surrounded by fine sediment or flocculent material			
8. Shading SCORE %	Percentage of segment that is shaded (duration is considered in scoring). 0% = fully exposed to sunlight all day in summer, 100% = fully and densely shaded all day in summer			
9. Riparian Buffer Zone Width (m)[g] LB 50 RB 50	Zone width in which human activity is not evident. 50m (164ft) is the maximum recorded value.			
10. Remoteness[h] SCORE 15	Roads greater than 400 meters (0.25 mi) from stream	Roads within 400 meters (0.25 mi) of stream; stream NOT accessible by trail.	Roads within 400 meters (0.25 mi) of stream; stream accessible by trail.	Roads adjacent to stream.
11. Aesthetic (trash) Rating[i] SCORE 19	Little or no human refuse visible from stream channel or riparian zone	Refuse present in minor amounts	Refuse present in moderate amounts	Refuse abundant and unsightly
12. Number of Woody Debris and Rootwads[j] SCORE 5	Count only woody debris and rootwads within the wetted portion of the sampling segment. Count only woody debris >10cm (4in) diameter and >1.5m (5ft) long and rootwads with trunk diameter (at chest height) >15cm (6in) that are functional habitat within the wetted portion of the stream.			

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS

STREAM NAME	MP 117A QA/QC	LOCATION	Lothian MA
STATION #	REACH ID#	STREAM CLASS	3
UTM N	UTM E	RIVER BASIN	Patuxent
STORET #		AGENCY	CEI
INVESTIGATORS	JS/CR		
FORM COMPLETED BY		DATE 3/29/16 TIME 14:30 PM	REASON FOR SURVEY BMI

Parameters to be evaluated in sampling reach

Habitat Parameter	Condition Category			
	Optimal	Suboptimal	Marginal	Poor
1. Epifaunal Substrate/ Available Cover	Greater than 50% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient).	30-50% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale).	10-30% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 10% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
SCORE 1	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 (1) 0
2. Pool Substrate Characterization	Mixture of substrate materials, with gravel and firm sand prevalent; root mats and submerged vegetation common.	Mixture of soft sand, mud, or clay; mud may be dominant; some root mats and submerged vegetation present.	All mud or clay or sand bottom; little or no root mat; no submerged vegetation.	Hard-pan clay or bedrock; no root mat or vegetation.
SCORE 1	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 (1) 0
3. Pool Variability	Even mix of large-shallow, large-deep, small-shallow, small-deep pools present.	Majority of pools large-deep; very few shallow.	Shallow pools much more prevalent than deep pools.	Majority of pools small-shallow or pools absent.
SCORE 3	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 (3) 2 1 0
4. Sediment Deposition	Little or no enlargement of islands or point bars and less than <20% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 20-50% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 50-80% of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; more than 80% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
SCORE 1	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 (1) 0
5. Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills >75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
SCORE 16	20 19 18 17 (16)	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS

Parameters to be evaluated broader than sampling reach

Habitat Parameter	Condition Category: Optimal	Suboptimal	Marginal	Poor
6. Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr) may be present, but recent channelization is not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.
SCORE 16	20 19 18 17 (16)	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
7. Channel Sinuosity (2 R. (FIG	The bends in the stream increase the stream length 3 to 4 times longer than if it was in a straight line. (Note - channel braiding is considered normal in coastal plains and other low-lying areas. This parameter is not easily rated in these areas.)	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	Channel straight; waterway has been channelized for a long distance.
SCORE 4	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 (4) 3 2 1 0
8. Bank Stability (score each bank)	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.
SCORE 2 (LB)	**Left Bank** 10 9	8 7 6	5 4 3	(2) 1 0
SCORE 2 (RB)	**Right Bank** 10 9	8 7 6	5 4 3	(2) 1 0
9. Vegetative Protection (score each bank) Note: determine left or right side by facing downstream.	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
SCORE 2 (LB)	**Left Bank** 10 9	8 7 6	5 4 3	(2) 1 0
SCORE 2 (RB)	**Right Bank** 10 9	8 7 6	5 4 3	(2) 1 0
10. Riparian Vegetative Zone Width (score each bank riparian zone)	Width of riparian zone >18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone.	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6-12 meters; human activities have impacted zone a great deal.	Width of riparian zone <6 meters: little or no riparian vegetation due to human activities.
SCORE 9 (LB)	**Left Bank** 10 (9)	8 7 6	5 4 3	2 1 0
SCORE 9 (RB)	**Right Bank** 10 9	8 7 6	5 4 3	2 1 0

Total Score 68

v. 2009

MBSS SPRING HABITAT DATA SHEET

Page 1 of 7

SITE — Watershed Code: MP | Segment: 118 | Type: 2 | Year: 2010

Reviewer: First JS / Second JA

DATE — Year: 10 | Month: 04 | Day: 15

400 Dist. from Nearest Road to Site (m)

15 Trash Rating 0 - 20

LANDUSE (Y/N)

Y	Old Field	Y	Residential
Y	Deciduous Forest	N	Commercial/Industrial
N	Coniferous Forest	N	Cropland
N	Wetland	Y	Pasture
N	Surface Mine	N	Orchard/Vineyard/Nursery
N	Landfill	N	Golf Course

RIPARIAN VEGETATION
(facing upstream)

	LEFT BANK	RIGHT BANK
Width (50m max)	50	50
Adjacent Land Cover	PA	PA
Vegetation Type	MRYG	MRYG
Buffer Breaks (Y/N)	N	N

ROAD CULVERT

Present in Segment (Y/N): N

Sampleable? (Y/N):

Width of Culvert (m):

Length of Culvert (m):

STREAM GRADIENT

	Location (m)	Height (m)
1		
2		
3		

Buffer Breaks

	LEFT BANK	RIGHT BANK
Storm Drain		
Tile Drain		
Impervious Drainage		
Gully		
Orchard		
Crop		
Pasture		
New Construction		
Dirt Road		
Gravel Road		
Raw Sewage		
Railroad		

Buffer Break Types
(M = minor; S = severe)

CHANNELIZATION

N Evidence of Channel Straightening or Dredging (Y/N)

TYPE	EXTENT (m) LEFT BANK	BOTTOM	RIGHT BANK
Concrete			
Gabion			
Rip-Rap			
Earthen Berm		N/A	
Dredge Spoil Off Channel		N/A	
Pipe Culvert			

Actual Coordinates
(If >30m distance between original coordinates and stream)

Lat

Lon

Stream Block Ht. (m)

Stream Block Type

Lat

Lon

v. 2009

MBSS SPRING INDEX PERIOD DATA SHEET

Page 2 Of 7

SITE: Watershed Code MP | Segment 18 A | Type 3 | Year 2016

Reviewer: First JS / Second TA

DATE: Year 16 Month 04 Day 15

CREW: JS/SA

STREAM: MP18A

TIME: 1019 (Military)

LOCALITY: AA Co, MD

SAMPLEABILITY

- [X] Benthos
- [X] Habitat Assessment
- [X] Water Quality
- [ ] Vernal Pool [A] (PRESENT/ABSENT)

OTHER (SPECIFY)

SITE ACCESS ROUTE

end of farm road walked into woods and around property owners fence

SAMPLE LABELS

Verified by: JS

QC LABEL

Watershed Code MP | Segment 18A (Letters only) | Type 3 | Year 2016

Dup. (D) or Blank (B): [ ] Verified by: _____

TEMP. LOGGER

	(Y/N)	(TIME - Military)	#
WATER			
AIR			

LOCATION _____

PHOTODOCUMENTATION

Number	Title	Voucher (Y/N)
	M - US/DS	
	D - US/DS	
	O - US/DS	

BENTHIC HABITAT SAMPLED

08	Riffle	02	Leaf Pack	00	Undercut Banks
07	Rootwad/Woody Debris	02	Macrophytes	XX	Other _____

SAMPLING CONSID.: ([ ] NUM. ANODES)

STREAM WIDTH (m): 0 m 25 | 75 m 15

MBSS SPRING FAUNA DATA SHEET

SITE — Watershed Code: MP | Segment: 118 A | Type: 2 | Year: 2016

Reviewer: First JS / Second JA

HERPETOFAUNA

None Observed: N

Species	Lifestage: Adult	Juv.	Larval	Egg	SEEN (Y/N)	HEARD (Y/N)	NUMBER RETAINED	NUMBER PHOTOS TAKEN
dead frog	X				Y	N	0	0

MUSSELS

None Observed: N

Species	LIVE	DEAD	NUMBER RETAINED	NUMBER PHOTOS TAKEN

Corbicula — LIVE ☐ DEAD ☐ NONE ☐

CRAYFISHES

None Observed: ☐

Species	NUMBER RETAINED
1 crayfish caught in net	00

Crayfish Burrows: P
(Absent, Present, Extensive)

COMMENTS

4 of 7

Physical Habitat Assessment and Water Quality Data Sheet

Site ID: MP118A
Subwatershed: Lynos Creek
Length of Reach: 75m **Date:** 4/15/16
Team Members: JS/JA **Time:** 10:20

Weather
Current: 60° sunny
Past 24hrs: 60° sunny
Past 48hrs: 60° sunny, some rain

Parameter	Down-stream	Mid-stream	Up-stream
Description			
pH	6.23	6.15	6.32
Temperature (°C)	10.17	10.82	10.32
DO (mg/l)	11.68	11.57	11.71
Conductivity (uS/cm)	169	169	170
TDS (mg/l)	153	153	153
Turbidity (NTU)	5.6	5.9	5.9

Notes:

Stream Character

P Meandering	A Channelized
A Braided	P Straight
P Riffle	A Run/Glide
P Deep Pool >.5m	P Silt/Clay
P Shallow Pool <.5m	P Sand
A Gravel	A Cobble
A Boulder >2m	A Boulder <2m
A Concrete/Gabion	A Bedrock
P Undercut Bank	P Rootwad
P Overhead Cover	A Storm Drain
A Effluent Discharge	A Human Refuse
P Emergent Vegetation	A Beaver Pond
P Floating Vegetation	

A=Absent *P=Present* *E=Extensive*

Bar Formation
☒ None ☐ Moderate
☐ Minor ☐ Extensive

Bank Erosion (see guidance sheet)

	Left Bank	Right Bank
Extent (m)	45	45
Severity	2	2
Avg. Height	1.75	1.75

Severity: 0=none 1=min 2=mod 3=severe

Maximum stream depth (cm) 83.82 (m)

Benthic Habitat Sampled (20 total)

	Sq. ft.
Riffle	9
Rootwad/Woody Debris	4
Leaf Pack	2
Submerged Vegetation	2
Undercut Banks	0
Other:	0

Rootwads/Woody Debris

# Instream Woody Debris	8
# Dewatered Woody Debris	5
# Instream Rootwads	1
# Dewatered Rootwads	1

Stream Gradient

Location (ft)	Height (ft)	Water Depth (ft)

Photographs/Observations:

MP118A

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MBSS Physical Habitat Assessment Sheet

Stream Habitat Assessment Guidance Sheet				
Habitat Parameter	Optimal 16-20	Sub-Optimal 11-15	Marginal 6-10	Poor 0-5
1. Instream Habitat[a] SCORE 16	Greater than 50% of a variety of cobble, boulder, submerged logs, undercut banks, snags, rootwads, aquatic plants or other stable habitat	30-50% of stable habitat. Adequate habitat	10-30% mix of stable habitat. Habitat availability less than desireable	Less than 10% stable habitat. Lack of habitat is obvious
2. Epifaunal Substrate[a] SCORE 12	Preferred substrate abundant, stable, and at full colonization potential (riffles well developed and dominated by cobble; and/or woody debris prevalent, not new, and not transient	Abund. of cobble with gravel and/or boulders common; or woody debris, aquatic veg., undercut banks common but not prevalent/suited for full colonization	Large boulders and/or bedrock prevalent; cobble, woody debris, or other preferred surfaces uncommon	Stable substrate lacking; or particles are over 75% surrounded by fine sediment or flocculent material
3. Velocity/Depth Diversity[a] SCORE 10	Slow (<0.3m/s), deep (>0.5m); slow, shallow (<0.5m); fast (>0.3m/s), deep; fast, shallow habitats all present	Only 3 of the 4 habitat categories present	Only 2 of the 4 habitat categories present	Dominated by 1 velocity/depth category (usually pools)
4. Pool/Glide/Eddy Quality[a] SCORE 10	Complex cover/& /or depth >1.5m; both deep (>0.5m)/shallows (<0.2m) present	Deep (>0.5m) areas present; but only moderate cover	Shallows (<0.2m) prevalent in pool/glide/eddy habitat; little cover	Max depth <0.2m in pool/glide/eddy habitat; or absent completely
5. Riffle/Run Quality[a] SCORE 15	Riffle/run depth generally >10cm, with maximum depth greater than 50 cm (maximum score); substrate stable (e.g. cobble, boulder) & variety of current velocities	Riffle/run depth generally 5-10cm, variety of current velocities	Riffle/run depth generally 1-5cm; primarily a single current velocity	Riffle/run depth <1cm; or riffle/run substrates concreted
6. Bank Stability[a] (facing downstream.) Score each bank LB SCORE 10 RB SCORE 10	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected. 10 9	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion. 8 7 6	Moderately unstable; 30-60% of bank in reach as areas of erosion; high erosion potential during floods. 5 4 3	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars. 2 1 0
7. Embeddedness SCORE 20 %	Percentage that gravel, cobble, and boulder particles are surrounded by fine sediment or flocculent material			
8. Shading SCORE 10 %	Percentage of segment that is shaded (duration is considered in scoring). 0% = fully exposed to sunlight all day in summer; 100% = fully and densely shaded all day in summer			
9. Riparian Buffer Zone Width (m)[a] LB 40 RB 40	Zone width in which human activity is not evident. 50m (164ft) is the maximum recorded value.			
10. Remoteness[a] SCORE 7	Roads greater than 400 meters (0.25 mi) from stream	Roads within 400 meters (0.25 mi) of stream; stream NOT accessible by trail.	Roads within 400 meters (0.25 mi) of stream; stream accessible by trail.	Roads adjacent to stream.
11. Aesthetic (trash) Rating[a] SCORE 16	Little or no human refuse visible from stream channel or riparian zone	Refuse present in minor amounts	Refuse present in moderate amounts	Refuse abundant and unsightly
12. Number of Woody Debris and Rootwads[a] SCORE 17	Count only woody debris and rootwads within the wetted portion of the sampling segment. Count only woody debris >10cm (4in) diameter and >1.5m (5ft) long and rootwads with trunk diameter (at chest height) >15cm (6in) that are functional habitat within the wetted portion of the stream.			

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS

STREAM NAME Lyons Creek	LOCATION AA County
STATION # LYBA REACH ID#	STREAM CLASS 2
UTM N UTM E	RIVER BASIN Patuxent River
STORET #	AGENCY CEI
INVESTIGATORS JS/JA	
FORM COMPLETED BY JS	DATE 4/15/10 TIME 10:30 PM
REASON FOR SURVEY BMI Sampling	

Parameters to be evaluated in sampling reach

Habitat Parameter	Condition Category			
	Optimal	Suboptimal	Marginal	Poor
1. Epifaunal Substrate/ Available Cover	Greater than 50% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient).	30-50% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale).	10-30% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 10% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
SCORE 12	20 19 18 17 16	15 14 13 (12) 11	10 9 8 7 6	5 4 3 2 1 0
2. Pool Substrate Characterization	Mixture of substrate materials, with gravel and firm sand prevalent; root mats and submerged vegetation common.	Mixture of soft sand, mud, or clay; mud may be dominant; some root mats and submerged vegetation present.	All mud or clay or sand bottom; little or no root mat; no submerged vegetation.	Hard-pan clay or bedrock; no root mat or vegetation.
SCORE 10	20 19 18 17 16	15 14 13 12 11	(10) 9 8 7 6	5 4 3 2 1 0
3. Pool Variability	Even mix of large-shallow, large-deep, small-shallow, small-deep pools present.	Majority of pools large-deep; very few shallow.	Shallow pools much more prevalent than deep pools.	Majority of pools small-shallow or pools absent.
SCORE 13	20 19 18 17 16	15 14 (13) 12 11	10 9 8 7 6	5 4 3 2 1 0
4. Sediment Deposition	Little or no enlargement of islands or point bars and less than <20% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 20-50% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 50-80% of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; more than 80% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
SCORE 9	20 19 18 17 16	15 14 13 12 11	10 (9) 8 7 6	5 4 3 2 1 0
5. Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills >75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
SCORE 16	20 19 18 17 (16)	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0

60

MP118A

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HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS

Parameters to be evaluated broader than sampling reach

Habitat Parameter	Condition Category			
	Optimal	Suboptimal	Marginal	Poor
6. Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr) may be present, but recent channelization is not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.
SCORE 18	20 19 (18) 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
7. Channel Sinuosity	The bends in the stream increase the stream length 3 to 4 times longer than if it was in a straight line. (Note - channel braiding is considered normal in coastal plains and other low-lying areas. This parameter is not easily rated in these areas.)	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	Channel straight; waterway has been channelized for a long distance.
SCORE 8	20 19 18 17 16	15 14 13 12 11	10 9 (8) 7 6	5 4 3 2 1 0
8. Bank Stability (score each bank)	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.
SCORE 6 (LB)	Left Bank 10 9	8 7 (6)	5 4 3	2 1 0
SCORE 6 (RB)	Right Bank 10 9	8 7 (6)	5 4 3	2 1 0
9. Vegetative Protection (score each bank) Note: determine left or right side by facing downstream.	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
SCORE 9 (LB)	Left Bank 10 (9)	8 7 6	5 4 3	2 1 0
SCORE 8 (RB)	Right Bank 10 9	(8) 7 6	5 4 3	2 1 0
10. Riparian Vegetative Zone Width (score each bank riparian zone)	Width of riparian zone >18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone.	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6-12 meters; human activities have impacted zone a great deal.	Width of riparian zone <6 meters: little or no riparian vegetation due to human activities.
SCORE 9 (LB)	Left Bank 10 (9)	8 7 6	5 4 3	2 1 0
SCORE 8 (RB)	Right Bank 10 9	(8) 7 6	5 4 3	2 1 0

72

Total Score 132

Form # EL2 - _____

v. 2009

MBSS SPRING HABITAT DATA SHEET

Page 1 of 7

SITE — Watershed Code: MP | Segment: 119 A | Type: 2 | Year: 2016

Reviewer: First: JS / Second: CR

DATE — Year: 16 | Month: 04 | Day: 18

75 Dist. from Nearest Road to Site (m)

16 Trash Rating 0 - 20

LANDUSE (Y/N)

Y	Old Field	Y	Residential
Y	Deciduous Forest	N	Commercial/Industrial
N	Coniferous Forest	N	Cropland
Y	Wetland	N	Pasture
N	Surface Mine	N	Orchard/Vineyard/Nursery
N	Landfill	N	Golf Course

ROAD CULVERT

Present in Segment (Y/N): N

Sampleable? (Y/N):

Width of Culvert (m):

Length of Culvert (m):

STREAM GRADIENT

	Elevation (m)	Height (m)
1		
2		
3		

RIPARIAN VEGETATION
(facing upstream)

	LEFT BANK	RIGHT BANK
Width (50m max)	50	50
Adjacent Land Cover	LN	LN
Vegetation Type	HYRG	PMYG
Buffer Breaks (Y/N)	N	N

	LEFT BANK	RIGHT BANK
Storm Drain		
Tile Drain		
Impervious Drainage		
Gully		
Orchard		
Crop		
Pasture		
New Construction		
Dirt Road		
Gravel Road		
Raw Sewage		
Railroad		

Buffer Break Types
(M = minor; S = severe)

CHANNELIZATION

N Evidence of Channel Straightening or Dredging (Y/N)

TYPE	EXTENT (m) N/A		
	LEFT BANK	BOTTOM	RIGHT BANK
Concrete			
Gabion			
Rip-Rap			
Earthen Berm		N/A	
Dredge Spoil Off Channel		N/A	
Pipe Culvert			

Actual Coordinates
(If >30m distance between original coordinates and stream)

Lat

Lon

Stream Block Ht. (m)

Stream Block Type

Lat

Lon

v. 2009

MBSS SPRING INDEX PERIOD DATA SHEET

Page 2 of 7

SITE Watershed Code: MP | Segment: 119 A | Type: 2 | Year: 2016

Reviewer: First: JS / Second: CR

DATE: Year 16 Month 04 Day 18

CREW: JOSEPH SMITH & CARISSA REH

STREAM: MP119A

TIME: 1007 (Military)

LOCALITY: AA Co, MD

SAMPLEABILITY

- Y Benthos
- Y Habitat Assessment
- Y Water Quality
- Y Vernal Pool P (PRESENT/ABSENT)

OTHER (SPECIFY): N/A

SITE ACCESS ROUTE

PARK ALONG MD RT 2
WALK THROUGH TREELINE
CROSS 2 TRIBS
~75m FROM RT 2 IS MIDPOINT

SAMPLE LABELS

Verified by: CR

QC LABEL

Watershed Code: MP | Segment: 119 (Letters only) A | Type: 2 | Year: 2016

Dup. (D) or Blank (B): | Verified by:

TEMP. LOGGER N/A

	(Y/N)	(TIME - Military)	#
WATER			
AIR			

LOCATION

PHOTODOCUMENTATION

Number	Title	Voucher (Y/N)
	MP - US, DS	
	US - US, DS	
	DS - US, DS	
	OVERVIEW - RB, LB	
	OVERVIEW - UP	

BENTHIC HABITAT SAMPLED

- 01 Riffle
- Rootwad/Woody Debris
- 19 Leaf Pack
- Macrophytes
- Undercut Banks
- Other

SAMPLING CONSID.: (NUM. ANODES)

STREAM WIDTH (m): 10 (0 m) | 10 (75 m)

v. 2009

MBSS SPRING FAUNA DATA SHEET

SITE Watershed Code MP | Segment 119 A | Type 2 | Year 2016

Reviewer: First JS / Second CR

HERPETOFAUNA

☐ None Observed

Species	Lifestage (Adult / Juv. / Larval / Egg)	SEEN (Y/N)	HEARD (Y/N)	NUMBER RETAINED	NUMBER PHOTOS TAKEN
FROG SPP	☐ ☒ ☐ ☐	☒	☐	☐	☐
	☐ ☐ ☐ ☐	☐	☐	☐	☐
	☐ ☐ ☐ ☐	☐	☐	☐	☐
	☐ ☐ ☐ ☐	☐	☐	☐	☐
	☐ ☐ ☐ ☐	☐	☐	☐	☐
	☐ ☐ ☐ ☐	☐	☐	☐	☐
	☐ ☐ ☐ ☐	☐	☐	☐	☐

MUSSELS

☒ None Observed

Species	LIVE	DEAD	NUMBER RETAINED	NUMBER PHOTOS TAKEN
	☐	☐	☐☐	☐
	☐	☐	☐☐	☐
	☐	☐	☐☐	☐
	☐	☐	☐☐	☐
	☐	☐	☐☐	☐

Corbicula — LIVE ☐ DEAD ☐ NONE ☒

CRAYFISHES

☒ None Observed

Species	NUMBER RETAINED
	☐☐
	☐☐
	☐☐
	☐☐
	☐☐

Crayfish Burrows [A]
(Absent, Present, Extensive)

COMMENTS

Physical Habitat Assessment and Water Quality Data Sheet

Site ID: MP119A
Subwatershed: Lyons Creek 7
Length of Reach: 75m **Date:** 4/18/16
Team Members: JS/CR **Time:** 10:08

Weather
Current: SUNNY 65°
Past 24hrs: SUNNY 70°
Past 48hrs: SUNNY 65°

Stream Character

[P] Meandering	[A] Channelized
[A] Braided	[P] Straight
[P] Riffle	[P] Run/Glide
[A] Deep Pool >.5m	[P] Silt/Clay
[P] Shallow Pool <.5m	[E] Sand
[P] Gravel	[P] Cobble
[A] Boulder >2m	[A] Boulder <2m
[A] Concrete/Gabion	[A] Bedrock
[A] Undercut Bank	[A] Rootwad
[E] Overhead Cover	[A] Storm Drain
[A] Effluent Discharge	[P] Human Refuse
[A] Emergent Vegetation	[A] Beaver Pond
[A] Floating Vegetation	

A=Absent P=Present E=Extensive

Bar Formation
[ ] None [ ] Moderate
[ ] Minor [ ] Extensive

Bank Erosion (see guidance sheet)

	Left Bank	Right Bank
Extent (m)	30m	30m
Severity	2	2
Avg. Height	0.6m	0.6m

Severity: 0=none 1=min 2=mod 3=severe

BANKFULL
Maximum stream depth (cm) 20

Benthic Habitat Sampled (20 total)

	Sq. ft.
Riffle	0
Rootwad/Woody Debris	1
Leaf Pack	19
Submerged Vegetation	0
Undercut Banks	0
Other: N/A	0

Rootwads/Woody Debris

# Instream Woody Debris	1
# Dewatered Woody Debris	2
# Instream Rootwads	0
# Dewatered Rootwads	0

Stream Gradient

Location (ft)	Height (ft)	Water Depth (ft)

Parameter	Down-stream	Mid-stream	Up-stream
Description			
pH	6.23	5.96	6.32
Temperature (°C)	11.19	11.16	11.13
DO (mg/l)	11.48	11.94	11.34
Conductivity (uS/cm)	232	240	221
TDS (mg/l)	205	212	194
Turbidity (NTU)	19.5	14.3	11.1

Notes: BARO 769.6 mmHg

Photographs/Observations:
- REACH AMONG FLOODPLAIN W/ NUMEROUS GROUNDWATER SEEPS
- MATURE, HEALTHY MID-SUCCESSIONAL DECIDUOUS FOREST BUFFER
- SUBSTRATE DOMINATED BY SAND
- NOT FAVORABLE SUBSTRATE FOR SAMPLING
- ONE CONTINUOUS SLOPE, HARDLY ANY SHALLOW POOLS

MBSS Physical Habitat Assessment Sheet

Stream Habitat Assessment Guidance Sheet				
Habitat Parameter	Optimal 16-20	Sub-Optimal 11-15	Marginal 6-10	Poor 0-5
1. Instream Habitat[2] SCORE 2	Greater than 50% of a variety of cobble, boulder, submerged logs, undercut banks, snags, rootwads, aquatic plants or other stable habitat	30-50% of stable habitat. Adequate habitat	10-30% mix of stable habitat. Habitat availability less than desirable	Less than 10% stable habitat. Lack of habitat is obvious
2. Epifaunal Substrate[3] SCORE 3	Preferred substrate abundant, stable, and at full colonization potential (riffles well developed and dominated by cobble; and/or woody debris prevalent, not new, and not transient	Abund. of cobble with gravel and/or boulders common; or woody debris, aquatic veg., undercut banks common but not prevalent/suited for full colonization	Large boulders and/or bedrock prevalent; cobble, woody debris, or other preferred surfaces uncommon	Stable substrate lacking; or particles are over 75% surrounded by fine sediment or flocculent material
3. Velocity/Depth Diversity[4] SCORE 3	Slow (<0.3m/s), deep (>0.5m); slow, shallow (<0.5m); fast (>0.3m/s), deep; fast, shallow habitats all present	Only 3 of the 4 habitat categories present	Only 2 of the 4 habitat categories present	Dominated by 1 velocity/depth category (usually pools)
4. Pool/Glide/Eddy Quality[5] SCORE 3	Complex cover/& or depth >1.5m; both deep (>0.5m)/shallows (<0.2m) present	Deep (>0.5m) areas present; but only moderate cover	Shallows (<0.2m) prevalent in pool/glide/eddy habitat; little cover	Max depth <0.2m in pool/glide/eddy habitat; or absent completely
5. Riffle/Run Quality[6] SCORE 2	Riffle/run depth generally >10cm, w/in maximum depth greater than 50 cm (maximum score); substrate stable (e.g. cobble, boulder) & variety of current velocities	Riffle/run depth generally 5-10cm, variety of current velocities	Riffle/run depth generally 1-5cm; primarily a single current velocity	Riffle/run depth <1cm; or riffle/run substrates concreted
6. Bank Stability[7] (facing downstream.) Score each bank LB SCORE 4 RB SCORE 4	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected. 10 9	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion. 8 7 6	Moderately unstable; 30-60% of bank in reach as areas of erosion; high erosion potential during floods. 5 4 3	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars. 2 1 0
7. Embeddedness SCORE 70 %	Percentage that gravel, cobble, and boulder particles are surrounded by fine sediment or flocculent material			
8. Shading SCORE 80 %	Percentage of segment that is shaded (duration is considered in scoring). 0% = fully exposed to sunlight all day in summer. 100% = fully and densely shaded all day in summer			
9. Riparian Buffer Zone Width (m)[8] LB 50 RB 50	Zone width in which human activity is not evident. 50m (164ft) is the maximum recorded value.			
10. Remoteness SCORE 6	Roads greater than 400 meters (0.25 mi) from stream	Roads within 400 meters (0.25 mi) of stream; stream NOT accessible by trail.	Roads within 400 meters (0.25 mi) of stream; stream accessible by trail.	Roads adjacent to stream.
11. Aesthetic (trash) Rating[9] SCORE 16	Little or no human refuse visible from stream channel or riparian zone	Refuse present in minor amounts	Refuse present in moderate amounts	Refuse abundant and unsightly
12. Number of Woody Debris and Rootwads[10] SCORE 1	Count only woody debris and rootwads within the wetted portion of the sampling segment. Count only woody debris >10cm (4in) diameter and >1.5m (5ft) long and rootwads with trunk diameter (at chest height) >15cm (6in) that are functional habitat within the wetted portion of the stream.			

75m, no trail

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS

STREAM NAME MP119A	LOCATION AA Co, MD
STATION # _____ REACH ID# _____	STREAM CLASS 2
UTM N _____ UTM E	RIVER BASIN PATUXENT RIVER
STORET #	AGENCY CEI
INVESTIGATORS JS | CR	
FORM COMPLETED BY CR	DATE 4/18/16 TIME ~10:08 AM PM
REASON FOR SURVEY BMI SAMPLING	

Parameters to be evaluated in sampling reach

Habitat Parameter	Condition Category			
	Optimal	Suboptimal	Marginal	Poor
1. Epifaunal Substrate/ Available Cover	Greater than 50% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient).	30-50% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale).	10-30% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 10% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
SCORE 3	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 (3) 2 1 0
2. Pool Substrate Characterization	Mixture of substrate materials, with gravel and firm sand prevalent; root mats and submerged vegetation common.	Mixture of soft sand, mud, or clay; mud may be dominant; some root mats and submerged vegetation present.	All mud or clay or sand bottom; little or no root mat; no submerged vegetation.	Hard-pan clay or bedrock; no root mat or vegetation.
SCORE 3	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 (3) 2 1 0
3. Pool Variability	Even mix of large-shallow, large-deep, small-shallow, small-deep pools present.	Majority of pools large-deep; very few shallow.	Shallow pools much more prevalent than deep pools.	Majority of pools small-shallow or pools absent.
SCORE 3	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 (3) 2 1 0
4. Sediment Deposition	Little or no enlargement of islands or point bars and less than <20% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 20-50% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 50-80% of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; more than 80% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
SCORE 3	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
5. Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills >75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
SCORE 11	20 19 18 17 16	15 14 13 12 (11)	10 9 8 7 6	5 4 3 2 1 0

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HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS

Parameters to be evaluated broader than sampling reach

Habitat Parameter	Condition Category			
	Optimal	Suboptimal	Marginal	Poor
6. Channel Alteration NO CHANNEL-IZATION SCORE 20	Channelization or dredging absent or minimal; stream with normal pattern. (20) 19 18 17 16	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr) may be present, but recent channelization is not present. 15 14 13 12 11	Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted. 10 9 8 7 6	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely. 5 4 3 2 1 0
7. Channel Sinuosity SCORE 11	The bends in the stream increase the stream length 3 to 4 times longer than if it was in a straight line. (Note - channel braiding is considered normal in coastal plains and other low-lying areas. This parameter is not easily rated in these areas.) 20 19 18 17 16	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line. 15 14 13 12 (11)	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line. 10 9 8 7 6	Channel straight; waterway has been channelized for a long distance. 5 4 3 2 1 0
8. Bank Stability (score each bank) SCORE 5 (LB) SCORE 5 (RB)	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected. Left Bank 10 9 Right Bank 10 9	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion. 8 7 6 8 7 6	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods. (5) 4 3 (5) 4 3	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars. 2 1 0 2 1 0
9. Vegetative Protection (score each bank) Note: determine left or right side by facing downstream. SCORE 4 (LB) SCORE 4 (RB)	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally. Left Bank 10 9 Right Bank 10 9	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining. 8 7 6 8 7 6	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining. 5 (4) 3 5 (4) 3	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height. 2 1 0 2 1 0
10. Riparian Vegetative Zone Width (score each bank riparian zone) SCORE 10 (LB) SCORE 10 (RB)	Width of riparian zone >18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone. Left Bank (10) 9 Right Bank (10) 9	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally. 8 7 6 8 7 6	Width of riparian zone 6-12 meters; human activities have impacted zone a great deal. 5 4 3 5 4 3	Width of riparian zone <6 meters: little or no riparian vegetation due to human activities. 2 1 0 2 1 0

Total Score 92

v. 2009

MBSS SPRING HABITAT DATA SHEET

SITE — Watershed Code: MP | Segment: 121 | Type: 2 | Year: 2016 A

Reviewer: First: JS / Second: CR

DATE — Year: 16 | Month: 04 | Day: 18

1100 Dist. from Nearest Road to Site (m)

18 Trash Rating 0 - 20

LANDUSE (Y/N)

N	Old Field	Y	Residential
Y	Deciduous Forest	N	Commercial/Industrial
N	Coniferous Forest	N	Cropland
N	Wetland	Y	Pasture
N	Surface Mine	N	Orchard/Vineyard/Nursery
N	Landfill	N	Golf Course

ROAD CULVERT

Present in Segment (Y/N): N

Sampleable? (Y/N):

Width of Culvert (m): N/A

Length of Culvert (m): N/A

STREAM GRADIENT

	Location (m)	Height (m)
1		
2		
3		

RIPARIAN VEGETATION
(facing upstream)

	LEFT BANK	RIGHT BANK
Width (50m max)	50	50
Adjacent Land Cover	LN	LU
Vegetation Type	MRYG	MRYG
Buffer Breaks (Y/N)	N	N

	LEFT BANK	RIGHT BANK
Storm Drain		
Tile Drain		
Impervious Drainage		
Gully		
Orchard		
Crop		
Pasture		
New Construction		
Dirt Road		
Gravel Road		
Raw Sewage		
Railroad		

Buffer Break Types
(M = minor; S = severe)

CHANNELIZATION

N Evidence of Channel Straightening or Dredging (Y/N)

TYPE	EXTENT (m) LEFT BANK	BOTTOM	RIGHT BANK
Concrete			
Gebion			
Rip-Rap			
Earthen Berm		N/A	
Dredge Spoil Off Channel		N/A	
Pipe Culvert			

Actual Coordinates
(If >30m distance between original coordinates and stream)

Lat

Lon

Stream Block Ht. (m)

Stream Block Type

Lat

Lon

v. 2009

MBSS SPRING INDEX PERIOD DATA SHEET

Page 2 of 7

SITE — Watershed Code: MP | Segment: 121 A | Type: 2 | Year: 2016

Reviewer: First JS / Second CR

DATE — Year: 16 | Month: 04 | Day: 18

CREW: JOSEPH SMITH / CARISSA REH

STREAM: MP121A

TIME 1247 (Military)

LOCALITY: AA CO., MD

SAMPLEABILITY

- Y Benthos
- Y Habitat Assessment
- Y Water Quality
- N Vernal Pool A (PRESENT/ABSENT)

OTHER (SPECIFY) N/A

SITE ACCESS ROUTE

PARK @ CUL-DE-SAC @ GREENRIDGE DR.
WALK ~100m TO SITE MIDPOINT

SAMPLE LABELS

Verified by: CR

QC LABEL

Watershed Code: MP | Segment: 121 (Letters only) A | Type: 2 | Year: 2016

Dup. (D) or Blank (B): ______ Verified by: ______

TEMP. LOGGER

N/A

	(Y/N)	(TIME - Military)	#
WATER			
AIR			

LOCATION ______

PHOTODOCUMENTATION

Number	Title	Voucher (Y/N)
	MP - US, DS	
	DS - US, DS	
	US - US, DS	
	OVERVIEW - RB, LB	

BENTHIC HABITAT SAMPLED

Riffle	
Rootwad/Woody Debris	01
Leaf Pack	19
Macrophytes	
Undercut Banks	
Other ______	

SAMPLING CONSID.: (2 NUM. ANODES)

STREAM WIDTH (m): 0 m: 2.0 | 75 m: 1.8

v. 2009

MBSS SPRING FAUNA DATA SHEET

SITE Watershed Code: MP | Segment: 12 (A) | Type: 2 | Year: 2016

Reviewer: First: JS / Second: CR

HERPETOFAUNA

☒ None Observed

Species	Lifestage (Adult, Juv, Larval, Egg)	SEEN (Y/N)	HEARD (Y/N)	NUMBER RETAINED	NUMBER PHOTOS TAKEN
	☐☐☐☐	☐	☐	☐	☐
	☐☐☐☐	☐	☐	☐	☐
	☐☐☐☐	☐	☐	☐	☐
	☐☐☐☐	☐	☐	☐	☐
	☐☐☐☐	☐	☐	☐	☐
	☐☐☐☐	☐	☐	☐	☐
	☐☐☐☐	☐	☐	☐	☐

MUSSELS

☒ None Observed

Species	LIVE	DEAD	NUMBER RETAINED	NUMBER PHOTOS TAKEN
	☐	☐	☐☐	☐
	☐	☐	☐☐	☐
	☐	☐	☐☐	☐
	☐	☐	☐☐	☐
	☐	☐	☐☐	☐

Corbicula: LIVE ☐ DEAD ☐ NONE ☒

CRAYFISHES

☒ None Observed

Species	NUMBER RETAINED
	☐☐
	☐☐
	☐☐
	☐☐
	☐☐

Crayfish Burrows ☐
(Absent, Present, Extensive)

COMMENTS

Physical Habitat Assessment and Water Quality Data Sheet

Site ID: MP121
Subwatershed: Lyons Creek S
Length of Reach: 75m **Date:** 4/18/16
Team Members: JS/CR **Time:** 12:47

Weather
Current: SUNNY 70°
Past 24hrs: SUNNY 65°
Past 48hrs: SUNNY 60°

Stream Character

[P] Meandering	[A] Channelized
[A] Braided	[P] Straight
[A] Riffle	[E] Run/Glide
[A] Deep Pool >.5m	[P] Silt/Clay
[P] Shallow Pool <.5m	[E] Sand
[P] Gravel	[P] Cobble
[A] Boulder >2m	[A] Boulder <2m
[A] Concrete/Gabion	[A] Bedrock
[A] Undercut Bank	[P] Rootwad
[E] Overhead Cover	[ ] Storm Drain
[A] Effluent Discharge	[ ] Human Refuse
[A] Emergent Vegetation	[A] Beaver Pond
[A] Floating Vegetation	

A=Absent P=Present E=Extensive

Bar Formation
[ ] None [X] Moderate
[ ] Minor [ ] Extensive

Bank Erosion (see guidance sheet)

	Left Bank	Right Bank	Severity:
Extent (m)	20	30	
Severity	3	3	0=none
Avg. Height*	0.5m	0.5m	1=min
	*BANKFULL		2=mod
Maximum stream depth (cm)	20		3=severe

Benthic Habitat Sampled (20 total)

	Sq. ft.
Riffle	0
Rootwad/Woody Debris	1
Leaf Pack	19
Submerged Vegetation	0
Undercut Banks	0
Other: N/A	0

Rootwads/Woody Debris

# Instream Woody Debris	1
# Dewatered Woody Debris	1
# Instream Rootwads	0
# Dewatered Rootwads	1

Stream Gradient

Location (ft)	Height (ft)	Water Depth (ft)

Parameter	Down-stream	Mid-stream	Up-stream
Description	—	—	—
pH	7.5	7.82	7.63
Temperature (°C)	18.38	18.41	18.73
DO (mg/l)	11.71	12.51	12.65
Conductivity (uS/cm)	286	286	290
TDS (mg/l)	212	213	214
Turbidity (NTU)	8.4	2.5	2.7
Notes: BARO mmHg	769.3	769.1	770.4

Photographs/Observations:
- HEALTHY MATURE MID-SUCCESSIONAL DECIDUOUS FOREST
- CHANNEL IS EXTREMELY INCISED
- FREEZE THAW & EROSION APPARENT AMONG BOTH BANK
- SEDIMENT BARS & ISLANDS ARE NUMEROUS
- SUBSTRATE DOMINATED BY SAND
- EROSION IS MORE SEVERE UPSTREAM

MBSS Physical Habitat Assessment Sheet

Stream Habitat Assessment Guidance Sheet				
Habitat Parameter	Optimal 16-20	Sub-Optimal 11-15	Marginal 6-10	Poor 0-5
1. Instream Habitat[a] SCORE 4	Greater than 50% of a variety of cobble, boulder, submerged logs, undercut banks, snags, rootwads, aquatic plants or other stable habitat	30-50% of stable habitat. Adequate habitat	10-30% mix of stable habitat. Habitat availability less than desireable	Less than 10% stable habitat. Lack of habitat is obvious
2. Epifaunal Substrate[b] SCORE 4	Preferred substrate abundant, stable, and at full colonization potential (riffles well developed and dominated by cobble; and/or woody debris prevalent, not new; and not transient	Abund. of cobble with gravel and/or boulders common; or woody debris, aquatic veg., undercut banks common but not prevalent/suited for full colonization	Large boulders and/or bedrock prevalent; cobble, woody debris, or other preferred surfaces uncommon	Stable substrate lacking; or particles are over 75% surrounded by fine sediment or flocculent material
3. Velocity/Depth Diversity[c] SCORE 4	Slow (<0.3m/s), deep (>0.5m); slow, shallow (<0.5m); fast (>0.3m/s), deep; fast, shallow habitats all present	Only 3 of the 4 habitat categories present	Only 2 of the 4 habitat categories present	Dominated by 1 velocity/depth category (usually pools)
4. Pool/Glide/Eddy Quality[d] SCORE 4	Complex cover/& /or depth >1.5m; both deep (>0.5m)/shallows (<0.2m) present	Deep (>0.5m) areas present; but only moderate cover	Shallows (<0.2m) prevalent in pool/glide/eddy habitat; little cover	Max depth <0.2m in pool/glide/eddy habitat; or absent completely
5. Riffle/Run Quality[e] SCORE 4	Riffle/run depth generally >10cm, with maximum depth greater than 50 cm (maximum score); substrate stable (e.g. cobble, boulder) & variety of current velocities	Riffle/run depth generally 5-10cm, variety of current velocities	Riffle/run depth generally 1-5cm; primarily a single current velocity	Riffle/run depth <1cm; or riffle/run substrates concreted
6. Bank Stability[f] (facing downstream.) Score each bank LB SCORE 1 RB SCORE 2	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected. 10 9	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion. 8 7 6	Moderately unstable; 30-60% of bank in reach as areas of erosion; high erosion potential during floods. 5 4 3	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars. (2) 1 0
7. Embeddedness SCORE 60 %	Percentage that gravel, cobble, and boulder particles are surrounded by fine sediment or flocculent material			
8. Shading SCORE 60 %	Percentage of segment that is shaded (duration is considered in scoring). 0% = fully exposed to sunlight all day in summer; 100% = fully and densely shaded all day in summer			
9. Riparian Buffer Zone Width (m)[g] LB 50 RB 50	Zone width in which human activity is not evident. 50m (164ft) is the maximum recorded value.			
10. Remoteness[h] SCORE 5	Roads greater than 400 meters (0.25 mi) from stream	Roads within 400 meters (0.25 mi) of stream; stream NOT accessible by trail.	Roads within 400 meters (0.25 mi) of stream; stream accessible by trail.	Roads adjacent to stream.
11. Aesthetic (trash) Rating[i] 18 SCORE	Little or no human refuse visible from stream channel or riparian zone	Refuse present in minor amounts	Refuse present in moderate amounts	Refuse abundant and unsightly
12. Number of Woody Debris and Rootwads[k] SCORE 1	Count only woody debris and rootwads within the wetted portion of the sampling segment. Count only woody debris >10cm (4in) diameter and >1.5m (5ft) long and rootwads with trunk diameter (at chest height) >15cm (6in) that are functional habitat within the wetted portion of the stream.			

* POOR PRIMARILY DUE TO UPSTREAM PORTION

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS

STREAM NAME MP121A		LOCATION AA. CO. MD.	
STATION #	REACH ID#	STREAM CLASS PERENNIAL – II	
UTM N	UTM E	RIVER BASIN PATUXENT RIVER	
STORET #		AGENCY CEI	
INVESTIGATORS JS/CR			
FORM COMPLETED BY		DATE 4/18/16 TIME - PM	REASON FOR SURVEY BMI SAMPLING

Parameters to be evaluated in sampling reach

Habitat Parameter	Condition Category			
	Optimal	Suboptimal	Marginal	Poor
1. Epifaunal Substrate/ Available Cover	Greater than 50% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient).	30-50% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale).	10-30% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 10% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
SCORE 4	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 (4) 3 2 1 0
2. Pool Substrate Characterization	Mixture of substrate materials, with gravel and firm sand prevalent; root mats and submerged vegetation common.	Mixture of soft sand, mud, or clay; mud may be dominant; some root mats and submerged vegetation present.	All mud or clay or sand bottom; little or no root mat; no submerged vegetation.	Hard-pan clay or bedrock; no root mat or vegetation.
SCORE 4	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 (4) 3 2 1 0
3. Pool Variability	Even mix of large-shallow, large-deep, small-shallow, small-deep pools present.	Majority of pools large-deep; very few shallow.	Shallow pools much more prevalent than deep pools.	Majority of pools small-shallow or pools absent.
SCORE 4	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 (4) 3 2 1 0
4. Sediment Deposition	Little or no enlargement of islands or point bars and less than <20% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 20-50% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 50-80% of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; more than 80% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
SCORE 5	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	(5) 4 3 2 1 0
5. Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills >75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
SCORE 6	20 19 18 17 16	15 14 13 12 11	10 9 8 7 (6)	5 4 3 2 1 0

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HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS

Parameters to be evaluated broader than sampling reach

Habitat Parameter	Condition Category			
	Optimal	Suboptimal	Marginal	Poor
6. Channel Alteration NOT CHANNEL-IZED SCORE 20	Channelization or dredging absent or minimal; stream with normal pattern. (20) 19 18 17 16	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr) may be present, but recent channelization is not present. 15 14 13 12 11	Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted. 10 9 8 7 6	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely. 5 4 3 2 1 0
7. Channel Sinuosity SCORE 6	The bends in the stream increase the stream length 3 to 4 times longer than if it was in a straight line. (Note - channel braiding is considered normal in coastal plains and other low-lying areas. This parameter is not easily rated in these areas.) 20 19 18 17 16	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line. 15 14 13 12 11	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line. 10 9 8 7 (6)	Channel straight; waterway has been channelized for a long distance. 5 4 3 2 1 0
8. Bank Stability (score each bank) SCORE 2 (LB) SCORE 2 (RB)	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected. Left Bank 10 9 Right Bank 10 9	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion. 8 7 6 8 7 6	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods. 5 4 3 5 4 3	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars. (2) 1 0 (2) 1 0
9. Vegetative Protection (score each bank) Note: determine left or right side by facing downstream. DISTURBED VIA EROSION SCORE 3 (LB) SCORE 3 (RB)	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally. Left Bank 10 9 Right Bank 10 9	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining. 8 7 6 8 7 6	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining. 5 4 (3) 5 4 (3)	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height. 2 1 0 2 1 0
10. Riparian Vegetative Zone Width (score each bank riparian zone) SCORE 10 (LB) SCORE 10 (RB)	Width of riparian zone >18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone. Left Bank (10) 9 Right Bank (10) 9	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally. 8 7 6 8 7 6	Width of riparian zone 6-12 meters; human activities have impacted zone a great deal. 5 4 3 5 4 3	Width of riparian zone <6 meters: little or no riparian vegetation due to human activities. 2 1 0 2 1 0

POOR ESPECIALLY UPSTREAM

56

Total Score 79

v. 2009 MP124A

MBSS SPRING HABITAT DATA SHEET

Page 1 of 7

SITE — Watershed Code: MP | Segment: 124 A | Type: 3 | Year: 2016

Reviewer: First EW / Second CR

DATE — Year: 16 | Month: 04 | Day: 20 | 11:54 AM

206 Dist. from Nearest Road to Site (m)

19 Trash Rating 0 - 20

LANDUSE (Y/N)

Y	Old Field	Y	Residential
Y	Deciduous Forest	N	Commercial/Industrial
N	Coniferous Forest	N	Cropland
Y	Wetland	N	Pasture
N	Surface Mine	N	Orchard/Vineyard/Nursery
N	Landfill	N	Golf Course

RIPARIAN VEGETATION
(facing upstream)

	LEFT BANK	RIGHT BANK
Width (50m max)	50	50
Adjacent Land Cover	FR	FR
Vegetation Type	GRY	G
Buffer Breaks (Y/N)	N	N

ROAD CULVERT

Present in Segment (Y/N): N

Sampleable? (Y/N):

Width of Culvert (m):

Length of Culvert (m):

STREAM GRADIENT

	Location (m)	Height (m)
1		
2		
3		

Buffer Breaks

	LEFT BANK	RIGHT BANK
Storm Drain		
Tile Drain		
Impervious Drainage		
Gully		
Orchard		
Crop		
Pasture		
New Construction		
Dirt Road		
Gravel Road		
Raw Sewage		
Railroad		

Buffer Break Types
(M = minor; S = severe)

CHANNELIZATION

N Evidence of Channel Straightening or Dredging (Y/N)

N/A

TYPE	EXTENT (m) LEFT BANK	BOTTOM	RIGHT BANK
Concrete			
Gebion			
Rip-Rap			
Earthen Berm		N/A	
Dredge Spoil Off Channel		N/A	
Pipe Culvert			

Actual Coordinates
(If >30m distance between original coordinates and stream)

Lat 38.76761.2

Lon -76.61261.0

Stream Block Ht. (m):

Stream Block Type:

Lat:

Lon:

v. 2009

MBSS SPRING INDEX PERIOD DATA SHEET

SITE: Watershed Code MP | Segment 124A | Type 3 | Year 2016

Reviewer: First EW / Second CR

DATE: Year 16 Month 04 Day 20

CREW: ELEANOR WILSON / CARISSA REH

STREAM: LYONS CREEK / MP124A

TIME: 1215 (Military)

LOCALITY: HARWOOD, AA Co, MD

SAMPLEABILITY

- [Y] Benthos
- [Y] Habitat Assessment
- [Y] Water Quality
- [N] Vernal Pool [P] (PRESENT/ABSENT)

OTHER (SPECIFY): N/A

SITE ACCESS ROUTE

DARK @ END OF RD; WALK ~500' DS TO REACH

SAMPLE LABELS

Verified by: CR

QC LABEL

Watershed Code MP | Segment 124 (Letters only) A | Type 3 | Year 2016

Dup. (D) or Blank (B): [ ] Verified by: _____

TEMP. LOGGER N/A

	(Y/N)	(TIME - Military)	#
WATER	Y	1215	3
AIR			#

LOCATION: RB

PHOTODOCUMENTATION

Number	Title	Voucher (Y/N)
	DS - US, DS (2)	
	MD - US, DS (2)	
	US - US, DS (2)	
	OVERVIEW - STREAM REST (3)	
	US BEYOND BRAID - US, DS (2)	
	OVERVIEW x3 - STREAM REST (12)	

BENTHIC HABITAT SAMPLED

08	Riffle	00	Leaf Pack	00	Undercut Banks
11	Rootwad/Woody Debris	01	Macrophytes	00	Other N/A

SAMPLING CONSID.: ([X] NUM. ANODES) (x2)

STREAM WIDTH (m): 0 m 11 | 75 m 17

v. 2009

MBSS SPRING FAUNA DATA SHEET

SITE — Watershed Code: MP | Segment: 124A | Type: 3 | Year: 2016

Reviewer: First: EW / Second: CR

HERPETOFAUNA

☐ None Observed

Species	Lifestage (Adult, Juv., Larval, Egg)	SEEN (Y/N)	HEARD (Y/N)	NUMBER RETAINED	NUMBER PHOTOS TAKEN
FROG SPP.	☒	☒	☐	0	0
	☐	☐	☐		
	☐	☐	☐		
	☐	☐	☐		
	☐	☐	☐		
	☐	☐	☐		
	☐	☐	☐		

MUSSELS

☒ None Observed

Species	LIVE	DEAD	NUMBER RETAINED	NUMBER PHOTOS TAKEN
1 TBD	☒	☐	0	3
	☐	☐		
	☐	☐		
	☐	☐		
	☐	☐		

Corbicula — LIVE ☐ DEAD ☐ NONE ☒

CRAYFISHES

☐ None Observed

Species	NUMBER RETAINED
(1) TBD	01

Crayfish Burrows: E

(Absent, Present, Extensive)

COMMENTS

Physical Habitat Assessment and Water Quality Data Sheet

Site ID: MP 124A
Subwatershed: LC-2
Length of Reach: 75 **Date:** 4/20/16
Team Members: EW/CR **Time:** 11:54 AM

Weather
Current: Sunny 70° F
Past 24hrs: SUNNY 70° F
Past 48hrs: SUNNY 70° F

Stream Character

[P] Meandering	[A] Channelized	
[P] Braided	[P] Straight	
[P] Riffle	[P] Run/Glide	
[P] Deep Pool >.5m	[E] Silt/Clay	
[P] Shallow Pool <.5m	[P] Sand	
[P] Gravel	[P] Cobble	
[A] Boulder >2m	[A] Boulder <2m	
[A] Concrete/Gabion	[A] Bedrock	
[P] Undercut Bank	[P] Rootwad	
[A] Overhead Cover	[A] Storm Drain	
[A] Effluent Discharge	[A] Human Refuse	
[E] Emergent Vegetation	[ ] Beaver Pond*	
[P] Floating Vegetation		

*SEE NOTES

A=Absent P=Present E=Extensive

Parameter	Down-stream	Mid-stream	Up-stream
Description	—		
pH	7.16	7.19	7.31
Temperature (°C)	17.97	18.16	18.43
DO (mg/l)	13.25	12.44	12.73
Conductivity (uS/cm)	210	211	211
TDS (mg/l)	158	157	157 g/L
Turbidity (NTU)	6.3	11.0	7.8
Notes: BARO mmHg		771.3	

Bar Formation
[X] None [ ] Moderate
[ ] Minor [ ] Extensive

Bank Erosion (see guidance sheet)

	Left Bank	Right Bank	Severity: 0=none 1=min 2=mod 3=severe
Extent (m)	0	0	
Severity	0	0	
Avg. Height	1.6m	1.6m	

Maximum stream depth (cm) 107 (3.5')

Benthic Habitat Sampled (20 total)

	Sq. ft.
Riffle	8
Rootwad/Woody Debris	11
Leaf Pack	0
Submerged Vegetation	0
Undercut Banks	8
Other: N/A	0

Rootwads/Woody Debris

# Instream Woody Debris	6
# Dewatered Woody Debris	1
# Instream Rootwads	4
# Dewatered Rootwads	1

Stream Gradient

Location (ft)	Height (ft)	Water Depth (ft)

Photographs/Observations:

- SITE AMONG REMNANT BEAVER SITE (NUMEROUS STUMPS)
- CHANNEL BRAIDED @ UPSTREAM PORTION
- ADJACENT DECIDUOUS FOREST IS STEEPLY SLOPING INWARD TOWARD FLOODPLAIN/WETLAND/LYONS CREEK
- FOSSIL FOUND

MBSS Physical Habitat Assessment Sheet

Stream Habitat Assessment Guidance Sheet				
Habitat Parameter	Optimal 16-20	Sub-Optimal 11-15	Marginal 6-10	Poor 0-5
1. Instream Habitat[1] SCORE 15	Greater than 50% of a variety of cobble, boulder, submerged logs, undercut banks, snags, rootwads, aquatic plants or other stable habitat	30-50% of stable habitat. Adequate habitat	10-30% mix of stable habitat. Habitat availability less than desireable	Less than 10% stable habitat. Lack of habitat is obvious
2. Epifaunal Substrate[2] SCORE 13	Preferred substrate abundant, stable, and at full colonization potential (riffles well developed and dominated by cobble; and/or woody debris prevalent, not new, and not transient	Abund. of cobble with gravel and/or boulders common; or woody debris, aquatic veg., undercut banks common but not prevalent/suited for full colonization	Large boulders and/or bedrock prevalent; cobble, woody debris, or other preferred surfaces uncommon	Stable substrate lacking; or particles are over 75% surrounded by fine sediment or flocculent material
3. Velocity/Depth Diversity[3] SCORE 16	Slow (<0.3m/s), deep (>0.5m); slow, shallow (<0.5m); fast (>0.3m/s), deep; fast, shallow habitats all present	Only 3 of the 4 habitat categories present	Only 2 of the 4 habitat categories present	Dominated by 1 velocity/depth category (usually pools)
4. Pool/Glide/Eddy Quality[4] SCORE 16	Complex cover&/or depth >1.5m; both deep (>0.5m)/shallows (<0.2m) present	Deep (>0.5m) areas present; but only moderate cover	Shallows (<0.2m) prevalent in pool/glide/eddy habitat; little cover	Max depth <0.2m in pool/glide/eddy habitat; or absent completely
5. Riffle/Run Quality[5] SCORE 13	Riffle/run depth generally >10cm, with maximum depth greater than 50 cm (maximum score); substrate stable (e.g. cobble, boulder) & variety of current velocities	Riffle/run depth generally 5-10cm, variety of current velocities	Riffle/run depth generally 1-5cm; primarily a single current velocity	Riffle/run depth <1cm; or riffle/run substrates concreted
6. Bank Stability[6] (facing downstream.) Score each bank LB SCORE 8 RB SCORE 8	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected. 10 9	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion. 8 7 6	Moderately unstable; 30-60% of bank in reach as areas of erosion; high erosion potential during floods. 5 4 3	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars. 2 1 0
7. Embeddedness SCORE 70 %	Percentage that gravel, cobble, and boulder particles are surrounded by fine sediment or flocculent material			
8. Shading SCORE 0 %	Percentage of segment that is shaded (duration is considered in scoring). 0% = fully exposed to sunlight all day in summer. 100% = fully and densely shaded all day in summer			
9. Riparian Buffer Zone Width (m)[7] LB 50 RB 50	Zone width in which human activity is not evident. 50m (164ft) is the maximum recorded value.			
10. Remoteness SCORE 11	Roads greater than 400 meters (0.25 mi) from stream	Roads within 400 meters (0.25 mi) of stream; stream NOT accessible by trail.	Roads within 400 meters (0.25 mi) of stream; stream accessible by trail.	Roads adjacent to stream.
11. Aesthetic (trash) Rating[8] SCORE 19	Little or no human refuse visible from stream channel or riparian zone	Refuse present in minor amounts	Refuse present in moderate amounts	Refuse abundant and unsightly
12. Number of Woody Debris and Rootwads[9] SCORE 10	Count only woody debris and rootwads within the wetted portion of the sampling segment. Count only woody debris >10cm (4in) diameter and >1.5m (5ft) long and rootwads with trunk diameter (at chest height) >15cm (6in) that are functional habitat within the wetted portion of the stream.			

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS

MP1214A

STREAM NAME LYONS CREEK	LOCATION HARWOOD, AA CO., MD
STATION # _____ REACH ID# _____	STREAM CLASS PERENNIAL - III
UTM N _____ UTM E	RIVER BASIN PATUXENT RIVER
STORET #	AGENCY CEI
INVESTIGATORS EW/CR	
FORM COMPLETED BY CR	DATE 4/20/16 TIME 12:15 (PM)
REASON FOR SURVEY BMI SAMPLING	

Parameters to be evaluated in sampling reach

Habitat Parameter	Condition Category			
	Optimal	Suboptimal	Marginal	Poor
1. Epifaunal Substrate/ Available Cover	Greater than 50% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient).	30-50% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale).	10-30% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 10% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
SCORE 13	20 19 18 17 16	15 14 (13) 12 11	10 9 8 7 6	5 4 3 2 1 0
2. Pool Substrate Characterization	Mixture of substrate materials, with gravel and firm sand prevalent; root mats and submerged vegetation common.	Mixture of soft sand, mud, or clay; mud may be dominant; some root mats and submerged vegetation present.	All mud or clay or sand bottom; little or no root mat; no submerged vegetation.	Hard-pan clay or bedrock; no root mat or vegetation.
SCORE 15	20 19 18 17 16	(15) 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
3. Pool Variability	Even mix of large-shallow, large-deep, small-shallow, small-deep pools present.	Majority of pools large-deep; very few shallow.	Shallow pools much more prevalent than deep pools.	Majority of pools small-shallow or pools absent.
SCORE 16	20 19 18 17 (16)	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
4. Sediment Deposition	Little or no enlargement of islands or point bars and less than <20% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 20-50% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 50-80% of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; more than 80% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
SCORE 16	20 19 18 17 (16)	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
5. Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills >75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
SCORE 18	20 19 (18) 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS

Parameters to be evaluated broader than sampling reach

Habitat Parameter	Condition Category			
	Optimal	Suboptimal	Marginal	Poor
6. Channel Alteration NO CHANNELIZATION SCORE 20	Channelization or dredging absent or minimal; stream with normal pattern. (20) 19 18 17 16	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr) may be present, but recent channelization is not present. 15 14 13 12 11	Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted. 10 9 8 7 6	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely. 5 4 3 2 1 0
7. Channel Sinuosity SCORE 9	The bends in the stream increase the stream length 3 to 4 times longer than if it was in a straight line. (Note - channel braiding is considered normal in coastal plains and other low-lying areas. This parameter is not easily rated in these areas.) 20 19 18 17 16	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line. 15 14 13 12 11	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line. 10 (9) 8 7 6	Channel straight; waterway has been channelized for a long distance. 5 4 3 2 1 0
8. Bank Stability (score each bank) SCORE 8 (LB) SCORE 8 (RB)	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected. Left Bank 10 9 Right Bank 10 9	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion. (8) 7 6 (8) 7 6	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods. 5 4 3 5 4 3	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars. 2 1 0 2 1 0
9. Vegetative Protection (score each bank) Note: determine left or right side by facing downstream. SCORE 7 (LB) SCORE 7 (RB)	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally. Left Bank 10 9 Right Bank 10 9	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining. 8 (7) 6 8 (7) 6	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining. 5 4 3 5 4 3	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height. 2 1 0 2 1 0
10. Riparian Vegetative Zone Width (score each bank riparian zone) SCORE 10 (LB) SCORE 10 (RB)	Width of riparian zone >18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone. Left Bank (10) 9 Right Bank (10) 9	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally. 8 7 6 8 7 6	Width of riparian zone 6-12 meters; human activities have impacted zone a great deal. 5 4 3 5 4 3	Width of riparian zone <6 meters: little or no riparian vegetation due to human activities. 2 1 0 2 1 0

Total Score 157

v. 2009

MBSS SPRING HABITAT DATA SHEET

Page 1 of 1

SITE — Watershed Code: MP | Segment: 126 A | Type: | Year: 2016

Reviewer: First: JT / Second: CR

DATE — Year: 16 | Month: 07 | Day: 15

300 Dist. from Nearest Road to Site (m)

4 Trash Rating 0 - 20

LANDUSE (Y/N)

Y	Old Field	Y	Residential
Y	Deciduous Forest	N	Commercial/Industrial
N	Coniferous Forest	N	Cropland
N	Wetland	N	Pasture
N	Surface Mine	Y	Orchard/Vineyard/Nursery
N	Landfill	N	Golf Course

RIPARIAN VEGETATION
(facing upstream)

	LEFT BANK	RIGHT BANK
Width (50m max)	20	10
Adjacent Land Cover	GR	OF
Vegetation Type	GRYM	GRYM
Buffer Breaks (Y/N)	Y	Y

ROAD CULVERT

Present in Segment (Y/N): N

Sampleable? (Y/N):

Width of Culvert (m):

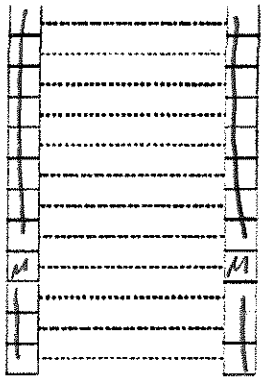
Length of Culvert (m):

STREAM GRADIENT

	Location (m)	Height (m)
1		
2		
3		

LEFT BANK / RIGHT BANK

Storm Drain
Tile Drain
Impervious Drainage
Gully
Orchard
Crop
Pasture
New Construction
Dirt Road
Gravel Road
Raw Sewage
Railroad



Buffer Break Types
(M = minor; S = severe)

CHANNELIZATION

N Evidence of Channel Straightening or Dredging (Y/N)

TYPE	EXTENT (m) LEFT BANK	BOTTOM	RIGHT BANK
Concrete			
Gabion			
Rip-Rap			
Earthen Berm		N/A	
Dredge Spoil Off Channel		N/A	
Pipe Culvert			

Actual Coordinates
(If >30m distance between original coordinates and stream)

Lat:

Lon:

Stream Block Ht. (m):

Stream Block Type:

Lat:

Lon:

v. 2009

MBSS SPRING INDEX PERIOD DATA SHEET

Page 2 Of 7

SITE Watershed Code MP | Segment 126 A | Type | Year 2016

Reviewer: First JT / Second CR

DATE Year 16 Month 04 Day 15

CREW: CR/JT

STREAM: MP126A

TIME 945 (Military)

LOCALITY: Lothian, MD

SAMPLEABILITY

- [X] Benthos
- [X] Habitat Assessment
- [X] Water Quality
- [N] Vernal Pool [A] (QUESTIONABLE)

OTHER (SPECIFY)

SITE ACCESS ROUTE

Pull into Nursery driveway off W Bay Front Rd continue past nursery and onto gravel road back to greenhouse

SAMPLE LABELS

Verified by: _____

QC LABEL

Watershed Code MP | Segment 126 (Letters only) A | Type | Year 2016

Dup. (D) or Blank (B): | Verified by: _____

TEMP. LOGGER

	(Y/N)	(TIME - Military)	#
WATER			
AIR			

LOCATION _____

PHOTODOCUMENTATION

Number	Title	Voucher (Y/N)
	Midstream US/DS	
	Upstream US/DS	
	Downstream US/DS	
	Bridge near DS point	
	Northern two-lined salamander	

BENTHIC HABITAT SAMPLED

11	Riffle 7.4	03	Leaf Pack 2.1
06	Rootwad/Woody Debris 5.9		Macrophytes
	Undercut Banks		
	Other _____		

SAMPLING CONSID.: ( ) NUM. ANODES

STREAM WIDTH (m) 0 m | 75 m

v. 2009

MBSS SPRING FAUNA DATA SHEET

SITE Watershed Code MP | Segment 126A | Type | Year 2016

Reviewer: First CR / Second JT

HERPETOFAUNA

☐ None Observed

Species	Lifestage (Adult / Juv. / Larval / Egg)	SEEN (Y/N)	HEARD (Y/N)	NUMBER RETAINED	NUMBER PHOTOS TAKEN
salamander (northern dusky-lined)	☒ / ☐ / ☐ / ☐	Y			1
salamander x 2	☐ / ☒ / ☐ / ☐	Y			

MUSSELS

☒ None Observed

Species	LIVE	DEAD	NUMBER RETAINED	NUMBER PHOTOS TAKEN

Corbicula — LIVE ☐ DEAD ☐ NONE ☐

CRAYFISHES

☒ None Observed

Species	NUMBER RETAINED
many juvenile unable to retrieve	

Crayfish Burrows [P]
(Absent, Present, Extensive)

COMMENTS

Physical Habitat Assessment and Water Quality Data Sheet

Site ID: MPI26A
Subwatershed: Lyons Creek SO
Length of Reach: 75 **Date:** 9/15/16
Team Members: CR/TT **Time:** 9:45 AM

Weather
Current: clear ~50°F
Past 24hrs: clear, warm
Past 48hrs: clear, warm

Stream Character

P	Meandering	A	Channelized
A	Braided	A	Straight
P	Riffle	P	Run/Glide
A	Deep Pool >.5m	P	Silt/Clay
P	Shallow Pool <.5m	P	Sand
P	Gravel	P	Cobble
A	Boulder >2m	A	Boulder <2m
A	Concrete/Gabion	P	Bedrock
P	Undercut Bank	P	Rootwad
P	Overhead Cover	A	Storm Drain
A	Effluent Discharge	A	Human Refuse
P	Emergent Vegetation	A	Beaver Pond
A	Floating Vegetation		

A=Absent P=Present E=Extensive

Parameter	Down-stream	Mid-stream	Up-stream
Description			
pH	6.92	7.05	6.85
Temperature (°C)	9.4	9.2	9.4
DO (mg/l)	12.46	12.73	12.19
Conductivity (uS/cm)	102.9	102.3	99.3
TDS (mg/l)	95.55	94.90	78
Turbidity (NTU)	31.7	28.4	33.0

Notes: 772.3 mm Hg

Bar Formation
☐ None ☐ Moderate
☒ Minor ☐ Extensive

Bank Erosion (see guidance sheet)

	Left Bank	Right Bank
Extent (m)	75	75
Severity	2	1
Avg. Height	3ft	3ft

Severity: 0=none 1=min 2=mod 3=severe

Maximum stream depth (cm) 20cm

Benthic Habitat Sampled (20 total)

	Sq. ft.
Riffle	11
Rootwad/Woody Debris	6
Leaf Pack	3
Submerged Vegetation	0
Undercut Banks	0
Other:	

Rootwads/Woody Debris

# Instream Woody Debris	2
# Dewatered Woody Debris	4
# Instream Rootwads	
# Dewatered Rootwads	

Stream Gradient

Location (ft)	Height (ft)	Water Depth (ft)

Photographs/Observations:
Midpoint US/DS
Upstream US/DS
Downstream US/DS
Bridge near downstream point
Footpath/bridge crossing stream
black pipe draining into stream
- salamander

MBSS Physical Habitat Assessment Sheet

Stream Habitat Assessment Guidance Sheet				
Habitat Parameter	Optimal 16-20	Sub-Optimal 11-15	Marginal 6-10	Poor 0-5
1. Instream Habitat[a] SCORE 11	Greater than 50% of a variety of cobble, boulder, submerged logs, undercut banks, snags, rootwads, aquatic plants or other stable habitat	30-50% of stable habitat. Adequate habitat	10-30% mix of stable habitat. Habitat availability less than desireable	Less than 10% stable habitat. Lack of habitat is obvious
2. Epifaunal Substrate[a] SCORE 11	Preferred substrate abundant, stable, and at full colonization potential (riffles well developed and dominated by cobble; and/or woody debris prevalent, not new; and not transient	Abund. of cobble with gravel and/or boulders common; or woody debris, aquatic veg., undercut banks common but not prevalent/suited for full colonization	Large boulders and/or bedrock prevalent; cobble, woody debris, or other preferred surfaces uncommon	Stable substrate lacking; or particles are over 75% surrounded by fine sediment or flocculent material
3. Velocity/Depth Diversity[a] SCORE 8	Slow (<0.3m/s), deep (>0.5m); slow, shallow (<0.5m); fast (>0.3m/s), deep; fast, shallow habitats all present	Only 3 of the 4 habitat categories present	Only 2 of the 4 habitat categories present	Dominated by 1 velocity/depth category (usually pools)
4. Pool/Glide/Eddy Quality[a] SCORE 8	Complex cover/& /or depth >1.5m; both deep (>0.5m)/shallows (<0.2m) present	Deep (>0.5m) areas present; but only moderate cover	Shallows (<0.2m) prevalent in pool/glide/eddy habitat; little cover	Max depth <0.2m in pool/glide/eddy habitat; or absent completely
5. Riffle/Run Quality[a] SCORE 7	Riffle/run depth generally >15cm, with maximum depth greater than 50 cm (maximum score); substrate stable (e.g. cobble, boulder) & variety of current velocities	Riffle/run depth generally 5-10cm, variety of current velocities	Riffle/run depth generally 1-5cm; primarily a single current velocity	Riffle/run depth <1cm; or riffle/run substrates concreted
6. Bank Stability[a] (facing downstream.) Score each bank LB SCORE 4 RB SCORE 6	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected. 10 9	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion. 8 7 6	Moderately unstable; 30-60% of bank in reach as areas of erosion; high erosion potential during floods. 5 4 3	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars. 2 1 0
7. Embeddedness SCORE 50 %	Percentage that gravel, cobble, and boulder particles are surrounded by fine sediment or flocculent material			
8. Shading SCORE 75 %	Percentage of segment that is shaded (duration is considered in scoring). 0% = fully exposed to sunlight all day in summer; 100% = fully and densely shaded all day in summer			
9. Riparian Buffer Zone Width (m)[a] LB 20 RB 10	Zone width in which human activity is not evident. 50m (164ft) is the maximum recorded value.			
10. Remoteness[a] SCORE 8	Roads greater than 400 meters (0.25 mi) from stream	Roads within 400 meters (0.25 mi) of stream; stream NOT accessible by trail.	Roads within 400 meters (0.25 mi) of stream; stream accessible by trail.	Roads adjacent to stream.
11. Aesthetic (trash) Rating[a] SCORE 5	Little or no human refuse visible from stream channel or riparian zone	Refuse present in minor amounts	Refuse present in moderate amounts	Refuse abundant and unsightly
12. Number of Woody Debris and Rootwads[a] SCORE 2	Count only woody debris and rootwads within the wetted portion of the sampling segment. Count only woody debris >10cm (4in) diameter and >1.5m (5ft) long and rootwads with trunk diameter (at chest height) >15cm (6in) that are functional habitat within the wetted portion of the stream.			

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS

STREAM NAME MP136A	LOCATION Lothian
STATION # REACH ID#	STREAM CLASS
UTM N UTM E	RIVER BASIN Patuxent River
STORET #	AGENCY CEI
INVESTIGATORS CR/JT	
FORM COMPLETED BY JT	DATE 4/15/16 TIME 10:15 PM AM — REASON FOR SURVEY MBSS

Parameters to be evaluated in sampling reach

Habitat Parameter	Condition Category			
	Optimal	Suboptimal	Marginal	Poor
1. Epifaunal Substrate/ Available Cover	Greater than 50% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient).	30-50% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale).	10-30% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 10% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
SCORE 8	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
2. Pool Substrate Characterization	Mixture of substrate materials, with gravel and firm sand prevalent; root mats and submerged vegetation common.	Mixture of soft sand, mud, or clay; mud may be dominant; some root mats and submerged vegetation present.	All mud or clay or sand bottom; little or no root mat; no submerged vegetation.	Hard-pan clay or bedrock; no root mat or vegetation.
SCORE 12	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
3. Pool Variability	Even mix of large-shallow, large-deep, small-shallow, small-deep pools present.	Majority of pools large-deep; very few shallow.	Shallow pools much more prevalent than deep pools.	Majority of pools small-shallow or pools absent.
SCORE 8	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
4. Sediment Deposition	Little or no enlargement of islands or point bars and less than <20% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 20-50% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 50-80% of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; more than 80% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
SCORE 9	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
5. Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills >75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
SCORE 8	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0

45

Form # EL - _____

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS

Parameters to be evaluated broader than sampling reach

Habitat Parameter	Condition Category			
	Optimal	Suboptimal	Marginal	Poor
6. Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr) may be present, but recent channelization is not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.
SCORE 19	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
7. Channel Sinuosity	The bends in the stream increase the stream length 3 to 4 times longer than if it was in a straight line. (Note - channel braiding is considered normal in coastal plains and other low-lying areas. This parameter is not easily rated in these areas.)	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	Channel straight; waterway has been channelized for a long distance.
SCORE 7	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
8. Bank Stability (score each bank)	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.
SCORE 4 (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE 6 (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0
9. Vegetative Protection (score each bank) Note: determine left or right side by facing downstream.	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
SCORE 4 (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE 4 (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0
10. Riparian Vegetative Zone Width (score each bank riparian zone)	Width of riparian zone >18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone.	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6-12 meters; human activities have impacted zone a great deal.	Width of riparian zone <6 meters: little or no riparian vegetation due to human activities.
SCORE 4 (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE 6 (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0

54

Total Score 99

Form # EL2 - _____

MP128A
Cabin 2

v. 2009

MBSS SPRING HABITAT DATA SHEET

SITE — Watershed Code: MP | Segment: 128 | Type: 3 | Year: 2016

Reviewer: First FW / Second DV

DATE — Year: 16 | Month: 03 | Day: 31

700 Dist. from Nearest Road to Site (m) — ½ MILE (walk off road)

17 Trash Rating 0 - 20

LANDUSE (Y/N)

N	Old Field	N	Residential
Y	Deciduous Forest	N	Commercial/Industrial
N	Coniferous Forest	N	Cropland
N	Wetland	Y	Pasture
N	Surface Mine	N	Orchard/Vineyard/Nursery
N	Landfill	N	Golf Course

RIPARIAN VEGETATION
(facing upstream)

	LEFT BANK	RIGHT BANK
Width (50m max)	50	50
Adjacent Land Cover	FR	FR
Vegetation Type	M M	M Y
Buffer Breaks (Y/N)	N	N

	LEFT BANK	RIGHT BANK
Storm Drain		
Tile Drain		
Impervious Drainage		
Gully		
Orchard		
Crop		
Pasture		
New Construction		
Dirt Road		
Gravel Road		
Raw Sewage		
Railroad		

Buffer Break Types
(M = minor; S = severe)

ROAD CULVERT

Present in Segment (Y/N)	N
Sampleable? (Y/N)	N
Width of Culvert (m)	NA
Length of Culvert (m)	NA

STREAM GRADIENT
(section crossed out)

	Location (m)	Height (m)
1		
2		
3		

CHANNELIZATION

N Evidence of Channel Straightening or Dredging (Y/N)

TYPE	EXTENT (m) LEFT BANK	BOTTOM	RIGHT BANK
Concrete	N	N	N
Gabion	N	N	N
Rip-Rap	N	N	N
Earthen Berm	N	N/A	N
Dredge Spoil Off Channel	N	N/A	N
Pipe Culvert	N	N	N

Actual Coordinates
(If >30m distance between original coordinates and stream)

Lat	
Lon	

from GPS point

Stream Block Ht. (m)	
Stream Block Type	
Lat	
Lon	

v. 2009

MBSS SPRING INDEX PERIOD DATA SHEET

Page 2 of 7

SITE: Watershed Code [ ][ ]MP | Segment 128 | Type B | Year 2016

Reviewer: First EW / Second DV

DATE: Year 16 Month 03 Day 21

CREW: EW + DV

STREAM: CABIN BRANCH

TIME: 1000 (Military)

LOCALITY: LOTHIAN, ANNE ARUNDEL CO, MD

SAMPLEABILITY

- [X] Benthos
- [X] Habitat Assessment
- [X] Water Quality
- [ ] Vernal Pool [A] (PRESENT/ABSENT)

OTHER (SPECIFY):

SITE ACCESS ROUTE

Foot path through property

SAMPLE LABELS

Verified by: EW

QC LABEL

Watershed Code [ ][ ]MP | Segment 128 (Letters only) | Type B | Year 2016

Dup. (D) or Blank (B): [ ] Verified by: _____

TEMP. LOGGER

	(Y/N)	(TIME - Military)	#
WATER	[ ]	[ ][ ][ ][ ]	[ ][ ][ ][ ][ ][ ][ ]
AIR	[ ]	[ ][ ][ ][ ]	[ ][ ][ ][ ][ ][ ][ ]

LOCATION _____

PHOTODOCUMENTATION

Number	Title	Voucher (Y/N)
[ ][ ][ ][ ]		[ ]
[ ][ ][ ][ ]		[ ]
[ ][ ][ ][ ]		[ ]
[ ][ ][ ][ ]		[ ]
[ ][ ][ ][ ]		[ ]
[ ][ ][ ][ ]		[ ]
[ ][ ][ ][ ]		[ ]
[ ][ ][ ][ ]		[ ]

BENTHIC HABITAT SAMPLED

- [14] Riffle
- [15] Rootwad/Woody Debris
- [11] Leaf Pack
- [10] Macrophytes
- [09] Undercut Banks
- [10] Other _____

SAMPLING CONSID.: ([ ] NUM. ANODES) _____

STREAM WIDTH (m): [ ][ ][4][ ] 0 m | [ ][ ][6][ ] 75 m

v. 2009

MBSS SPRING FAUNA DATA SHEET

SITE — Watershed Code: MP | Segment: 1248 | Type: 3 | Year: 2016

Reviewer: First: EW / Second: DV

HERPETOFAUNA

☐ None Observed

Species	Lifestage (Adult, Juv., Larval, Egg)	SEEN (Y/N)	HEARD (Y/N)	NUMBER RETAINED	NUMBER PHOTOS TAKEN
Salamander (see pic)	Juv.	X		0	1

MUSSELS

☐ None Observed

Species	LIVE	DEAD	NUMBER RETAINED	NUMBER PHOTOS TAKEN

Corbicula — LIVE ☒ DEAD ☐ NONE ☐

CRAYFISHES

☐ None Observed

Species	NUMBER RETAINED

Crayfish Burrows ☐
(Absent, Present, Extensive)

COMMENTS

Physical Habitat Assessment and Water Quality Data Sheet

Site ID: MP129A
Subwatershed: Cabin Branch 2
Length of Reach: 75m **Date:** 3/31/16
Team Members: EW/DV **Time:** 9:47A

Weather
Current: Clear skys
Past 24hrs: Clear
Past 48hrs: Clear

Parameter	Down-stream	Mid-stream	Up-stream
Description			
pH	6.29	6.10	6.09
Temperature (°C)	10.73	10.85	10.9
DO (mg/l)	11.22	11.27	11.26
Conductivity (uS/cm)	125	125	125
TDS (mg/l) g/L	0.112	0.112	0.111
Turbidity (NTU)	2.5	3.2	2.4

ORP 120.4

Notes:

Stream Character

P Meandering	A Channelized
A Braided	P Straight
P Riffle	P Run/Glide
A Deep Pool >.5m	P Silt/Clay
P Shallow Pool <.5m	P Sand
P Gravel	P Cobble
A Boulder >2m	A Boulder <2m
A Concrete/Gabion	A Bedrock
P Undercut Bank	P Rootwad
P Overhead Cover	A Storm Drain
A Effluent Discharge	A Human Refuse
P Emergent Vegetation	A Beaver Pond
A Floating Vegetation	

A=Absent P=Present E=Extensive

Bar Formation
☐ None ☑ Moderate
☐ Minor ☐ Extensive

Bank Erosion (see guidance sheet)

	Left Bank	Right Bank
Extent (m)	60	15
Severity	2	2
Avg. Height	5'	3'

Severity: 0=none 1=min 2=mod 3=severe

Maximum stream depth (cm) 15

Benthic Habitat Sampled (20 total)

	Sq. ft.
Riffle	14
Rootwad/Woody Debris	5
Leaf Pack	1
Submerged Vegetation	
Undercut Banks	
Other:	

Rootwads/Woody Debris

# Instream Woody Debris	11
# Dewatered Woody Debris	8
# Instream Rootwads	3
# Dewatered Rootwads	2

Stream Gradient

Location (ft)	Height (ft)	Water Depth (ft)

Photographs/Observations:
Barometer 761.9
PICTURE ~ DOWNSTREAM (UPSTREAM PIC)
MID "
UPPER "
L bank

MBSS Physical Habitat Assessment Sheet

Stream Habitat Assessment Guidance Sheet				
Habitat Parameter	Optima: 16-20	Sub-Optimal: 11-15	Marginal: 6-10	Poor: 0-5
1. Instream Habitat* SCORE 13	Greater than 50% of a variety of cobble, boulder, submerged logs, undercut banks, snags, rootwads, aquatic plants or other stable habitat	30-50% of stable habitat. Adequate habitat	10-30% mix of stable habitat. Habitat availability less than desireable	Less than 10% stable habitat. Lack of habitat is obvious
2. Epifaunal Substrate* SCORE 12	Preferred substrate abundant, stable, and at full colonization potential (riffles well developed and dominated by cobble; and/or woody debris prevalent, not new; and not transient	Abund. of cobble with gravel and/or boulders common; or woody debris, aquatic veg., undercut banks common but not prevalent/suited for full colonization	Large boulders and/or bedrock prevalent; cobble, woody debris, or other preferred surfaces uncommon	Stable substrate lacking; or particles are over 75% surrounded by fine sediment or flocculent material
3. Velocity/Depth Diversity* SCORE 16	Slow (<0.3m/s), deep (>0.5m); slow, shallow (<0.5m); fast (>0.3m/s), deep; fast, shallow habitats all present	Only 3 of the 4 habitat categories present	Only 2 of the 4 habitat categories present	Dominated by 1 velocity/depth category (usually pools)
4. Pool/Glide/Eddy Quality* SCORE 10	Complex cover/& for depth >1.5m; both deep (>0.5m)/shallows (<0.2m) present	Deep (>0.5m) areas present; but only moderate cover	Shallows (<0.2m) prevalent in pool/glide/eddy habitat; little cover	Max depth <0.2m in pool/glide/eddy habitat; or absent completely
5. Riffle/Run Quality* SCORE 13	Riffle/run depth generally >10cm, with maximum depth greater than 50 cm (maximum score); substrate stable (e.g. cobble, boulder) & variety of current velocities	Riffle/run depth generally 5-10cm, variety of current velocities	Riffle/run depth generally 1-5cm; primarily a single current velocity	Riffle/run depth <1cm; or riffle/run substrates concreted
6. Bank Stability* (facing downstream.) Score each bank LB SCORE 5 RB SCORE 7	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected. 10 9	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion. 8 7 6	Moderately unstable; 30-60% of bank in reach as areas of erosion; high erosion potential during floods. 5 4 3	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars. 2 1 0
7. Embeddedness SCORE 70 %	Percentage that gravel, cobble, and boulder particles are surrounded by fine sediment or flocculent material			
8. Shading SCORE 80 %	Percentage of segment that is shaded (duration is considered in scoring). 0% = fully exposed to sunlight all day in summer; 100% = fully and densely shaded all day in summer			
9. Riparian Buffer Zone Width (m)* LB 50 RB 50	Zone width in which human activity is not evident. 50m (164ft) is the maximum recorded value.			
10. Remoteness* SCORE 18	Roads greater than 400 meters (0.25 mi) from stream	Roads within 400 meters (0.25 mi) of stream; stream NOT accessible by trail.	Roads within 400 meters (0.25 mi) of stream; stream accessible by trail.	Roads adjacent to stream.
11. Aesthetic (trash) Rating* SCORE 18	Little or no human refuse visible from stream channel or riparian zone	Refuse present in minor amounts	Refuse present in moderate amounts	Refuse abundant and unsightly
12. Number of Woody Debris and Rootwads* SCORE 10	Count only woody debris and rootwads within the wetted portion of the sampling segment. Count only woody debris >10cm (4in) diameter and >1.5m (5ft) long and rootwads with trunk diameter (at chest height) >15cm (6in) that are functional habitat within the wetted portion of the stream.			

low gradient stream
small cobble/gravel
sand

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS

STREAM NAME MP-128-CABIN BRANCH	LOCATION LOTHIAN, AA CO, MD
STATION # _____ REACH ID# _____	STREAM CLASS III
UTM N _____ UTM E	RIVER BASIN PATUXENT
STORET #	AGENCY CEI
INVESTIGATORS EW, DV	
FORM COMPLETED BY DV	DATE 3/31/16 TIME ~10:00 (AM) PM
REASON FOR SURVEY BMI	

Parameters to be evaluated in sampling reach

Habitat Parameter	Condition Category			
	Optimal	Suboptimal	Marginal	Poor
1. Epifaunal Substrate/ Available Cover	Greater than 50% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient).	30-50% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale).	10-30% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 10% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
SCORE 14	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
2. Pool Substrate Characterization	Mixture of substrate materials, with gravel and firm sand prevalent; root mats and submerged vegetation common.	Mixture of soft sand, mud, or clay; mud may be dominant; some root mats and submerged vegetation present.	All mud or clay or sand bottom; little or no root mat; no submerged vegetation.	Hard-pan clay or bedrock; no root mat or vegetation.
SCORE 13	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
3. Pool Variability	Even mix of large-shallow, large-deep, small-shallow, small-deep pools present.	Majority of pools large-deep; very few shallow.	Shallow pools much more prevalent than deep pools.	Majority of pools small-shallow or pools absent.
SCORE 15	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
4. Sediment Deposition	Little or no enlargement of islands or point bars and less than <20% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 20-50% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 50-80% of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; more than 80% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
SCORE 12	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
5. Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills >75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
SCORE 14	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS

Parameters to be evaluated broader than sampling reach

Habitat Parameter	Condition Category			
	Optimal	Suboptimal	Marginal	Poor
6. Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr) may be present, but recent channelization is not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.
SCORE 19	20 (19) 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
7. Channel Sinuosity	The bends in the stream increase the stream length 3 to 4 times longer than if it was in a straight line. (Note - channel braiding is considered normal in coastal plains and other low-lying areas. This parameter is not easily rated in these areas.)	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	Channel straight; waterway has been channelized for a long distance.
SCORE 12	20 19 18 17 16	15 14 13 (12) 11	10 9 8 7 6	5 4 3 2 1 0
8. Bank Stability (score each bank)	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.
SCORE 5 (LB)	Left Bank 10 9	8 7 6	(5) 4 3	2 1 0
SCORE 7 (RB)	Right Bank 10 9	8 (7) 6	5 4 3	2 1 0
9. Vegetative Protection (score each bank) Note: determine left or right side by facing downstream.	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
SCORE 9 (LB)	Left Bank 10 (9)	8 7 6	5 4 3	2 1 0
SCORE 9 (RB)	Right Bank 10 (9)	8 7 6	5 4 3	2 1 0
10. Riparian Vegetative Zone Width (score each bank riparian zone)	Width of riparian zone >18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone.	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6-12 meters; human activities have impacted zone a great deal.	Width of riparian zone <6 meters: little or no riparian vegetation due to human activities.
SCORE 10 (LB)	Left Bank (10) 9	8 7 6	5 4 3	2 1 0
SCORE 10 (RB)	Right Bank (10) 9	8 7 6	5 4 3	2 1 0

Total Score 149

v. 2009

MBSS SPRING HABITAT DATA SHEET

SITE — Watershed Code: MP | Segment: 13 | Type: 1 | Year: 2016

Reviewer: First KB / Second JT

DATE — Year: 16 | Month: 03 | Day: 31

200 Dist. from Nearest Road to Site (m)

11 Trash Rating 0 - 20

LANDUSE (Y/N)

N	Old Field	N	Residential
N	Deciduous Forest	N	Commercial/Industrial
N	Coniferous Forest	N	Cropland
N	Wetland	N	Pasture
N	Surface Mine	N	Orchard/Vineyard/Nursery
N	Landfill	N	Golf Course

RIPARIAN VEGETATION
(facing upstream)

	LEFT BANK	RIGHT BANK
Width (50m max)	50	50
Adjacent Land Cover	FR	FR
Vegetation Type	DMYS	DMYS
Buffer Breaks (Y/N)	N	N

ROAD CULVERT

Present in Segment (Y/N): N

Sampleable? (Y/N):

Width of Culvert (m):

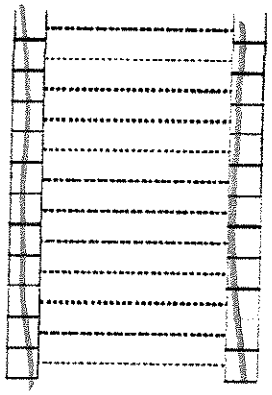
Length of Culvert (m):

STREAM GRADIENT

	Location (m)	Height (m)
1		
2		
3		

Buffer Breaks

	LEFT BANK	RIGHT BANK
Storm Drain		
Tile Drain		
Impervious Drainage		
Gully		
Orchard		
Crop		
Pasture		
New Construction		
Dirt Road		
Gravel Road		
Raw Sewage		
Railroad		



Buffer Break Types
(M = minor; S = severe)

CHANNELIZATION

N Evidence of Channel Straightening or Dredging (Y/N)

TYPE	EXTENT (m)		
	LEFT BANK	BOTTOM	RIGHT BANK
Concrete			
Gebion			
Rip-Rap			
Earthen Berm		N/A	
Dredge Spoil Off Channel		N/A	
Pipe Culvert			

Actual Coordinates
(If >30m distance between original coordinates and stream)

Lat

Lon

Stream Block Ht. (m)

Stream Block Type

Lat

Lon

v. 2009

MBSS SPRING INDEX PERIOD DATA SHEET

Page 2 of 7

SITE Watershed Code: MP | Segment: 13 | Type: 1 | Year: 2016

Reviewer: First KB / Second JT

DATE: Year 16 Month 03 Day 31

CREW: KB/JT

STREAM: MD-13

TIME: 1104 (Military)

LOCALITY: Lathian, MD

SAMPLEABILITY

- ✓ Benthos
- ✓ Habitat Assessment
- ✓ Water Quality
- ☐ Vernal Pool [A] (PRESENT/ABSENT)

OTHER (SPECIFY)

SITE ACCESS ROUTE

Ed Pruitt Rd, take driveway to culvert, walk 200 m through woods to site.

SAMPLE LABELS

Verified by: KB

QC LABEL

Watershed Code: MP | Segment: 13 (Letters only) | Type: 1 | Year: 2016

Dup. (D) or Blank (B): ☐ Verified by: _____

TEMP. LOGGER

	(Y/N)	(TIME - Military)	#
WATER			
AIR			

LOCATION _____

PHOTODOCUMENTATION

Number	Title	Voucher (Y/N)
	M - US / DS	
	D - US / DS	
	U - US / DS	

BENTHIC HABITAT SAMPLED

- 13 Riffle
- 06 Rootwad/Woody Debris
- 01 Leaf Pack
- ☐☐ Macrophytes
- ☐☐ Undercut Banks
- ☐☐ Other _____

SAMPLING CONSID.: (☐ NUM. ANODES)

STREAM WIDTH (m): 0 m _____ 75 m _____

v. 2009

MBSS SPRING FAUNA DATA SHEET

SITE Watershed Code [ ][ ][M][D] Segment [ ][1][3] Type [1] Year [2][0][1][6]

Reviewer: First KB / Second JT

HERPETOFAUNA

☒ None Observed

Species	Lifestage (Adult, Juv, Larval, Egg)	SEEN (Y/N)	HEARD (Y/N)	NUMBER RETAINED	NUMBER PHOTOS TAKEN
	☐☐☐☐	☐	☐	☐	☐
	☐☐☐☐	☐	☐	☐	☐
	☐☐☐☐	☐	☐	☐	☐
	☐☐☐☐	☐	☐	☐	☐
	☐☐☐☐	☐	☐	☐	☐
	☐☐☐☐	☐	☐	☐	☐
	☐☐☐☐	☐	☐	☐	☐

MUSSELS

☒ None Observed

Species	LIVE	DEAD	NUMBER RETAINED	NUMBER PHOTOS TAKEN
	☐	☐	☐☐	☐
	☐	☐	☐☐	☐
	☐	☐	☐☐	☐
	☐	☐	☐☐	☐
	☐	☐	☐☐	☐

Corbicula LIVE ☐ DEAD ☐ NONE ☐

CRAYFISHES

☑ None Observed

Species	NUMBER RETAINED
~~Unidentified juvenile~~	~~1~~ 0
	☐☐
	☐☐
	☐☐
	☐☐

Crayfish Burrows [A]
(Absent, Present, Extensive)

COMMENTS

Some fish in pools, None Caught

Physical Habitat Assessment and Water Quality Data Sheet

Site ID: MP-13
Subwatershed: Middle Patuxent
Length of Reach: 75m Date: 3/31/16
Team Members: KR/JT Time: 1130

Stream Character

- [F] Meandering
- [A] Braided
- [F] Riffle
- [P] Deep Pool >.5m
- [P] Shallow Pool <.5m
- [P] Gravel
- [A] Boulder >2m
- [A] Concrete/Gabion
- [P] Undercut Bank
- [P] Overhead Cover
- [A] Effluent Discharge
- [P] Emergent Vegetation
- [A] Floating Vegetation

- [A] Channelized
- [A] Straight
- [F] Run/Glide
- [P] Silt/Clay
- [P] Sand
- [P] Cobble
- [A] Boulder <2m
- [A] Bedrock
- [P] Rootwad
- [A] Storm Drain
- [P] Human Refuse
- [A] Beaver Pond

A=Absent P=Present E=Extensive

Bar Formation

- [ ] None
- [ ] Minor
- [x] Moderate
- [ ] Extensive

Bank Erosion (see guidance sheet)

	Left Bank	Right Bank
Extent (m)	35	35
Severity	2	2
Avg. Height	2'	2'

Severity: 0=none, 1=min, 2=mod, 3=severe

Maximum stream depth (cm): 45

Benthic Habitat Sampled (20 total)

	Sq. ft.
Riffle	12
Rootwad/Woody Debris	6
Leaf Pack	1
Submerged Vegetation	
Undercut Banks	
Other:	

Rootwads/Woody Debris

# Instream Woody Debris	4
# Dewatered Woody Debris	5
# Instream Rootwads	2
# Dewatered Rootwads	3

Stream Gradient

Location (ft)	Height (ft)	Water Depth (ft)

Weather
Current: Sunny, 105°F
Past 24hrs: Sunny, 100°F
Past 48hrs: Sunny, windy, 55°F

Parameter	Down-stream	Mid-stream	Up-stream
Description			
pH	6.92	7.42	6.83
Temperature (°C)	12.3	12.2	12.3
DO (mg/l)	11.19	11.13	10.23
Conductivity (uS/cm)	189.7	189.8	189.4
TDS (mg/l)	163.15	163.15	163.15
Turbidity (NTU)	3.35	41.86	3.27

Notes: Barometer 29.99 inHg

Photographs/Observations:
H - US/DS
D - DS/US
U - DS/US

MBSS Physical Habitat Assessment Sheet

Stream Habitat Assessment Guidance Sheet				
Habitat Parameter	Optima 16-20	Sub-Optimal 11-15	Marginal 6-10	Poor 0-5
1. Instream Habitat* SCORE 16	Greater than 50% of a variety of cobble, boulder, submerged logs, undercut banks, snags, rootwads, aquatic plants or other stable habitat	30-50% of stable habitat. Adequate habitat	10-30% mix of stable habitat. Habitat availability less than desireable	Less than 10% stable habitat. Lack of habitat is obvious
2. Epifaunal Substrate* SCORE 11	Preferred substrate abundant, stable, and at full colonization potential (riffles well developed and dominated by cobble; and/or woody debris prevalent, not new, and not transient	Abund. of cobble with gravel and/or boulders common; or woody debris, aquatic veg., undercut banks common but not prevalent/suited for full colonization	Large boulders and/or bedrock prevalent; cobble, woody debris, or other preferred surfaces uncommon	Stable substrate lacking; or particles are over 75% surrounded by fine sediment or flocculent material
3. Velocity/Depth Diversity* SCORE 12	Slow (<0.3m/s), deep (>0.5m); slow, shallow (<0.5m); fast (>0.3m/s), deep; fast, shallow habitats all present	Only 3 of the 4 habitat categories present	Only 2 of the 4 habitat categories present	Dominated by 1 velocity/depth category (usually pools)
4. Pool/Glide/Eddy Quality* SCORE 10	Complex cover/&/or depth >1.5m; both deep (>0.5m)/shallows (<0.2m) present	Deep (>0.5m) areas present; but only moderate cover	Shallows (<0.2m) prevalent in pool/glide/eddy habitat; little cover	Max depth <0.2m in pool/glide/eddy habitat; or absent completely
5. Riffle/Run Quality* SCORE 12	Riffle/run depth generally >10cm, with maximum depth greater than 50 cm (maximum score); substrate stable (e.g. cobble, boulder) & variety of current velocities	Riffle/run depth generally 5-10cm, variety of current velocities	Riffle/run depth generally 1-5cm; primarily a single current velocity	Riffle/run depth <1cm; or riffle/run substrates concreted
6. Bank Stability* (facing downstream) Score each bank LB SCORE 10 RB SCORE 10	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected. 10 9	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion. 8 7 6	Moderately unstable; 30-60% of bank in reach as areas of erosion; high erosion potential during floods. 5 4 3	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars. 2 1 0
7. Embeddedness SCORE 40 %	Percentage that gravel, cobble, and boulder particles are surrounded by fine sediment or flocculent material			
8. Shading* SCORE 85 %	Percentage of segment that is shaded (duration is considered in scoring); 0% = fully exposed to sunlight all day in summer; 100% = fully and densely shaded all day in summer			
9. Riparian Buffer Zone Width (m)* LB 50 RB 50	Zone width in which human activity is not evident. 50m (164ft) is the maximum recorded value.			
10. Remoteness* SCORE 12	Roads greater than 400 meters (0.25 mi) from stream	Roads within 400 meters (0.25 mi) of stream; stream NOT accessible by trail.	Roads within 400 meters (0.25 mi) of stream; stream accessible by trail.	Roads adjacent to stream.
11. Aesthetic (trash) Rating* SCORE 14	Little or no human refuse visible from stream channel or riparian zone	Refuse present in minor amounts	Refuse present in moderate amounts	Refuse abundant and unsightly
12. Number of Woody Debris and Rootwads* SCORE 6	Count only woody debris and rootwads within the wetted portion of the sampling segment. Count only woody debris >10cm (4in) diameter and >1.5m (5ft) long and rootwads with trunk diameter (at chest height) >15cm (6in) that are functional habitat within the wetted portion of the stream.			

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS

STREAM NAME MP13		LOCATION Lothian, MD	
STATION #	REACH ID#	STREAM CLASS Perennial	
UTM N	UTM E	RIVER BASIN Patuxent River	
STORET #		AGENCY CEI	
INVESTIGATORS KB/JT			
FORM COMPLETED BY KB	DATE 3/31/16 TIME ~11:30 PM	REASON FOR SURVEY MBSS	

Parameters to be evaluated in sampling reach

Habitat Parameter	Condition Category			
	Optimal	Suboptimal	Marginal	Poor
1. Epifaunal Substrate/ Available Cover	Greater than 50% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient).	30-50% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale).	10-30% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 10% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
SCORE 15	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
2. Pool Substrate Characterization	Mixture of substrate materials, with gravel and firm sand prevalent; root mats and submerged vegetation common.	Mixture of soft sand, mud, or clay; mud may be dominant; some root mats and submerged vegetation present.	All mud or clay or sand bottom; little or no root mat; no submerged vegetation.	Hard-pan clay or bedrock; no root mat or vegetation.
SCORE 16	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
3. Pool Variability	Even mix of large-shallow, large-deep, small-shallow, small-deep pools present.	Majority of pools large-deep; very few shallow.	Shallow pools much more prevalent than deep pools.	Majority of pools small-shallow or pools absent.
SCORE 13	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
4. Sediment Deposition	Little or no enlargement of islands or point bars and less than <20% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 20-50% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 50-80% of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; more than 80% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
SCORE 12	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
5. Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills >75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
SCORE 13	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS

Parameters to be evaluated broader than sampling reach

Habitat Parameter	Condition Category			
	Optimal	Suboptimal	Marginal	Poor
6. Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr) may be present, but recent channelization is not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.
SCORE 18	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
7. Channel Sinuosity	The bends in the stream increase the stream length 3 to 4 times longer than if it was in a straight line. (Note - channel braiding is considered normal in coastal plains and other low-lying areas. This parameter is not easily rated in these areas.)	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	Channel straight; waterway has been channelized for a long distance.
SCORE 11	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
8. Bank Stability (score each bank)	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.
SCORE 4 (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE 4 (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0
9. Vegetative Protection (score each bank) Note: determine left or right side by facing downstream.	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
SCORE 5 (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE 3 (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0
10. Riparian Vegetative Zone Width (score each bank riparian zone)	Width of riparian zone >18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone.	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6-12 meters; human activities have impacted zone a great deal.	Width of riparian zone <6 meters: little or no riparian vegetation due to human activities.
SCORE 10 (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE 10 (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0

Total Score 134

Form # EL2 - _____

v. 2009

MBSS SPRING HABITAT DATA SHEET

SITE — Watershed Code: MP | Segment: 15 | Type: 2 | Year: 2016

Reviewer: First KB / Second CL

DATE — Year: 16 | Month: 03 | Day: 25

250 Dist. from Nearest Road to Site (m)

15 Trash Rating 0 - 20

LANDUSE (Y/N)

N	Old Field	Y	Residential
Y	Deciduous Forest	N	Commercial/Industrial
N	Coniferous Forest	N	Cropland
N	Wetland	N	Pasture
N	Surface Mine	N	Orchard/Vineyard/Nursery
N	Landfill	N	Golf Course

RIPARIAN VEGETATION
(facing upstream)

	LEFT BANK	RIGHT BANK
Width (50m max)	50	50
Adjacent Land Cover	FR	HO
Vegetation Type	MRYG	MRYG
Buffer Breaks (Y/N)	N	N

ROAD CULVERT

N/A

Present in Segment (Y/N): N

Sampleable? (Y/N):

Width of Culvert (m):

Length of Culvert (m):

STREAM GRADIENT

	Location (m)	Height (m)
1		
2		
3		

LEFT BANK / RIGHT BANK

	LEFT BANK	RIGHT BANK
Storm Drain	N	N
Tile Drain	N	N
Impervious Drainage	N	N
Gully	N	N
Orchard	N	N
Crop	N	N
Pasture	N	N
New Construction	N	N
Dirt Road	N	N
Gravel Road	N	N
Raw Sewage	N	N
Railroad	N	N

Buffer Break Types
(M = minor; S = severe)

CHANNELIZATION

N Evidence of Channel Straightening or Dredging (Y/N)

TYPE	EXTENT (m) N/A		
	LEFT BANK	BOTTOM	RIGHT BANK
Concrete			
Gabion			
Rip-Rap			
Earthen Berm		N/A	
Dredge Spoil Off Channel		N/A	
Pipe Culvert			

Actual Coordinates
(If >30m distance between original coordinates and stream)

Lat

Lon

Stream Block Ht. (m)

Stream Block Type

Lat

Lon

v. 2009

MBSS SPRING INDEX PERIOD DATA SHEET

SITE (Watershed Code) MP (Segment) 15 (Type) (Year) 2016

Reviewer: (First) KB / (Second) CR

DATE (Year) 16 (Month) 03 (Day) 23

CREW: KAREN BOWMAN / CARISSA REH

STREAM: MPIS

TIME 1215 (Military)

LOCALITY: LOTHIAN, AA CO., MD

SAMPLEABILITY

- [Y] Benthos
- [Y] Habitat Assessment
- [Y] Water Quality
- [N] Vernal Pool [A] (PRESENT/ABSENT)

OTHER (SPECIFY) N/A

SITE ACCESS ROUTE

GRAVEL PATH FROM BACK OF 810 RUSTIC LN DIRECTLY TO REACH

SAMPLE LABELS

Verified by: CR

QC LABEL

(Watershed Code) MP (Segment) 15 (Letters only) (Type) (Year) 2016

Dup. (D) or Blank (B): Verified by:

TEMP. LOGGER N/A

	(Y/N)	(TIME - Military)	#
WATER			#
AIR			#

LOCATION

PHOTODOCUMENTATION

Number	Title	Voucher (Y/N)
	MP US, DS	
	DS P US, DS	
	US P US, DS	

BENTHIC HABITAT SAMPLED

00	Riffle	05	Leaf Pack	02	Undercut Banks
13	Rootwad/Woody Debris	00	Macrophytes	00	Other

SAMPLING CONSID.: (2 NUM. ANODES) REACH WAS DEEP BANKS (3-4' DEEP)

STREAM WIDTH (m): 0023 (0 m); 0021 (75 m)

v. 2009

MBSS SPRING FAUNA DATA SHEET

SITE Watershed Code MP | Segment 15 | Type 2 | Year 2018 | Reviewer: First KB / Second CR

HERPETOFAUNA

☐ None Observed

Species	Lifestage (Adult, Juv., Larval, Egg)	SEEN (Y/N)	HEARD (Y/N)	NUMBER RETAINED	NUMBER PHOTOS TAKEN
SPRING PEEPERS - NUMEROUS	☒	☒	☒	☐	0
HEARD JUMPING	☐	☐	☐	☐	☐
	☐	☐	☐	☐	☐
	☐	☐	☐	☐	☐
	☐	☐	☐	☐	☐
	☐	☐	☐	☐	☐
	☐	☐	☐	☐	☐

MUSSELS

☒ None Observed

Species	LIVE	DEAD	NUMBER RETAINED	NUMBER PHOTOS TAKEN
	☐	☐	☐☐	☐
	☐	☐	☐☐	☐
	☐	☐	☐☐	☐
	☐	☐	☐☐	☐
	☐	☐	☐☐	☐

Corbicula LIVE ☐ DEAD ☐ NONE ☐

CRAYFISHES

☑ None Observed

Species	NUMBER RETAINED
[redacted]	01 → 0
	☐☐
	☐☐
	☐☐
	☐☐

Crayfish Burrows ☐ (Absent, Present, Extensive)

COMMENTS

1 GRUB FELL BACK INTO STREAM

Physical Habitat Assessment and Water Quality Data Sheet

Site ID: MP15
Subwatershed: Ferry Branch 2
Length of Reach: 75M **Date:** 3-25-16
Team Members: KB|CR **Time:** 12:15

Weather
Current: OVERCAST - LIGHT SHOWERS
Past 24hrs: OVERCAST
Past 48hrs: OVERCAST

Stream Character

- [x] Meandering
- [ ] Braided
- [ ] Riffle
- [x] Deep Pool >.5m
- [x] Shallow Pool <.5m
- [ ] Gravel
- [ ] Boulder >2m
- [ ] Concrete/Gabion
- [x] Undercut Bank
- [ ] Overhead Cover
- [ ] Effluent Discharge
- [ ] Emergent Vegetation
- [ ] Floating Vegetation
- [ ] Channelized
- [ ] Straight
- [ ] Run/Glide
- [ ] Silt/Clay
- [x] Sand
- [x] Cobble
- [ ] Boulder <2m
- [ ] Bedrock
- [ ] Rootwad
- [ ] Storm Drain
- [ ] Human Refuse
- [ ] Beaver Pond

A=Absent P=Present E=Extensive

Parameter	Down-stream	Mid-stream	Up-stream
Description			
pH	6.86	6.92	6.96
Temperature (°C)	14.7	14.5	14.7
DO (mg/l)	9.66	10.74	10.93
Conductivity (uS/cm)	161.4	161.7	162.1
TDS (mg/l)	130.65	131.30	131.30
Turbidity (NTU)	7.11	6.78	7.34

Notes: BARO – M: 754.7 mm Hg
– D: 754.8 mm Hg
– U: 754.9 mm Hg

Bar Formation

- [ ] None
- [ ] Minor
- [ ] Moderate
- [x] Extensive

Bank Erosion (see guidance sheet)

	Left Bank	Right Bank
Extent (m)	65m	45m
Severity	3	3
Avg. Height	1.3m	1.3m

Severity: 0=none 1=min 2=mod 3=severe

Maximum stream depth (cm): 106 cm

Benthic Habitat Sampled (20 total)

	Sq. ft.
Riffle	8
Rootwad/Woody Debris	13
Leaf Pack	3
Submerged Vegetation	0
Undercut Banks	2
Other: N/A	0

Rootwads/Woody Debris

# Instream Woody Debris	5
# Dewatered Woody Debris	4
# Instream Rootwads	4
# Dewatered Rootwads	3

Stream Gradient

Location (ft)	Height (ft)	Water Depth (ft)

Photographs/Observations:

- SHEER EXPOSED L & R BANKS
- POOLS RANGING FROM 0.3 - 1.4m (1-4.5')
- MUCKY/UNSTABLE SUBSTRATE
- STREAM SURROUNDED BY HEALTHY MATURE DECIDUOUS FOREST
- BED & BANK EROSION IS SEVERE
- DEEPERS HEARD / SALAMANDER RETAINED FOR PHOTOGRAPH
- EPHEMERAL DRAINAGE CHANNEL ALONG R.B. @ MIDREACH

MBSS Physical Habitat Assessment Sheet

Stream Habitat Assessment Guidance Sheet				
Habitat Parameter	Optima: 16-20	Sub-Optimal 11-15	Marginal 6-10	Poor 0-5
1. Instream Habitat[1] SCORE 5	Greater than 50% of a variety of cobble, boulder, submerged logs, undercut banks, snags, rootwads, aquatic plants or other stable habitat	30-50% of stable habitat. Adequate habitat	10-30% mix of stable habitat. Habitat availability less than desireable	Less than 10% stable habitat. Lack of habitat is obvious
2. Epifaunal Substrate[2] SCORE 3	Preferred substrate abundant, stable, and at full colonization potential (riffles well developed and dominated by cobble; and/or woody debris prevalent, not new, and not transient	Abund. of cobble with gravel and/or boulders common; or woody debris, aquatic veg., undercut banks common but not prevalent/suited for full colonization	Large boulders and/or bedrock prevalent; cobble, woody debris, or other preferred surfaces uncommon	Stable substrate lacking; or particles are over 75% surrounded by fine sediment or flocculent material
3. Velocity/Depth Diversity[3] SCORE 7	Slow (<0.3m/s), deep (>0.5m); slow, shallow (<0.5m); fast (>0.3m/s), deep; fast, shallow habitats all present	Only 3 of the 4 habitat categories present	Only 2 of the 4 habitat categories present	Dominated by 1 velocity/depth category (usually pools)
4. Pool/Glide/Eddy Quality[4] SCORE 16	Complex cover/&/or depth >1.5m; both deep (>0.5m)/shallows (<0.2m) present	Deep (>0.5m) areas present; but only moderate cover	Shallows (<0.2m) prevalent in pool/glide/eddy habitat; little cover	Max depth <0.2m in pool/glide/eddy habitat; or absent completely
5. Riffle/Run Quality[5] SCORE 2	Riffle/run depth generally >10cm, with maximum depth greater than 50 cm (maximum score); substrate stable (e.g. cobble, boulder) & variety of current velocities	Riffle/run depth generally 5-10cm, variety of current velocities	Riffle/run depth generally 1-5cm; primarily a single current velocity	Riffle/run depth <1cm; or riffle/run substrates concreted
6. Bank Stability[6] (facing downstream.) Score each bank LB SCORE 1 RB SCORE 2	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected. 10 9	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion. 8 7 6	Moderately unstable; 30-60% of bank in reach as areas of erosion; high erosion potential during floods. 5 4 3	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars. 2 1 0
7. Embeddedness SCORE 90 %	Percentage that gravel, cobble, and boulder particles are surrounded by fine sediment or flocculent material			
8. Shading SCORE 60 %	Percentage of segment that is shaded (duration is considered in scoring). 0% = fully exposed to sunlight all day in summer, 100% = fully and densely shaded all day in summer			
9. Riparian Buffer Zone Width (m)[7] LB 50 RB 50	Zone width in which human activity is not evident. 50m (164ft) is the maximum recorded value.			
10. Remoteness[8] SCORE 8	Roads greater than 400 meters (0.25 mi) from stream	Roads within 400 meters (0.25 mi) of stream; stream NOT accessible by trail.	Roads within 400 meters (0.25 mi) of stream; stream accessible by trail.	Roads adjacent to stream.
11. Aesthetic (trash) Rating[9] SCORE 15	Little or no human refuse visible from stream channel or riparian zone	Refuse present in minor amounts	Refuse present in moderate amounts	Refuse abundant and unsightly
12. Number of Woody Debris and Rootwads[10] SCORE 9	Count only woody debris and rootwads within the wetted portion of the sampling segment. Count only woody debris >10cm (4in) diameter and >1.5m (5ft) long and rootwads with trunk diameter (at chest height) >15cm (6in) that are functional habitat within the wetted portion of the stream.			

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS

STREAM NAME MP 15	LOCATION LOTHIAN, MD
STATION # _____ REACH ID# _____	STREAM CLASS Perennial
UTM N _____ UTM E	RIVER BASIN Patuxent River
STORET #	AGENCY CEI
INVESTIGATORS KB/CR	
FORM COMPLETED BY CR	DATE 3/25/16 TIME - 1215 PM / REASON FOR SURVEY MBSS

Parameters to be evaluated in sampling reach

Habitat Parameter	Condition Category			
	Optimal	Suboptimal	Marginal	Poor
1. Epifaunal Substrate/ Available Cover	Greater than 50% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient).	30-50% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale).	10-30% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 10% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
SCORE 2	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 (2) 1 0
2. Pool Substrate Characterization	Mixture of substrate materials, with gravel and firm sand prevalent; root mats and submerged vegetation common.	Mixture of soft sand, mud, or clay; mud may be dominant; some root mats and submerged vegetation present.	All mud or clay or sand bottom; little or no root mat; no submerged vegetation.	Hard-pan clay or bedrock; no root mat or vegetation.
SCORE 9	20 19 18 17 16	15 14 13 12 11	10 (9) 8 7 6	5 4 3 2 1 0
3. Pool Variability	Even mix of large-shallow, large-deep, small-shallow, small-deep pools present.	Majority of pools large-deep; very few shallow.	Shallow pools much more prevalent than deep pools.	Majority of pools small-shallow or pools absent.
SCORE 16	20 19 18 17 (16)	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
4. Sediment Deposition	Little or no enlargement of islands or point bars and less than <20% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 20-50% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 50-80% of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; more than 80% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
SCORE 6	20 19 18 17 16	15 14 13 12 11	10 9 8 7 (6)	5 4 3 2 1 0
5. Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills >75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
SCORE 7	20 19 18 17 16	15 14 13 12 11	10 9 8 (7) 6	5 4 3 2 1 0

40

Form # EL - _____

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS

Parameters to be evaluated broader than sampling reach

Habitat Parameter	Condition Category			
	Optimal	Suboptimal	Marginal	Poor
6. Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr) may be present, but recent channelization is not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.
SCORE 18	20 19 **(18)** 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
7. Channel Sinuosity	The bends in the stream increase the stream length 3 to 4 times longer than if it was in a straight line. (Note - channel braiding is considered normal in coastal plains and other low-lying areas. This parameter is not easily rated in these areas.)	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	Channel straight; waterway has been channelized for a long distance.
SCORE 11	20 19 18 17 16	15 14 13 12 **(11)**	10 9 8 7 6	5 4 3 2 1 0
8. Bank Stability (score each bank)	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.
SCORE 2 (LB)	**Left Bank** 10 9	8 7 6	5 4 3	**(2)** 1 0
SCORE 2 (RB)	**Right Bank** 10 9	8 7 6	5 4 3	**(2)** 1 0
9. Vegetative Protection (score each bank) Note: determine left or right side by facing downstream.	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
SCORE 2 (LB)	**Left Bank** 10 9	8 7 6	5 4 3	**(2)** 1 0
SCORE 2 (RB)	**Right Bank** 10 9	8 7 6	5 4 3	**(2)** 1 0
10. Riparian Vegetative Zone Width (score each bank riparian zone)	Width of riparian zone >18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone.	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6-12 meters; human activities have impacted zone a great deal.	Width of riparian zone <6 meters: little or no riparian vegetation due to human activities.
SCORE 9 (LB)	**Left Bank** 10 **(9)**	8 7 6	5 4 3	2 1 0
SCORE 7 (RB)	**Right Bank** 10 9	8 **(7)** 6	5 4 3	2 1 0

Total Score 93

Form # EL2 - _____

v. 2009

MBSS SPRING HABITAT DATA SHEET

Page 1 of 7

SITE — Watershed Code: MP | Segment: 29 | Type: 2 | Year: 2016

Reviewer: First JT / Second KB

DATE — Year: 16 | Month: 03 | Day: 30

209 Dist. from Nearest Road to Site (m)

13 Trash Rating 0 - 20

LANDUSE (Y/N)

N	Old Field	Y	Residential
Y	Deciduous Forest	N	Commercial/Industrial
N	Coniferous Forest	N	Cropland
N	Wetland	N	Pasture
N	Surface Mine	N	Orchard/Vineyard/Nursery
N	Landfill	N	Golf Course

RIPARIAN VEGETATION
(facing upstream)

	LEFT BANK	RIGHT BANK
Width (50m max)	50	50
Adjacent Land Cover	CP	HO
Vegetation Type	RYMO	RYMO
Buffer Breaks (Y/N)	Y	N

ROAD CULVERT

Present in Segment (Y/N): N

Sampleable? (Y/N):

Width of Culvert (m):

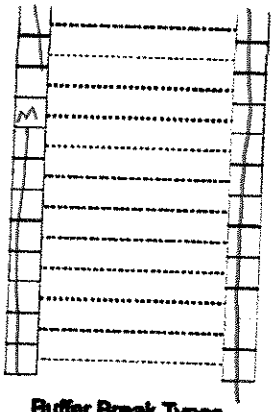
Length of Culvert (m):

STREAM GRADIENT

	Elevation (m)	Height (m)
1		
2		
3		

Buffer Breaks

	LEFT BANK	RIGHT BANK
Storm Drain		
Tile Drain		
Impervious Drainage		
Gully	M	
Orchard		
Crop		
Pasture		
New Construction		
Dirt Road		
Gravel Road		
Raw Sewage		
Railroad		



Buffer Break Types
(M = minor; S = severe)

CHANNELIZATION

N Evidence of Channel Straightening or Dredging (Y/N)

TYPE	EXTENT (m) LEFT BANK	BOTTOM	RIGHT BANK
Concrete			
Gebion			
Rip-Rap			
Earthen Berm		N/A	
Dredge Spoil Off Channel		N/A	
Pipe Culvert			

Actual Coordinates
(If >30m distance between original coordinates and stream)

Lat

Lon

Stream Block Ht. (m)

Stream Block Type

Lat

Lon

v. 2009

MBSS SPRING INDEX PERIOD DATA SHEET

Page 2 of 7

SITE: Watershed Code MP | Segment 24 | Type 2 | Year 2016

Reviewer: First JT / Second KB

DATE: Year 16 | Month 03 | Day 30

CREW: KB, JT

STREAM: MP 24

TIME: 1109 (Military)

LOCALITY: Lothian

SAMPLEABILITY

- [X] Benthos
- [X] Habitat Assessment
- [X] Water Quality
- [ ] Vernal Pool [A] (PRESENT/ABSENT)

OTHER (SPECIFY)

SITE ACCESS ROUTE

Park along Marlboro Rd and hike across the field into the woods

SAMPLE LABELS

Verified by: KB

QC LABEL

Watershed Code: MP | Segment: 24 (Letters only) | Type: | Year: 2016

Dup. (D) or Blank (B): | Verified by:

TEMP. LOGGER

	(Y/N)	(TIME - Military)	#
WATER			
AIR			

LOCATION

PHOTODOCUMENTATION

Number	Title	Voucher (Y/N)
	Midpoint US/DS	
	Downstream US/DS	
	Upstream US/DS	

BENTHIC HABITAT SAMPLED

- [13] Riffle
- [02] Rootwad/Woody Debris
- [05] Leaf Pack
- [ ] Macrophytes
- [ ] Undercut Banks
- [ ] Other

SAMPLING CONSID.: ([ ] NUM. ANODES)

STREAM WIDTH (m): 0 m | 75 m

v. 2009

MBSS SPRING FAUNA DATA SHEET

SITE Watershed Code [ ][ ][M][P] Segment [ ][2][9] Type [2] Year [2][0][1][6]

Reviewer: First JT / Second KB

HERPETOFAUNA

☐ None Observed

Species	Lifestage (Adult / Juv. / Larval / Egg)	SEEN (Y/N)	HEARD (Y/N)	NUMBER RETAINED	NUMBER PHOTOS TAKEN
salamander (3 seen total)	☐ ☑ ☐ ☐	Y	☐	☐	1
	☐ ☐ ☐ ☐	☐	☐	☐	☐
	☐ ☐ ☐ ☐	☐	☐	☐	☐
	☐ ☐ ☐ ☐	☐	☐	☐	☐
	☐ ☐ ☐ ☐	☐	☐	☐	☐
	☐ ☐ ☐ ☐	☐	☐	☐	☐
	☐ ☐ ☐ ☐	☐	☐	☐	☐

MUSSELS

☑ None Observed

Species	LIVE	DEAD	NUMBER RETAINED	NUMBER PHOTOS TAKEN
	☐	☐	☐☐	☐
	☐	☐	☐☐	☐
	☐	☐	☐☐	☐
	☐	☐	☐☐	☐
	☐	☐	☐☐	☐

Corbicula LIVE ☐ DEAD ☐ NONE ☐

CRAYFISHES

☑ None Observed

Species	NUMBER RETAINED
[illegible]	☐☐
	☐☐
	☐☐
	☐☐
	☐☐

Crayfish Burrows [A]
(Absent, Present, Extensive)

COMMENTS

Physical Habitat Assessment and Water Quality Data Sheet

Site ID: MP24
Subwatershed: Middle Patuxent
Length of Reach: 75m Date: 3/30/16
Team Members: KB/JT Time: 11:00

Weather
Current: clear, sunny, ~40°F
Past 24hrs: clear
Past 48hrs: clear, rain in AM

Stream Character

- [P] Meandering
- [A] Braided
- [P] Riffle
- [A] Deep Pool >.5m
- [P] Shallow Pool <.5m
- [P] Gravel
- [A] Boulder >2m
- [A] Concrete/Gabion
- [P] Undercut Bank
- [E] Overhead Cover
- [A] Effluent Discharge
- [P] Emergent Vegetation
- [A] Floating Vegetation

- [A] Channelized
- [A] Straight
- [A] Run/Glide
- [E] Silt/Clay
- [E] Sand
- [A] Cobble
- [A] Boulder <2m
- [A] Bedrock
- [P] Rootwad
- [A] Storm Drain
- [A] Human Refuse
- [A] Beaver Pond

A=Absent P=Present E=Extensive

Parameter	Down-stream	Mid-stream	Up-stream
Description			
pH	6.78	7.3	6.53
Temperature (°C)	9.6	9.5	9.7
DO (mg/l)	11.46	11.38	11.41
Conductivity (uS/cm)	260.4	238	174
TDS (mg/l)	239.2	219.7	159.9
Turbidity (NTU)	9.97	5.62	6.08

Notes: _____

Bar Formation

- [ ] None
- [x] Minor
- [ ] Moderate
- [ ] Extensive

Bank Erosion (see guidance sheet)

	Left Bank	Right Bank
Extent (m)	75	75
Severity	2	2
Avg. Height	1.5	1.5

Severity: 0=none 1=min 2=mod 3=severe

Maximum stream depth (cm) 70

Benthic Habitat Sampled (20 total)

	Sq. ft.
Riffle	13
Rootwad/Woody Debris	2
Leaf Pack	5
Submerged Vegetation	
Undercut Banks	
Other:	

Rootwads/Woody Debris

# Instream Woody Debris	7
# Dewatered Woody Debris	5
# Instream Rootwads	2
# Dewatered Rootwads	1

Stream Gradient

Location (ft)	Height (ft)	Water Depth (ft)

Photographs/Observations:
Midpoint US/DS
Downstream US/DS
Upstream US/DS
1 salamander

MBSS Physical Habitat Assessment Sheet

Stream Habitat Assessment Guidance Sheet

Habitat Parameter	Optimal 16-20	Sub-Optimal 11-15	Marginal 6-10	Poor 0-5
1. Instream Habitat[a] SCORE 6	Greater than 50% of a variety of cobble, boulder, submerged logs, undercut banks, snags, rootwads, aquatic plants or other stable habitat	30-50% of stable habitat. Adequate habitat	10-30% mix of stable habitat. Habitat availability less than desireable	Less than 10% stable habitat. Lack of habitat is obvious
2. Epifaunal Substrate[b] SCORE 3	Preferred substrate abundant, stable, and at full colonization potential (riffles well developed and dominated by cobble; and/or woody debris prevalent, not new, and not transient	Abund. of cobble with gravel and/or boulders common; or woody debris, aquatic veg., undercut banks common but not prevalent/suited for full colonization	Large boulders and/or bedrock prevalent; cobble, woody debris, or other preferred surfaces uncommon	Stable substrate lacking; or particles are over 75% surrounded by fine sediment or flocculent material
3. Velocity/Depth Diversity[c] SCORE 6	Slow (<0.3m/s), deep (>0.5m); slow, shallow (<0.5m); fast (>0.3m/s), deep; fast, shallow habitats all present	Only 3 of the 4 habitat categories present	Only 2 of the 4 habitat categories present	Dominated by 1 velocity/depth category (usually pools)
4. Pool/Glide/Eddy Quality[d] SCORE 3	Complex cover/&/or depth >1.5m; both deep (>0.5m)/shallows (<0.2m) present	Deep (>0.5m) areas present; but only moderate cover	Shallows (<0.2m) prevalent in pool/glide/eddy habitat; little cover	Max depth <0.2m in pool/glide/eddy habitat; or absent completely
5. Riffle/Run Quality[e] SCORE 6	Riffle/run depth generally >10cm, with maximum depth greater than 50 cm (maximum score); substrate stable (e.g. cobble, boulder) & variety of current velocities	Riffle/run depth generally 5-10cm, variety of current velocities	Riffle/run depth generally 1-5cm; primarily a single current velocity	Riffle/run depth <1cm; or riffle/run substrates concreted
6. Bank Stability[f] (facing downstream.) Score each bank LB SCORE 4 RB SCORE 4	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected. 10 9	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion. 8 7 6	Moderately unstable; 30-60% of bank in reach as areas of erosion; high erosion potential during floods. 5 4 3	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars. 2 1 0
7. Embeddedness SCORE 75 %	Percentage that gravel, cobble, and boulder particles are surrounded by fine sediment or flocculent material			
8. Shading SCORE 80 %	Percentage of segment that is shaded (duration is considered in scoring). 0% = fully exposed to sunlight all day in summer, 100% = fully and densely shaded all day in summer			
9. Riparian Buffer Zone Width (m)[g] LB 50m RB	Zone width in which human activity is not evident. 50m (164ft) is the maximum recorded value.			
10. Remoteness SCORE 13	Roads greater than 400 meters (0.25 mi) from stream	Roads within 400 meters (0.25 mi) of stream; stream NOT accessible by trail.	Roads within 400 meters (0.25 mi) of stream; stream accessible by trail.	Roads adjacent to stream.
11. Aesthetic (trash) Rating[h] SCORE 14	Little or no human refuse visible from stream channel or riparian zone	Refuse present in minor amounts	Refuse present in moderate amounts	Refuse abundant and unsightly
12. Number of Woody Debris and Rootwads[i] SCORE 9	Count only woody debris and rootwads within the wetted portion of the sampling segment. Count only woody debris >10cm (4in) diameter and >1.5m (5ft) long and rootwads with trunk diameter (at chest height) >15cm (6in) that are functional habitat within the wetted portion of the stream.			

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS

STREAM NAME MD 24		LOCATION Lothian, MD	
STATION #	REACH ID#	STREAM CLASS Perennial	
UTM N	UTM E	RIVER BASIN Patuxent	
STORET #		AGENCY EA	
INVESTIGATORS KB, JT			
FORM COMPLETED BY JT	DATE 3/30/16 TIME ~11:00 PM	REASON FOR SURVEY MBSS	

Parameters to be evaluated in sampling reach

Habitat Parameter	Condition Category			
	Optimal	Suboptimal	Marginal	Poor
1. Epifaunal Substrate/ Available Cover SCORE 8	Greater than 50% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient). 20 19 18 17 16	30-50% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale). 15 14 13 12 11	10-30% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed. 10 9 8 7 6	Less than 10% stable habitat; lack of habitat is obvious; substrate unstable or lacking. 5 4 3 2 1 0
2. Pool Substrate Characterization SCORE 8	Mixture of substrate materials, with gravel and firm sand prevalent; root mats and submerged vegetation common. 20 19 18 17 16	Mixture of soft sand, mud, or clay; mud may be dominant; some root mats and submerged vegetation present. 15 14 13 12 11	All mud or clay or sand bottom; little or no root mat; no submerged vegetation. 10 9 8 7 6	Hard-pan clay or bedrock; no root mat or vegetation. 5 4 3 2 1 0
3. Pool Variability SCORE 7	Even mix of large-shallow, large-deep, small-shallow, small-deep pools present. 20 19 18 17 16	Majority of pools large-deep; very few shallow. 15 14 13 12 11	Shallow pools much more prevalent than deep pools. 10 9 8 7 6	Majority of pools small-shallow or pools absent. 5 4 3 2 1 0
4. Sediment Deposition SCORE 7	Little or no enlargement of islands or point bars and less than <20% of the bottom affected by sediment deposition. 20 19 18 17 16	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 20-50% of the bottom affected; slight deposition in pools. 15 14 13 12 11	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 50-80% of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent. 10 9 8 7 6	Heavy deposits of fine material, increased bar development; more than 80% of the bottom changing frequently; pools almost absent due to substantial sediment deposition. 5 4 3 2 1 0
5. Channel Flow Status SCORE 10	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed. 20 19 18 17 16	Water fills >75% of the available channel; or <25% of channel substrate is exposed. 15 14 13 12 11	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed. 10 9 8 7 6	Very little water in channel and mostly present as standing pools. 5 4 3 2 1 0

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS

Parameters to be evaluated broader than sampling reach

Habitat Parameter	Condition Category			
	Optimal	Suboptimal	Marginal	Poor
6. Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr) may be present, but recent channelization is not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.
SCORE 20	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
7. Channel Sinuosity	The bends in the stream increase the stream length 3 to 4 times longer than if it was in a straight line. (Note - channel braiding is considered normal in coastal plains and other low-lying areas. This parameter is not easily rated in these areas.)	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	Channel straight; waterway has been channelized for a long distance.
SCORE 14	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
8. Bank Stability (score each bank)	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.
SCORE 6 (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE 6 (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0
9. Vegetative Protection (score each bank) Note: determine left or right side by facing downstream.	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
SCORE 7 (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE 7 (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0
10. Riparian Vegetative Zone Width (score each bank riparian zone)	Width of riparian zone >18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone.	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6-12 meters; human activities have impacted zone a great deal.	Width of riparian zone <6 meters: little or no riparian vegetation due to human activities.
SCORE 10 (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE 10 (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0

Total Score 117

v. 2009

MBSS SPRING HABITAT DATA SHEET

Page 1 of 2

SITE — Watershed Code: MP | Segment: 25 | Type: 1 | Year: 2016

Reviewer: First: JT / Second: KB

DATE — Year: 16 | Month: 04 | Day: 22

800 Dist. from Nearest Road to Site (m)

3 Trash Rating 0 - 20

LANDUSE (Y/N)

N	Old Field	Y	Residential
Y	Deciduous Forest	N	Commercial/Industrial
N	Coniferous Forest	N	Cropland
N	Wetland	Y	Pasture
N	Surface Mine	N	Orchard/Vineyard/Nursery
N	Landfill	N	Golf Course

RIPARIAN VEGETATION
(facing upstream)

	LEFT BANK	RIGHT BANK
Width (50m max)	40	50
Adjacent Land Cover	PA	FR
Vegetation Type	6R	6RYM
Buffer Breaks (Y/N)	N	N

ROAD CULVERT

Present in Segment (Y/N): N

Sampleable? (Y/N):

Width of Culvert (m):

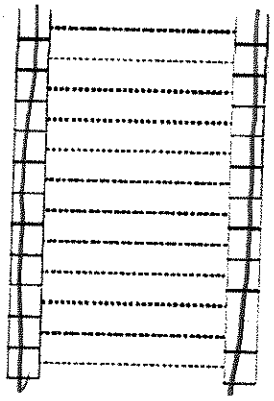
Length of Culvert (m):

STREAM GRADIENT

	Location (m)	Height (m)
1		
2		
3		

Buffer Breaks

	LEFT BANK	RIGHT BANK
Storm Drain		
Tile Drain		
Impervious Drainage		
Gully		
Orchard		
Crop		
Pasture		
New Construction		
Dirt Road		
Gravel Road		
Raw Sewage		
Railroad		



Buffer Break Types
(M = minor; S = severe)

CHANNELIZATION

N Evidence of Channel Straightening or Dredging (Y/N)

TYPE	EXTENT (m)		
	LEFT BANK	BOTTOM	RIGHT BANK
Concrete			
Gebion			
Rip-Rap			
Earthen Berm		N/A	
Dredge Spoil Off Channel		N/A	
Pipe Culvert			

Actual Coordinates
(If >30m distance between original coordinates and stream)

Lat

Lon

Stream Block Ht. (m)

Stream Block Type

Lat

Lon

v. 2009

MBSS SPRING INDEX PERIOD DATA SHEET

SITE: Watershed Code MP | Segment 25 | Type 1 | Year 2016

Reviewer: First JT / Second KB

DATE: Year 16 | Month 04 | Day 22

CREW: KB/JT

STREAM: trib to Lyon's Creek

TIME: 1218 (Military)

LOCALITY: Deale, MD

SAMPLEABILITY

- X Benthos
- Y Habitat Assessment
- Y Water Quality
- N Vernal Pool A (PRESENT/ABSENT)

OTHER (SPECIFY):

SITE ACCESS ROUTE

Property off Brooks Dale Rd, behind barn, and down hill.

SAMPLE LABELS

Verified by: KB

QC LABEL

Watershed Code 3 MP | Segment 25 (Letters only) | Type | Year 2016

Dup. (D) or Blank (B): | Verified by:

TEMP. LOGGER

	(Y/N)	(TIME - Military)	#
WATER			
AIR			

LOCATION

PHOTODOCUMENTATION

Number	Title	Voucher (Y/N)
	Midpoint US/DS	Y
	Upstream point US/DS	Y
	Downstream point US/DS	Y
	trib in LB rear US point	

BENTHIC HABITAT SAMPLED

- 03 Riffle
- 08 Rootwad/Woody Debris
- 09 Leaf Pack
- Macrophytes
- Undercut Banks
- Other

SAMPLING CONSID.: (NUM. ANODES)

STREAM WIDTH (m): 0 m | 75 m

v. 2009

MBSS SPRING FAUNA DATA SHEET

SITE Watershed Code MP | Segment 25 | Type | Year 2016

Reviewer: First JT / Second NB

HERPETOFAUNA

☒ None Observed

Species	Lifestage (Adult, Juv, Larval, Egg)	SEEN (Y/N)	HEARD (Y/N)	NUMBER RETAINED	NUMBER PHOTOS TAKEN

MUSSELS

☒ None Observed

Species	LIVE	DEAD	NUMBER RETAINED	NUMBER PHOTOS TAKEN

Corbicula: LIVE ☐ DEAD ☐ NONE ☐

CRAYFISHES

☒ None Observed

Species	NUMBER RETAINED

Crayfish Burrows: P

(Absent, Present, Extensive)

COMMENTS

Physical Habitat Assessment and Water Quality Data Sheet

Site ID: MP 25
Subwatershed: Lyons Creek 5
Length of Reach: 75m **Date:** 4/22/16
Team Members: MB/JT **Time:** 1216

Weather
Current: cloudy ~80°F
Past 24hrs: clear ~60°F
Past 48hrs: clear ~70°F

Parameter	Down-stream	Mid-stream	Up-stream
Description			
pH	6.81	7.11	6.82
Temperature (°C)	16.2	16.2	16.6
DO (mg/l)	9.55	10.03	9.62
Conductivity (uS/cm)	144.8	143.3	143.9
TDS (mg/l)	152.1	150.6	150.15
Turbidity (NTU)	27.5	29.1	14.2

Notes:

Stream Character

[P] Meandering	[A] Channelized
[A] Braided	[A] Straight
[P] Riffle	[P] Run/Glide
[A] Deep Pool >.5m	[P] Silt/Clay
[P] Shallow Pool <.5m	[P] Sand
[A] Gravel	[A] Cobble
[A] Boulder >2m	[A] Boulder <2m
[A] Concrete/Gabion	[A] Bedrock
[P] Undercut Bank	[P] Rootwad
[P] Overhead Cover	[A] Storm Drain
[A] Effluent Discharge	[A] Human Refuse
[P] Emergent Vegetation	[A] Beaver Pond
[A] Floating Vegetation	

A=Absent P=Present E=Extensive

Bar Formation
[ ] None [ ] Moderate
[X] Minor [ ] Extensive

Bank Erosion (see guidance sheet)

	Left Bank	Right Bank
Extent (m)	75m	75m
Severity	1	1
Avg. Height	100cm	100cm

Severity: 0=none 1=min 2=mod 3=severe

Maximum stream depth (cm) 100cm

Benthic Habitat Sampled (20 total)

	Sq. ft.
Riffle	3
Rootwad/Woody Debris	3
Leaf Pack	9
Submerged Vegetation	0
Undercut Banks	0
Other:	0

Rootwads/Woody Debris

# Instream Woody Debris	4
# Dewatered Woody Debris	9
# Instream Rootwads	0
# Dewatered Rootwads	0

Stream Gradient

Location (ft)	Height (ft)	Water Depth (ft)

Photographs/Observations:
Midpoint US/DS
US point LB/DS
DS point US/DS
tab 1 in LB
tab 2 in LB

MBSS Physical Habitat Assessment Sheet

Stream Habitat Assessment Guidance Sheet				
Habitat Parameter	Optimal 16-20	Sub-Optimal 11-15	Marginal 6-10	Poor 0-5
1. Instream Habitat[1] SCORE 2	Greater than 50% of a variety of cobble, boulder, submerged logs, undercut banks, snags, rootwads, aquatic plants or other stable habitat	30-50% of stable habitat. Adequate habitat	10-30% mix of stable habitat. Habitat availability less than desireable	Less than 10% stable habitat. Lack of habitat is obvious
2. Epifaunal Substrate[1] SCORE 2	Preferred substrate abundant, stable, and at full colonization potential (riffles well developed and dominated by cobble; and/or woody debris prevalent, not new, and not transient	Abund. of cobble with gravel and/or boulders common; or woody debris, aquatic veg., undercut banks common but not prevalent/suited for full colonization	Large boulders and/or bedrock prevalent; cobble, woody debris, or other preferred surfaces uncommon	Stable substrate lacking; or particles are over 75% surrounded by fine sediment or flocculent material
3. Velocity/Depth Diversity[1] SCORE 6	Slow (<0.3m/s), deep (>0.5m); slow, shallow (<0.5m); fast (>0.3m/s), deep; fast, shallow habitats all present	Only 3 of the 4 habitat categories present	Only 2 of the 4 habitat categories present	Dominated by 1 velocity/depth category (usually pools)
4. Pool/Glide/Eddy Quality[1] SCORE 2	Complex cover/&/or depth >1.5m; both deep (>0.5m)/shallows (<0.2m) present	Deep (>0.5m) areas present; but only moderate cover	Shallows (<0.2m) prevalent in pool/glide/eddy habitat; little cover	Max depth <0.2m in pool/glide/eddy habitat; or absent completely
5. Riffle/Run Quality[1] SCORE 6	Riffle/run depth generally >10cm, with maximum depth greater than 50 cm (maximum score); substrate stable (e.g. cobble, boulder) & variety of current velocities	Riffle/run depth generally 5-10cm, variety of current velocities	Riffle/run depth generally 1-5cm; primarily a single current velocity	Riffle/run depth <1CM; or riffle/run substrates concreted
6. Bank Stability[2] (facing downstream.) Score each bank LB SCORE 5 RB SCORE 5	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected. 10 9	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion. 8 7 6	Moderately unstable; 30-60% of bank in reach as areas of erosion; high erosion potential during floods. 5 4 3	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars. 2 1 0
7. Embeddedness SCORE 90 %	Percentage that gravel, cobble, and boulder particles are surrounded by fine sediment or flocculent material			
8. Shading SCORE 75 %	Percentage of segment that is shaded (duration is considered in scoring). 0% = fully exposed to sunlight all day in summer; 100% = fully and densely shaded all day in summer			
9. Riparian Buffer Zone Width (m)[3] LB 50 RB 40	Zone width in which human activity is not evident. 50m (164ft) is the maximum recorded value.			
10. Remoteness SCORE 18	Roads greater than 400 meters (0.25 mi) from stream	Roads within 400 meters (0.25 mi) of stream; stream NOT accessible by trail.	Roads within 400 meters (0.25 mi) of stream; stream accessible by trail.	Roads adjacent to stream.
11. Aesthetic (trash) Rating[2] SCORE 4	Little or no human refuse visible from stream channel or riparian zone	Refuse present in minor amounts	Refuse present in moderate amounts	Refuse abundant and unsightly
12. Number of Woody Debris and Rootwads[4] SCORE 4	Count only woody debris and rootwads within the wetted portion of the sampling segment. Count only woody debris >10cm (4in) diameter and >1.5m (5ft) long and rootwads with trunk diameter (at chest height) >15cm (6in) that are functional habitat within the wetted portion of the stream.			

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS

STREAM NAME MP2S (Lyon's Creek trib)	LOCATION Deale, MD
STATION # REACH ID#	STREAM CLASS
UTM N UTM E	RIVER BASIN Patuxent River
STORET #	AGENCY CEI
INVESTIGATORS KB / JT	
FORM COMPLETED BY JT	DATE 4/22/16 TIME 1213 PM / REASON FOR SURVEY MBSS

Parameters to be evaluated in sampling reach

Habitat Parameter	Optimal	Suboptimal	Marginal	Poor
1. Epifaunal Substrate/ Available Cover	Greater than 50% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient).	30-50% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale).	10-30% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 10% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
SCORE 4	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
2. Pool Substrate Characterization	Mixture of substrate materials, with gravel and firm sand prevalent; root mats and submerged vegetation common.	Mixture of soft sand, mud, or clay; mud may be dominant; some root mats and submerged vegetation present.	All mud or clay or sand bottom; little or no root mat; no submerged vegetation.	Hard-pan clay or bedrock; no root mat or vegetation.
SCORE 7	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
3. Pool Variability	Even mix of large-shallow, large-deep, small-shallow, small-deep pools present.	Majority of pools large-deep; very few shallow.	Shallow pools much more prevalent than deep pools.	Majority of pools small-shallow or pools absent.
SCORE 3	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
4. Sediment Deposition	Little or no enlargement of islands or point bars and less than <20% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 20-50% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 50-80% of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; more than 80% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
SCORE 12	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
5. Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills >75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
SCORE 9	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS

Parameters to be evaluated broader than sampling reach

Habitat Parameter	Condition Category			
	Optimal	Suboptimal	Marginal	Poor
6. Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr) may be present, but recent channelization is not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.
SCORE 17	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
7. Channel Sinuosity	The bends in the stream increase the stream length 3 to 4 times longer than if it was in a straight line. (Note - channel braiding is considered normal in coastal plains and other low-lying areas. This parameter is not easily rated in these areas.)	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	Channel straight; waterway has been channelized for a long distance.
SCORE 7	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
8. Bank Stability (score each bank)	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.
SCORE 4 (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE 4 (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0
9. Vegetative Protection (score each bank) Note: determine left or right side by facing downstream.	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
SCORE 5 (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE 5 (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0
10. Riparian Vegetative Zone Width (score each bank riparian zone)	Width of riparian zone >18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone.	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6-12 meters; human activities have impacted zone a great deal.	Width of riparian zone <6 meters: little or no riparian vegetation due to human activities.
SCORE 9 (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE 6 (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0

Total Score 92

v. 2009

MBSS SPRING HABITAT DATA SHEET

Page 1 of 7

SITE — Watershed Code: MP | Segment: 26 | Type: 3 | Year: 2016

Reviewer: First: JS / Second: CR

DATE — Year: 16 | Month: 04 | Day: 19

1600 Dist. from Nearest Road to Site (m) PAVED
STONE RD TO B&B 400m

06 Trash Rating 0 - 20
OLD CARS ~50 m beyond reach

LANDUSE (Y/N)

Y	Old Field	Y	Residential
Y	Deciduous Forest	N	Commercial/Industrial
N	Coniferous Forest	Y	Cropland
Y	Wetland	Y	Pasture
N	Surface Mine	N	Orchard/Vineyard/Nursery
N	Landfill	N	Golf Course

RIPARIAN VEGETATION
(facing upstream)

	LEFT BANK	RIGHT BANK
Width (50m max)	50	50
Adjacent Land Cover		
Vegetation Type	MYRG	MYRG
Buffer Breaks (Y/N)	N	N

ROAD CULVERT

N/A

Present in Segment (Y/N): N

N/A
Sampleable? (Y/N): N

N/A
Width of Culvert (m):

N/A
Length of Culvert (m):

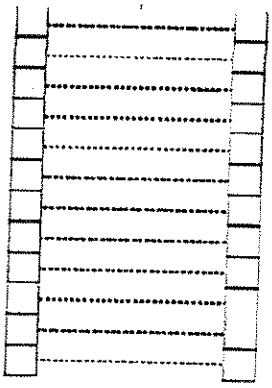
N/A

STREAM GRADIENT

	Elevation (m)	Height (m)
1		
2		
3		

BUFFER BREAKS

	LEFT BANK	RIGHT BANK
Storm Drain		
Tile Drain		
Impervious Drainage		
Gully		
Orchard		
Crop		
Pasture		
New Construction		
Dirt Road		
Gravel Road		
Raw Sewage		
Railroad		



Buffer Break Types
(M = minor; S = severe)

CHANNELIZATION

N Evidence of Channel Straightening or Dredging (Y/N)

TYPE	EXTENT (m)		
	LEFT BANK	BOTTOM	RIGHT BANK
Concrete			
Gabion			
Rip-Rap			
Earthen Berm		N/A	
Dredge Spoil Off Channel		N/A	
Pipe Culvert			

* Actual Coordinates
(If >30m distance between original coordinates and stream)

Lat
Lon

Stream Block Ht. (m)
Stream Block Type
Lat
Lon

v. 2009

MBSS SPRING INDEX PERIOD DATA SHEET

SITE Watershed Code: MP | Segment: 26 | Type: 3 | Year: 2016

Reviewer: First: JS / Second: CR

DATE: Year 16 | Month 04 | Day 14

CREW: JOSEPH SMITH / CARISSA REH

STREAM: LYONS CREEK / MP26

TIME: 1106 (Military)

LOCALITY: LOTHIAN, AA Co., MD

SAMPLEABILITY

- Y Benthos
- Y Habitat Assessment
- Y Water Quality
- Y Vernal Pool P (PRESENT/ABSENT)

OTHER (SPECIFY): N/A

SITE ACCESS ROUTE

PARK @ BUTTERFLY FIELDS FARM & B&B
FOLLOW ACCESS PATH THROUGH TREE LINE
TO CULVERT. WALK ~100m US TO REACH

SAMPLE LABELS

Verified by: CR

QC LABEL

Watershed Code: MP | Segment: 26 (Letters only) | Type: 3 | Year: 2016

Dup. (D) or Blank (B): | Verified by:

TEMP. LOGGER N/A

	(Y/N)	(TIME - Military)	#
WATER			#
AIR			#

LOCATION

PHOTODOCUMENTATION

Number	Title	Voucher (Y/N)
	US - UP, DS, LB	
	MP - US, DS, VERNAL POOL	
	DS - US, DS, RB	
	GENERAL - BURROWS, TURTLE (BOX) SHELL	
	SALAMANDERS	

BENTHIC HABITAT SAMPLED

01	Riffle	04	Leaf Pack	05	Undercut Banks
10	Rootwad/Woody Debris	00	Macrophytes	00	Other N/A

SAMPLING CONSID.: (| NUM. ANODES)

STREAM WIDTH (m): 0 m: 11 | 75 m: 12

v. 2009

MBSS SPRING FAUNA DATA SHEET

SITE Watershed Code [ ][ ][M][P] Segment [ ][2][6] Type [3] Year [2][0][1][6]

Reviewer: First JS / Second CR

HERPETOFAUNA

☒ None Observed

Species	Lifestage (Adult, Juv, Larval, Egg)	SEEN (Y/N)	HEARD (Y/N)	NUMBER RETAINED	NUMBER PHOTOS TAKEN
	☐☐☐☐	☐	☐	☐	☐
	☐☐☐☐	☐	☐	☐	☐
	☐☐☐☐	☐	☐	☐	☐
	☐☐☐☐	☐	☐	☐	☐
	☐☐☐☐	☐	☐	☐	☐
	☐☐☐☐	☐	☐	☐	☐
	☐☐☐☐	☐	☐	☐	☐

MUSSELS

☒ None Observed

Species	LIVE	DEAD	NUMBER RETAINED	NUMBER PHOTOS TAKEN
	☐	☐	☐☐	☐
	☐	☐	☐☐	☐
	☐	☐	☐☐	☐
	☐	☐	☐☐	☐
	☐	☐	☐☐	☐

Corbicula LIVE ☐ DEAD ☐ NONE ☒

CRAYFISHES

☒ None Observed

Species	NUMBER RETAINED
	☐☐
	☐☐
	☐☐
	☐☐
	☐☐

Crayfish Burrows [P]
(Absent, Present, Extensive)

COMMENTS

BOX TURTLE SHELL
SEVEN (7) SALAMANDERS

Physical Habitat Assessment and Water Quality Data Sheet

Site ID: MP26
Subwatershed: LYONS CREEK
Length of Reach: 75m **Date:** 4/14/16
Team Members: JS/CR **Time:** 11:06 AM

Weather
Current: SUNNY 55°F
Past 24hrs: SUNNY 55°F
Past 48hrs: OVERCAST/RAIN ~50°F

Stream Character

- [P] Meandering
- [A] Braided
- [P] Riffle
- [A] Deep Pool >.5m
- [P] Shallow Pool <.5m
- [P] Gravel
- [A] Boulder >2m
- [A] Concrete/Gabion
- [P] Undercut Bank
- [E] Overhead Cover
- [A] Effluent Discharge
- [P] Emergent Vegetation
- [A] Floating Vegetation
- [A] Channelized
- [P] Straight
- [E] Run/Glide
- [E] Silt/Clay
- [P] Sand
- [P] Cobble
- [A] Boulder <2m
- [A] Bedrock
- [P] Rootwad
- [A] Storm Drain
- [P] Human Refuse
- [A] Beaver Pond

A=Absent *P=Present* *E=Extensive*

Bar Formation

- [ ] None
- [x] Minor
- [ ] Moderate
- [ ] Extensive

Bank Erosion (see guidance sheet)

	Left Bank	Right Bank
Extent (m)	20	20
Severity	1	1
Avg. Height	0.7m	0.7m

Severity: 0=none 1=min 2=mod 3=severe

Maximum stream depth (cm): 45

Benthic Habitat Sampled (20 total)

	Sq. ft.
Riffle	
Rootwad/Woody Debris	10
Leaf Pack	4
Submerged Vegetation	0
Undercut Banks	5
Other: N/A	0

Rootwads/Woody Debris

# Instream Woody Debris	2
# Dewatered Woody Debris	3
# Instream Rootwads	2
# Dewatered Rootwads	5

Stream Gradient

Location (ft)	Height (ft)	Water Depth (ft)

Parameter	Downstream	Midstream	Upstream
Description			
pH	6.13	6.20	9.24
Temperature (°C)	11.7	11.68	11.38
DO (mg/l)	9.18	11.62	11.79
Conductivity (uS/cm)	185	179	177
TDS (mg/l)	101	156	155
Turbidity (NTU)	12.4	11.5	9.5

Notes: BARO mmHg

Photographs/Observations:

- IMMEDIATE BUFFER DOMINATED BY HEALTHY MID-SUCCESSIONAL DECIDUOUS FOREST
- WETLAND & VERNAL POOL
- CULVERT DS OF REACH
- FOOTPATH BRIDGE OVER ~~UPS~~ IMMEDIATELY UPSTREAM OF REACH
- RELATIVELY STRAIGHT MORPHOLOGY
- VARYING SUBSTRATE

MBSS Physical Habitat Assessment Sheet

Stream Habitat Assessment Guidance Sheet

Habitat Parameter	Optimal 16-20	Sub-Optimal 11-15	Marginal 6-10	Poor 0-5
1. Instream Habitat* SCORE 10	Greater than 50% of a variety of cobble, boulder, submerged logs, undercut banks, snags, rootwads, aquatic plants or other stable habitat	30-50% of stable habitat. Adequate habitat	10-30% mix of stable habitat. Habitat availability less than desireable	Less than 10% stable habitat. Lack of habitat is obvious
2. Epifaunal Substrate* SCORE 8	Preferred substrate abundant, stable, and at full colonization potential (riffles well developed and dominated by cobble; and/or woody debris prevalent, not new, and not transient	Abund. of cobble with gravel and/or boulders common; or woody debris, aquatic veg., undercut banks common but not prevalent/suited for full colonization	Large boulders and/or bedrock prevalent; cobble, woody debris, or other preferred surfaces uncommon	Stable substrate lacking; or particles are over 75% surrounded by fine sediment or flocculent material
3. Velocity/Depth Diversity* SCORE 8	Slow (<0.3m/s), deep (>0.5m); slow, shallow (<0.5m); fast (>0.3m/s), deep; fast, shallow habitats all present	Only 3 of the 4 habitat categories present	Only 2 of the 4 habitat categories present	Dominated by 1 velocity/depth category (usually pools)
4. Pool/Glide/Eddy Quality* SCORE 6	Complex cover&/or depth >1.5m; both deep (>0.5m)/shallows (<0.2m) present	Deep (>0.5m) areas present; but only moderate cover	Shallows (<0.2m) prevalent in pool/glide/eddy habitat; little cover	Max depth <0.2m in pool/glide/eddy habitat; or absent completely
5. Riffle/Run Quality* SCORE 6	Riffle/run depth generally >10cm, with maximum depth greater than 50 cm (maximum score); substrate stable (e.g. cobble, boulder) & variety of current velocities	Riffle/run depth generally 5-10cm, variety of current velocities	Riffle/run depth generally 1-5cm; primarily a single current velocity	Riffle/run depth <1cm; or riffle/run substrates concreted
6. Bank Stability* (facing downstream.) Score each bank LB SCORE 5 RB SCORE 5	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected. 10 9	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion. 8 7 6	Moderately unstable; 30-60% of bank in reach as areas of erosion; high erosion potential during floods. 5 4 3	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars. 2 1 0
7. Embeddedness SCORE 70 %	Percentage that gravel, cobble, and boulder particles are surrounded by fine sediment or flocculent material			
8. Shading SCORE 75 %	Percentage of segment that is shaded (duration is considered in scoring). 0% = fully exposed to sunlight all day in summer; 100% = fully and densely shaded all day in summer			
9. Riparian Buffer Zone Width (m)* LB 50 RB 50	Zone width in which human activity is not evident. 50m (164ft) is the maximum recorded value.			
10. Remoteness* SCORE 6	Roads greater than 400 meters (0.25 mi) from stream	Roads within 400 meters (0.25 mi) of stream; stream NOT accessible by trail.	Roads within 400 meters (0.25 mi) of stream; stream accessible by trail.	Roads adjacent to stream.
11. Aesthetic (trash) Rating* SCORE 6	Little or no human refuse visible from stream channel or riparian zone	Refuse present in minor amounts	Refuse present in moderate amounts	Refuse abundant and unsightly
12. Number of Woody Debris and Rootwads* SCORE 4	Count only woody debris and rootwads within the wetted portion of the sampling segment. Count only woody debris >10cm (4in) diameter and >1.5m (5ft) long and rootwads with trunk diameter (at chest height) >15cm (6in) that are functional habitat within the wetted portion of the stream.			

ACCESS ROADS

CARS & TRASH

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS

STREAM NAME MP26	LOCATION LOTHIAN, AA CO, MD
STATION # _____ REACH ID# _____	STREAM CLASS III
UTM N _____ UTM E	RIVER BASIN PATUXENT RIVER
STORET #	AGENCY CEI
INVESTIGATORS JS & CR	
FORM COMPLETED BY CR	DATE 4/14/16 TIME 11:06 AM PM
REASON FOR SURVEY BMI SAMPLING	

Parameters to be evaluated in sampling reach

Habitat Parameter	Condition Category			
	Optimal	Suboptimal	Marginal	Poor
1. Epifaunal Substrate/ Available Cover	Greater than 50% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient).	30-50% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale).	10-30% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 10% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
SCORE 8	20 19 18 17 16	15 14 13 12 11	10 9 (8) 7 6	5 4 3 2 1 0
2. Pool Substrate Characterization	Mixture of substrate materials, with gravel and firm sand prevalent; root mats and submerged vegetation common.	Mixture of soft sand, mud, or clay; mud may be dominant; some root mats and submerged vegetation present.	All mud or clay or sand bottom; little or no root mat; no submerged vegetation.	Hard-pan clay or bedrock; no root mat or vegetation.
SCORE 8	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
3. Pool Variability	Even mix of large-shallow, large-deep, small-shallow, small-deep pools present.	Majority of pools large-deep; very few shallow.	Shallow pools much more prevalent than deep pools.	Majority of pools small-shallow or pools absent.
SCORE 6	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
4. Sediment Deposition	Little or no enlargement of islands or point bars and less than <20% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 20-50% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 50-80% of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; more than 80% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
SCORE 7	20 19 18 17 16	15 14 13 12 11	10 9 8 (7) 6	5 4 3 2 1 0
5. Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills >75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
SCORE 11	20 19 18 17 16	15 14 13 12 (11)	10 9 8 7 6	5 4 3 2 1 0

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS

Parameters to be evaluated broader than sampling reach

Habitat Parameter	Condition Category			
	Optimal	Suboptimal	Marginal	Poor
6. Channel Alteration NOT W/IN REACH	Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr) may be present, but recent channelization is not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.
SCORE 20	(20) 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
7. Channel Sinuosity	The bends in the stream increase the stream length 3 to 4 times longer than if it was in a straight line. (Note - channel braiding is considered normal in coastal plains and other low-lying areas. This parameter is not easily rated in these areas.)	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	Channel straight; waterway has been channelized for a long distance.
SCORE 9	20 19 18 17 16	15 14 13 12 11	10 9 (8) 7 6	5 4 3 2 1 0
8. Bank Stability (score each bank)	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.
SCORE 6 (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE 6 (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0
9. Vegetative Protection (score each bank) Note: determine left or right side by facing downstream.	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
SCORE 9 (LB)	Left Bank 10 (9)	8 7 6	5 4 3	2 1 0
SCORE 9 (RB)	Right Bank 10 (9)	8 7 6	5 4 3	2 1 0
10. Riparian Vegetative Zone Width (score each bank riparian zone)	Width of riparian zone >18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone.	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6-12 meters; human activities have impacted zone a great deal.	Width of riparian zone <6 meters: little or no riparian vegetation due to human activities.
SCORE 9 (LB)	Left Bank 10 (9)	8 7 6	5 4 3	2 1 0
SCORE 9 (RB)	Right Bank 10 (9)	8 7 6	5 4 3	2 1 0

Total Score 116 NOT W/IN REACH

Form # EL2 - _____

v. 2009

MBSS SPRING HABITAT DATA SHEET

Page 1 of 2

SITE Watershed Code: MP | Segment: 037 | Type: 3 | Year: 2016

Reviewer: First: KB / Second: CR

DATE: Year: 16 | Month: 04 | Day: 04

800 Dist. from Nearest Road to Site (m)

16 Trash Rating 0 - 20

LANDUSE (Y/N)

N	Old Field	Y	Residential
Y	Deciduous Forest	N	Commercial/Industrial
N	Coniferous Forest	N	Cropland
N	Wetland	N	Pasture
N	Surface Mine	N	Orchard/Vineyard/Nursery
N	Landfill	N	Golf Course

RIPARIAN VEGETATION
(facing upstream)

	LEFT BANK	RIGHT BANK
Width (50m max)	15	50
Adjacent Land Cover	HO	FR
Vegetation Type	Y R M L	Y R M
Buffer Breaks (Y/N)	N	N

ROAD CULVERT

Present in Segment (Y/N): N

Sampleable? (Y/N):

Width of Culvert (m):

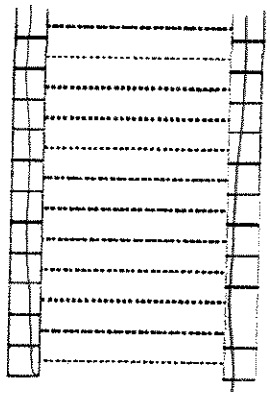
Length of Culvert (m):

STREAM GRADIENT

	Position (m)	Height (m)
1		
2		
3		

Buffer Breaks

	LEFT BANK	RIGHT BANK
Storm Drain		
Tile Drain		
Impervious Drainage		
Gully		
Orchard		
Crop		
Pasture		
New Construction		
Dirt Road		
Gravel Road		
Raw Sewage		
Railroad		



Buffer Break Types
(M = minor; S = severe)

CHANNELIZATION

N Evidence of Channel Straightening or Dredging (Y/N)

TYPE	EXTENT (m)		
	LEFT BANK	BOTTOM	RIGHT BANK
Concrete			
Gebion			
Rip-Rap			
Earthen Berm		N/A	
Dredge Spoil Off Channel		N/A	
Pipe Culvert			

Actual Coordinates
(If >30m distance between original coordinates and stream)

Lat

Lon

Stream Block Ht. (m)

Stream Block Type

Lat

Lon

v. 2009

MBSS SPRING INDEX PERIOD DATA SHEET

Page 2 Of 7

SITE (Watershed Code: NP) (Segment: 037) (Type: 3) (Year: 2016) Reviewer: (First: KB / Second: CR)

DATE (Year: 16 Month: 04 Day: 04)

TIME: 1610 (Military)

CREW: KB / CR

STREAM: CABIN BRANCH

LOCALITY: Lothian, MD

SAMPLEABILITY

- [N] Benthos
- [N] Habitat Assessment
- [N] Water Quality
- [N] Vernal Pool [A] (PRESENT/ABSENT)

OTHER (SPECIFY)

SITE ACCESS ROUTE

Access off MD 254, back driveway, access through woods

SAMPLE LABELS

Verified by: KB

QC LABEL

(Watershed Code: NP) (Segment: 034 (Letters only)) (Type: 3) (Year: 2016)

Dup. (D) or Blank (B): [ ] Verified by: _____

TEMP. LOGGER

	(Y/N)	(TIME - Military)	#
WATER			
AIR			

LOCATION _____

PHOTODOCUMENTATION

Number	Title	Voucher (Y/N)
	M - US/DS	
	D - US/DS	
	U - US/DS	

BENTHIC HABITAT SAMPLED

- [06] Riffle
- [02] Rootwad/Woody Debris
- [12] Leaf Pack
- [ ] Macrophytes
- [ ] Undercut Banks
- [ ] Other _____

SAMPLING CONSID.: ([ ] NUM. ANODES)

STREAM WIDTH (m): 0 m _____ 75 m _____

v. 2009

MBSS SPRING FAUNA DATA SHEET

SITE Watershed Code: U P | Segment: 0 3 7 | Type: 3 | Year: 2 0 1 6

Reviewer: First: KB / Second: CR

HERPETOFAUNA

☐ None Observed

Species	Lifestage (Adult, Juv., Larval, Egg)	SEEN (Y/N)	HEARD (Y/N)	NUMBER RETAINED	NUMBER PHOTOS TAKEN
Northern 2-lined Salamander	Juv.	Y	N	0	0
Frog	Adult	Y	N	0	0

MUSSELS

☒ None Observed

Species	LIVE	DEAD	NUMBER RETAINED	NUMBER PHOTOS TAKEN

Corbicula: LIVE ☐ DEAD ☐ NONE ☐

CRAYFISHES

☑ None Observed

Species	NUMBER RETAINED
~~Many juvenile~~ J J	

Crayfish Burrows ☐
(Absent, Present, Extensive)

COMMENTS

56

Physical Habitat Assessment and Water Quality Data Sheet

Site ID: UP037
Subwatershed: Cuban Branch
Length of Reach: 75M **Date:** 4/4/16
Team Members: KB/CR **Time:** 1610

Weather
Current: Cloudy, 70°F
Past 24hrs: Sunny/windy, 50°
Past 48hrs: Sunny, 65°

Parameter	Down-stream	Mid-stream	Up-stream
Description			
pH	6.66	6.70	6.65
Temperature (°C)	14.0	13.9	14.0
DO (mg/l)	9.46	9.64	9.4
Conductivity (uS/cm)	101.3	101.9	103.7
TDS (mg/l)	83.85	83.85	85.15
Turbidity (NTU)	20.7	21.8	19.9

Notes: Barometer 752.6 mmHg

Stream Character

[P] Meandering		[A] Channelized	
[A] Braided		[A] Straight	
[P] Riffle		[P] Run/Glide	
[A] Deep Pool >.5m		[P] Silt/Clay	
[P] Shallow Pool <.5m		[P] Sand	
[P] Gravel		[P] Cobble	
[A] Boulder >2m		[A] Boulder <2m	
[A] Concrete/Gabion		[A] Bedrock	
[P] Undercut Bank		[A] Rootwad	
[P] Overhead Cover		[A] Storm Drain	
[A] Effluent Discharge		[A] Human Refuse	
[A] Emergent Vegetation		[A] Beaver Pond	
[A] Floating Vegetation			

A=Absent P=Present E=Extensive

Bar Formation
☐ None ☑ Moderate
☐ Minor ☐ Extensive

Bank Erosion (see guidance sheet)

	Left Bank	Right Bank
Extent (m)	75	75
Severity	3	3
Avg. Height	5'	5'

Severity: 0=none 1=min 2=mod 3=severe

Maximum stream depth (cm) 24

Photographs/Observations:
M - US/DS
A - US/DS
D - US/DS

Benthic Habitat Sampled (20 total)

	Sq. ft.
Riffle	6
Rootwad/Woody Debris	3
Leaf Pack	10
Submerged Vegetation	0
Undercut Banks	0
Other:	0

Rootwads/Woody Debris

# Instream Woody Debris	1
# Dewatered Woody Debris	6
# Instream Rootwads	0
# Dewatered Rootwads	5

Stream Gradient

Location (ft)	Height (ft)	Water Depth (ft)

MBSS Physical Habitat Assessment Sheet

Stream Habitat Assessment Guidance Sheet				
Habitat Parameter	Optima 16-20	Sub-Optimal 11-15	Marginal 6-10	Poor 0-5
1. Instream Habitat[a] SCORE 5	Greater than 50% of a variety of cobble, boulder, submerged logs, undercut banks, snags, rootwads, aquatic plants or other stable habitat	30-50% of stable habitat. Adequate habitat	10-30% mix of stable habitat. Habitat availability less than desireable	Less than 10% stable habitat. Lack of habitat is obvious
2. Epifaunal Substrate[b] SCORE 5	Preferred substrate abundant, stable, and at full colonization potential (riffles wet developed and dominated by cobble; and/or woody debris prevalent, not new; and not transient	Abund. of cobble with gravel and/or boulders common; or woody debris, aquatic veg., undercut banks common but not prevalent/suited for full colonization	Large boulders and/or bedrock prevalent; cobble, woody debris, or other preferred surfaces uncommon	Stable substrate lacking; or particles are over 75% surrounded by fine sediment or flocculent material
3. Velocity/Depth Diversity[c] SCORE 5	Slow (<0.3m/s), deep (>0.5m); slow, shallow (<0.5m); fast (>0.3m/s), deep; fast, shallow habitats all present	Only 3 of the 4 habitat categories present	Only 2 of the 4 habitat categories present	Dominated by 1 velocity/depth category (usually pools)
4. Pool/Glide/Eddy Quality[d] SCORE 5	Complex cover/d/or depth >1.5m; both deep (>0.5m)/shallows (<0.2m) present	Deep (>0.5m) areas present; but only moderate cover	Shallows (<0.2m) prevalent in pool/glide/eddy habitat; little cover	Max depth <0.2m in pool/glide/eddy habitat; or absent completely
5. Riffle/Run Quality[e] SCORE 6	Riffle/run depth generally >10cm, with maximum depth greater than 50 cm (maximum score); substrate stable (e.g. cobble, boulder) & variety of current velocities	Riffle/run depth generally 5-10cm, variety of current velocities	Riffle/run depth generally 1-5cm; primarily a single current velocity	Riffle/run depth <1cm; or riffle/run substrates concreted
6. Bank Stability[f] (facing downstream.) Score each bank LB SCORE 2 RB SCORE 2	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected. 10 9	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion. 8 7 6	Moderately unstable; 30-60% of bank in reach as areas of erosion; high erosion potential during floods. 5 4 3	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars. 2 1 0
7. Embeddedness SCORE 60 %	Percentage that gravel, cobble, and boulder particles are surrounded by fine sediment or flocculent material			
8. Shading SCORE 75 %	Percentage of segment that is shaded (duration is considered in scoring). 0% = fully exposed to sunlight all day in summer; 100% = fully and densely shaded all day in summer			
9. Riparian Buffer Zone Width (m)[g] LB 15 RB 50	Zone width in which human activity is not evident. 50m (164ft) is the maximum recorded value.			
10. Remoteness SCORE 16	Roads greater than 400 meters (0.25 mi) from stream	Roads within 400 meters (0.25 mi) of stream; stream NOT accessible by trail.	Roads within 400 meters (0.25 mi) of stream; stream accessible by trail.	Roads adjacent to stream.
11. Aesthetic (trash) Rating[h] SCORE 15	Little or no human refuse visible from stream channel or riparian zone	Refuse present in minor amounts	Refuse present in moderate amounts	Refuse abundant and unsightly
12. Number of Woody Debris and Rootwads[i] SCORE 1	Count only woody debris and rootwads within the wetted portion of the sampling segment. Count only woody debris >10cm (4in) diameter and >1.5m (5ft) long and rootwads with trunk diameter (at chest height) >15cm (6in) that are functional habitat within the wetted portion of the stream.			

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS

STREAM NAME MP 37	LOCATION Lothian, MD
STATION # _____ REACH ID# _____	STREAM CLASS 3 / Perennial
UTM N _____ UTM E	RIVER BASIN Middle Patuxent
STORET #	AGENCY CEI
INVESTIGATORS KB / CR	
FORM COMPLETED BY KB	DATE 4/4/16 TIME ~1610 PM
REASON FOR SURVEY MBSS	

Parameters to be evaluated in sampling reach

Habitat Parameter	Condition Category			
	Optimal	Suboptimal	Marginal	Poor
1. Epifaunal Substrate/ Available Cover	Greater than 50% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient).	30-50% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale).	10-30% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 10% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
SCORE 5	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
2. Pool Substrate Characterization	Mixture of substrate materials, with gravel and firm sand prevalent; root mats and submerged vegetation common.	Mixture of soft sand, mud, or clay; mud may be dominant; some root mats and submerged vegetation present.	All mud or clay or sand bottom; little or no root mat; no submerged vegetation.	Hard-pan clay or bedrock; no root mat or vegetation.
SCORE 8	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
3. Pool Variability	Even mix of large-shallow, large-deep, small-shallow, small-deep pools present.	Majority of pools large-deep; very few shallow.	Shallow pools much more prevalent than deep pools.	Majority of pools small-shallow or pools absent.
SCORE 8	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
4. Sediment Deposition	Little or no enlargement of islands or point bars and less than <20% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 20-50% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 50-80% of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; more than 80% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
SCORE 8	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
5. Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills >75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
SCORE 10	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS

Parameters to be evaluated broader than sampling reach

Habitat Parameter	Condition Category			
	Optimal	Suboptimal	Marginal	Poor
6. Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr) may be present, but recent channelization is not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.
SCORE 6	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
7. Channel Sinuosity	The bends in the stream increase the stream length 3 to 4 times longer than if it was in a straight line. (Note - channel braiding is considered normal in coastal plains and other low-lying areas. This parameter is not easily rated in these areas.)	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	Channel straight; waterway has been channelized for a long distance.
SCORE 11	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
8. Bank Stability (score each bank)	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.
SCORE 2 (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE 2 (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0
9. Vegetative Protection (score each bank) Note: determine left or right side by facing downstream.	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
SCORE 2 (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE 2 (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0
10. Riparian Vegetative Zone Width (score each bank riparian zone)	Width of riparian zone >18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone.	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6-12 meters; human activities have impacted zone a great deal.	Width of riparian zone <6 meters: little or no riparian vegetation due to human activities.
SCORE 8 (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE 9 (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0

Total Score 81

v. 2009

MBSS SPRING HABITAT DATA SHEET

Page 1 of 7

SITE Watershed Code: MP | Segment: 39 | Type: 3 | Year: 2016

Reviewer: First: FW / Second: DV

DATE Year: 16 | Month: 03 | Day: 30

250 Dist. from Nearest Road to Site (m)

18 Trash Rating 0 - 20

LANDUSE (Y/N)

N	Old Field	N	Residential
Y	Deciduous Forest	N	Commercial/Industrial
N	Coniferous Forest	N	Cropland
N	Wetland	N	Pasture
N	Surface Mine	N	Orchard/Vineyard/Nursery
N	Landfill	N	Golf Course

RIPARIAN VEGETATION
(facing upstream)

	LEFT BANK	RIGHT BANK
Width (50m max)	50	50
Adjacent Land Cover	FR	FR
Vegetation Type	TM	TM
Buffer Breaks (Y/N)	N	N

ROAD CULVERT

Present in Segment (Y/N): N

Sampleable? (Y/N):

Width of Culvert (m):

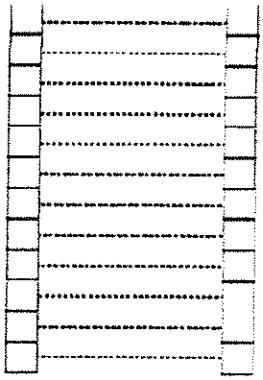
Length of Culvert (m):

STREAM GRADIENT

	Location (m)	Height (m)
1		
2		
3		

Buffer Breaks

	LEFT BANK	RIGHT BANK
Storm Drain		
Tile Drain		
Impervious Drainage		
Gully		
Orchard		
Crop		
Pasture		
New Construction		
Dirt Road		
Gravel Road		
Raw Sewage		
Railroad		



Buffer Break Types
(M = minor; S = severe)

CHANNELIZATION

Y Evidence of Channel Straightening or Dredging (Y/N)

TYPE	EXTENT (m)		
	LEFT BANK	BOTTOM	RIGHT BANK
Concrete			
Gabion			
Rip-Rap			
Earthen Berm		N/A	
Dredge Spoil Off Channel		N/A	
Pipe Culvert			

Actual Coordinates
(If >30m distance between original coordinates and stream)

Lat 38 78 49 26 8

Lon 76 65 08 08 5

Stream Block Ht. (m):

Stream Block Type:

Lat:

Lon:

v. 2009

MBSS SPRING INDEX PERIOD DATA SHEET

SITE (Watershed Code) MP (Segment) 39 (Type) 3 (Year) 2016

Reviewer: (First) EW / (Second) DV

DATE (Year) 16 (Month) 03 (Day) 31

CREW: DV + EW

STREAM: CABIN BRANCH 5

TIME 1320 (Military)

LOCALITY: LOTHIAN, AA. CO., MD

SAMPLEABILITY

- [✓] Benthos
- [✓] Habitat Assessment
- [✓] Water Quality
- [✓] Vernal Pool P (PRESENT/ABSENT)

OTHER (SPECIFY)

SITE ACCESS ROUTE

DARK ALONG S. EXTENT OF CABIN CREEK RD. WALK N 2.5 DM W INWARD SITE

SAMPLE LABELS

Verified by: EW

QC LABEL

(Watershed Code) MP (Segment) 39 (Letters only) (Type) 2 (Year) 16

Dup. (D) or Blank (B): [ ] Verified by: _____

TEMP. LOGGER

	(Y/N)	(TIME - Military)	#
WATER			
AIR			

LOCATION _____

PHOTODOCUMENTATION

Number	Title	Voucher (Y/N)

BENTHIC HABITAT SAMPLED

- [13] Riffle
- [05] Rootwad/Woody Debris
- [02] Leaf Pack
- [ ] Macrophytes
- [ ] Undercut Banks
- [ ] Other _____

SAMPLING CONSID.: ([ ] NUM. ANODES)

STREAM WIDTH (m): 4.0 (0 m); 6.0 (75 m)

v. 2009

MBSS SPRING FAUNA DATA SHEET

SITE — Watershed Code: MP | Segment: 39 | Type: 3 | Year: 2016

Reviewer: First EW / Second DV

☑ None Observed

HERPETOFAUNA

Species	Lifestage: Adult	Juv.	Larval	Egg	SEEN (Y/N)	HEARD (Y/N)	NUMBER RETAINED	NUMBER PHOTOS TAKEN

☑ None Observed

MUSSELS

Species	LIVE	DEAD	NUMBER RETAINED	NUMBER PHOTOS TAKEN

Corbicula — LIVE ☐ DEAD ☐ NONE ☐

☑ None Observed

CRAYFISHES

Species	NUMBER RETAINED

Crayfish Burrows: P
(Absent, Present, Extensive)

COMMENTS

Physical Habitat Assessment and Water Quality Data Sheet

Site ID: MP39
Subwatershed: Cabin Branch 5
Length of Reach: 75m Date: 3/3
Team Members: EW/DV Time: 1120 PM

Weather
Current: SUNNY 62's
Past 24hrs:
Past 48hrs: V

Stream Character

P Meandering	A Channelized
A Braided	A Straight
P Riffle	Run/Glide
P Deep Pool >.5m	P Silt/Clay
P Shallow Pool <.5m	P Sand
P Gravel	P Cobble
A Boulder >2m	A Boulder <2m
A Concrete/Gabion	A Bedrock
P Undercut Bank	P Rootwad
P Overhead Cover	A Storm Drain
Effluent Discharge	A Human Refuse
A Emergent Vegetation	A Beaver Pond
A Floating Vegetation	

A=Absent P=Present E=Extensive

Bar Formation
☐ None ☐ Moderate
☑ Minor ☐ Extensive

Bank Erosion (see guidance sheet)

	Left Bank	Right Bank	Severity:
Extent (m)	20	15	0=none
Severity	M	M	1=min
Avg. Height	2m	2m	2=mod
			3=severe

Maximum stream depth (cm) 10

Benthic Habitat Sampled (20 total)	Sq. ft.
Riffle	13
Rootwad/Woody Debris	5
Leaf Pack	2
Submerged Vegetation	
Undercut Banks	
Other:	

Rootwads/Woody Debris

# Instream Woody Debris	8
# Dewatered Woody Debris	4
# Instream Rootwads	0
# Dewatered Rootwads	3

Stream Gradient

Location (ft)	Height (ft)	Water Depth (ft)

Parameter	Down-stream	Mid-stream	Up-stream
Description			
pH	6.69	6.66	6.70
Temperature (°C)	13.16	13.94	14.12
DO (mg/l)	11.75	11.09	10.9
Conductivity (uS/cm)	133	136	136
TDS (mg/l) g/L	.112	.112	.112
Turbidity (NTU)	8.8	7.9	9.3

Notes:

Photographs/Observations:
CAMERA

MBSS Physical Habitat Assessment Sheet

Stream Habitat Assessment Guidance Sheet				
Habitat Parameter	Optimal 16-20	Sub-Optimal 11-15	Marginal 6-10	Poor 0-5
1. Instream Habitat* SCORE 15	Greater than 50% of a variety of cobble, boulder, submerged logs, undercut banks, snags, rootwads, aquatic plants or other stable habitat	30-50% of stable habitat. Adequate habitat	10-30% mix of stable habitat. Habitat availability less than desireable	Less than 10% stable habitat. Lack of habitat is obvious
2. Epifaunal Substrate* SCORE 12	Preferred substrate abundant, stable, and at full colonization potential (riffles well developed and dominated by cobble; and/or woody debris prevalent, not new, and not transient	Abund. of cobble with gravel and/or boulders common; or woody debris, aquatic veg., undercut banks common but not prevalent/suited for full colonization	Large boulders and/or bedrock prevalent; cobble, woody debris, or other preferred surfaces uncommon	Stable substrate lacking; or particles are over 75% surrounded by fine sediment or flocculent material
3. Velocity/Depth Diversity* SCORE 13	Slow (<0.3m/s), deep (>0.5m); slow, shallow (<0.5m); fast (>0.3m/s), deep; fast, shallow habitats all present	Only 3 of the 4 habitat categories present	Only 2 of the 4 habitat categories present	Dominated by 1 velocity/depth category (usually pools)
4. Pool/Glide/Eddy Quality* SCORE 15	Complex cover/&/or depth >1.5m; both deep (>0.5m)/shallows (<0.2m) present	Deep (>0.5m) areas present; but only moderate cover	Shallows (<0.2m) prevalent in pool/glide/eddy habitat; little cover	Max depth <0.2m in pool/glide/eddy habitat; or absent completely
5. Riffle/Run Quality* SCORE 14	Riffle/run depth generally >10cm, with maximum depth greater than 50 cm (maximum score); substrate stable (e.g. cobble, boulder) & variety of current velocities	Riffle/run depth generally 5-10cm, variety of current velocities	Riffle/run depth generally 1-5cm; primarily a single current velocity	Riffle/run depth <1cm; or riffle/run substrates concreted
6. Bank Stability* (facing downstream) Score each bank LB SCORE 5 RB SCORE 7	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected. 10 9	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion. 8 7 6	Moderately unstable; 30-60% of bank in reach as areas of erosion; high erosion potential during floods. 5 4 3	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars. 2 1 0
7. Embeddedness SCORE 80 %	Percentage that gravel, cobble, and boulder particles are surrounded by fine sediment or flocculent material			
8. Shading SCORE 90 %	Percentage of segment that is shaded (duration is considered in scoring). 0% = fully exposed to sunlight all day in summer; 100% = fully and densely shaded all day in summer			
9. Riparian Buffer Zone Width (m)* LB 50 RB 50	Zone width in which human activity is not evident. 50m (164ft) is the maximum recorded value.			
10. Remoteness SCORE 10	Roads greater than 400 meters (0.25 mi) from stream	Roads within 400 meters (0.25 mi) of stream; stream NOT accessible by trail.	Roads within 400 meters (0.25 mi) of stream; stream accessible by trail.	Roads adjacent to stream.
11. Aesthetic (trash) Rating* SCORE 15	Little or no human refuse visible from stream channel or riparian zone	Refuse present in minor amounts	Refuse present in moderate amounts	Refuse abundant and unsightly
12. Number of Woody Debris and Rootwads* SCORE 6	Count only woody debris and rootwads within the wetted portion of the sampling segment. Count only woody debris >10cm (4in) diameter and >1.5m (5ft) long and rootwads with trunk diameter (at chest height) >15cm (6in) that are functional habitat within the wetted portion of the stream.			

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS

STREAM NAME MP39		LOCATION LOTHIAN, AA CO, MD	
STATION #	REACH ID#	STREAM CLASS 3	
UTM N	UTM E	RIVER BASIN PATUXENT	
STORET #		AGENCY CEI	
INVESTIGATORS EW/DV			
FORM COMPLETED BY DV	DATE 3/31/16 TIME - 1120 (PM)	REASON FOR SURVEY BMI	

Parameters to be evaluated in sampling reach

Habitat Parameter	Condition Category			
	Optimal	Suboptimal	Marginal	Poor
1. Epifaunal Substrate/ Available Cover	Greater than 50% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient).	30-50% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale).	10-30% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 10% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
SCORE 15	20 19 18 17 16	(15) 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
2. Pool Substrate Characterization	Mixture of substrate materials, with gravel and firm sand prevalent; root mats and submerged vegetation common.	Mixture of soft sand, mud, or clay; mud may be dominant; some root mats and submerged vegetation present.	All mud or clay or sand bottom; little or no root mat; no submerged vegetation.	Hard-pan clay or bedrock; no root mat or vegetation.
SCORE 16	20 19 18 17 (16)	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
3. Pool Variability	Even mix of large-shallow, large-deep, small-shallow, small-deep pools present.	Majority of pools large-deep; very few shallow.	Shallow pools much more prevalent than deep pools.	Majority of pools small-shallow or pools absent.
SCORE 10	20 19 18 17 16	15 14 13 12 11	(10) 9 8 7 6	5 4 3 2 1 0
4. Sediment Deposition	Little or no enlargement of islands or point bars and less than <20% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 20-50% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 50-80% of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; more than 80% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
SCORE 9	20 19 18 17 16	15 14 13 12 11	10 (9) 8 7 6	5 4 3 2 1 0
5. Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills >75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
SCORE 13	20 19 18 17 16	15 14 (13) 12 11	10 9 8 7 6	5 4 3 2 1 0

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS

Parameters to be evaluated broader than sampling reach

Habitat Parameter	Condition Category			
	Optimal	Suboptimal	Marginal	Poor
6. Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr) may be present, but recent channelization is not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.
SCORE 19	20 (19) 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
7. Channel Sinuosity	The bends in the stream increase the stream length 3 to 4 times longer than if it was in a straight line. (Note - channel braiding is considered normal in coastal plains and other low-lying areas. This parameter is not easily rated in these areas.)	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	Channel straight; waterway has been channelized for a long distance.
SCORE 16	20 19 18 17 (16)	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
8. Bank Stability (score each bank)	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.
SCORE 5 (LB)	Left Bank 10 9	8 7 6	(5) 4 3	2 1 0
SCORE 7 (RB)	Right Bank 10 9	8 (7) 6	5 4 3	2 1 0
9. Vegetative Protection (score each bank) Note: determine left or right side by facing downstream.	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
SCORE 10 (LB)	Left Bank (10) 9	8 7 6	5 4 3	2 1 0
SCORE 10 (RB)	Right Bank (10) 9	8 7 6	5 4 3	2 1 0
10. Riparian Vegetative Zone Width (score each bank riparian zone)	Width of riparian zone >18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone.	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6-12 meters; human activities have impacted zone a great deal.	Width of riparian zone <6 meters: little or no riparian vegetation due to human activities.
SCORE 10 (LB)	Left Bank (10) 9	8 7 6	5 4 3	2 1 0
SCORE 10 (RB)	Right Bank (10) 9	8 7 6	5 4 3	2 1 0

Total Score 150

Form # EL2 - _____

v. 2009

MBSS SPRING HABITAT DATA SHEET

Page 1 of 7

SITE — Watershed Code: MP | Segment: 39 | Type: 3 | Year: 2016 | REP

Reviewer: First EW / Second DV

DATE — Year: 16 | Month: 03 | Day: 30

GIS rev

250 Dist. from Nearest Road to Site (m)

18 Trash Rating 0 - 20

LANDUSE (Y/N)

N	Old Field	Y	Residential
Y	Deciduous Forest	N	Commercial/Industrial
N	Coniferous Forest	N	Cropland
N	Wetland	N	Pasture
N	Surface Mine	N	Orchard/Vineyard/Nursery
N	Landfill	N	Golf Course

RIPARIAN VEGETATION
(facing upstream)

	LEFT BANK	RIGHT BANK
Width (50m max)	50	50
Adjacent Land Cover	FR	FR
Vegetation Type	MY	MY
Buffer Breaks (Y/N)	N	N

ROAD CULVERT

Present in Segment (Y/N): N

Sampleable? (Y/N): N

Width of Culvert (m): NA

Length of Culvert (m): NA

STREAM GRADIENT

	Upstream (m)	Height (m)
1		
2		
3		

Buffer Breaks

	LEFT BANK	RIGHT BANK
Storm Drain		
Tile Drain		
Impervious Drainage		
Gully		
Orchard		
Crop		
Pasture		
New Construction		
Dirt Road		
Gravel Road		
Raw Sewage		
Railroad		

Buffer Break Types
(M = minor; S = severe)

CHANNELIZATION

N Evidence of Channel Straightening or Dredging (Y/N)

TYPE	EXTENT (m)		
	LEFT BANK	BOTTOM	RIGHT BANK
Concrete			
Gebion			
Rip-Rap			
Earthen Berm		N/A	
Dredge Spoil Off Channel		N/A	
Pipe Culvert			

Actual Coordinates
(If >30m distance between original coordinates and stream)

Lat 39.78480

Lon

Stream Block Ht. (m)

Stream Block Type

Lat

Lon

v. 2009

MBSS SPRING INDEX PERIOD DATA SHEET

Page 2 of 7

SITE Watershed Code MP | Segment 39 | Type 3 | Year 2016 - REP

Reviewer: First EW / Second DV

DATE Year 16 Month 03 Day 30

CREW: EW + DV

STREAM: CABIN BRANCH J

TIME 1330 (Military)

LOCALITY: AA CO. MD

SAMPLEABILITY

- [✓] Benthos
- [✓] Habitat Assessment
- [✓] Water Quality
- [ ] Vernal Pool [A] (PRESENT/ABSENT)

OTHER (SPECIFY)

SITE ACCESS ROUTE

Foot path thru woods
N250 M WEST OF CABIN CREEK RD

SAMPLE LABELS

Verified by: _____

QC LABEL

Watershed Code MP | Segment 39 (Letters only) | Type | Year 2016

Dup. (D) or Blank (B): [D] Verified by: _____

TEMP. LOGGER

	(Y/N)	(TIME - Military)	#
WATER			#
AIR			#

LOCATION _____

PHOTODOCUMENTATION

Number	Title	Voucher (Y/N)

BENTHIC HABITAT SAMPLED

- [15] Riffle
- [3] Rootwad/Woody Debris
- [2] Leaf Pack
- [ ] Macrophytes
- [ ] Undercut Banks
- [ ] Other _____

SAMPLING CONSID.: ([ ] NUM. ANODES)

STREAM WIDTH (m): 4 (0 m) | 65 (75 m)

v. 2009

MBSS SPRING FAUNA DATA SHEET

SITE — Watershed Code: MD | Segment: REP 39 | Type: 3 | Year: 2016 | Reviewer: First: SW / Second: DV

HERPETOFAUNA

☒ None Observed

Species	Lifestage (Adult, Juv, Larval, Egg)	SEEN (Y/N)	HEARD (Y/N)	NUMBER RETAINED	NUMBER PHOTOS TAKEN
	☐ ☐ ☐ ☐	☐	☐	☐	☐
	☐ ☐ ☐ ☐	☐	☐	☐	☐
	☐ ☐ ☐ ☐	☐	☐	☐	☐
	☐ ☐ ☐ ☐	☐	☐	☐	☐
	☐ ☐ ☐ ☐	☐	☐	☐	☐
	☐ ☐ ☐ ☐	☐	☐	☐	☐
	☐ ☐ ☐ ☐	☐	☐	☐	☐

MUSSELS

☑ None Observed

Species	LIVE	DEAD	NUMBER RETAINED	NUMBER PHOTOS TAKEN
	☐	☐	☐☐	☐
	☐	☐	☐☐	☐
	☐	☐	☐☐	☐
	☐	☐	☐☐	☐
	☐	☐	☐☐	☐

Corbicula — LIVE ☐ DEAD ☐ NONE ☐

CRAYFISHES

☐ None Observed

Species	NUMBER RETAINED
	☐☐
	☐☐
	☐☐
	☐☐
	☐☐

Crayfish Burrows: P

(Absent, Present, Extensive)

COMMENTS

Physical Habitat Assessment and Water Quality Data Sheet

Site ID: MP39 REP
Subwatershed: CABIN BRANCH 5
Length of Reach: 75m **Date:** 3/30/10
Team Members: EW + DN **Time:** 1420

Weather
Current: Sunny 60's
Past 24hrs: Sunny
Past 48hrs: Sunny

Parameter	Down-stream	Mid-stream	Up-stream
Description			
pH	6.86	6.78	6.72
Temperature (°C)	15.78	15.8	15.83
DO (mg/l)	11.28	11.29	10.83
Conductivity (uS/cm)	140	140	140
TDS (mg/l) g/L	.110	.111	.110
Turbidity (NTU)	13	11.6	9

Notes:

Stream Character

[P] Meandering	[A] Channelized
[A] Braided	[P] Straight
[E] Riffle	[P] Run/Glide
[P] Deep Pool >.5m	[P] Silt/Clay
[P] Shallow Pool <.5m	[P] Sand
[P] Gravel	[P] Cobble
[A] Boulder >2m	[A] Boulder <2m
[A] Concrete/Gabion	[A] Bedrock
[P] Undercut Bank	[P] Rootwad
[P] Overhead Cover	[A] Storm Drain
[A] Effluent Discharge	[A] Human Refuse
[A] Emergent Vegetation	[A] Beaver Pond
[A] Floating Vegetation	

A=Absent P=Present E=Extensive

Bar Formation
[ ] None [ ] Minor [✓] Moderate [ ] Extensive

Bank Erosion (see guidance sheet)

	Left Bank	Right Bank
Extent (m)	20	12
Severity	2	1
Avg. Height	4'	3'

Severity: 0=none 1=min 2=mod 3=severe

Maximum stream depth (cm) 20

Benthic Habitat Sampled (20 total)

	Sq. ft.
Riffle	~~15~~
Rootwad/Woody Debris	~~3~~
Leaf Pack	~~2~~
Submerged Vegetation	
Undercut Banks	
Other:	

Rootwads/Woody Debris

# Instream Woody Debris	0
# Dewatered Woody Debris	3
# Instream Rootwads	2
# Dewatered Rootwads	4

Stream Gradient

Location (ft)	Height (ft)	Water Depth (ft)

Photographs/Observations:

MBSS Physical Habitat Assessment Sheet

Stream Habitat Assessment Guidance Sheet				
Habitat Parameter	Optimal 16-20	Sub-Optimal 11-15	Marginal 6-10	Poor 0-5
1. Instream Habitat[1] SCORE 15	Greater than 50% of a variety of cobble, boulder, submerged logs, undercut banks, snags, rootwads, aquatic plants or other stable habitat	30-50% of stable habitat. Adequate habitat	10-30% mix of stable habitat. Habitat availability less than desireable	Less than 10% stable habitat. Lack of habitat is obvious
2. Epifaunal Substrate[2] SCORE 14	Preferred substrate abundant, stable, and at full colonization potential (riffles well developed and dominated by cobble; and/or woody debris prevalent, not new, and not transient	Abund. of cobble with gravel and/or boulders common; or woody debris, aquatic veg., undercut banks common but not prevalent/suited for full colonization	Large boulders and/or bedrock prevalent; cobble, woody debris, or other preferred surfaces uncommon	Stable substrate lacking; or particles are over 75% surrounded by fine sediment or flocculent material
3. Velocity/Depth Diversity[3] SCORE 16	Slow (<0.3m/s), deep (>0.5m); slow, shallow (<0.5m); fast (>0.3m/s), deep; fast, shallow habitats all present	Only 3 of the 4 habitat categories present	Only 2 of the 4 habitat categories present	Dominated by 1 velocity/depth category (usually pools)
4. Pool/Glide/Eddy Quality[4] SCORE 16	Complex cover&/or depth >1.5m; both deep (>0.5m)/shallows (<0.2m) present	Deep (>0.5m) areas present; but only moderate cover	Shallows (<0.2m) prevalent in pool/glide/eddy habitat; little cover	Max depth <0.2m in pool/glide/eddy habitat; or absent completely
5. Riffle/Run Quality[4] SCORE 15	Riffle/run depth generally >10cm, with maximum depth greater than 50 cm (maximum score); substrate stable (e.g. cobble, boulder) & variety of current velocities	Riffle/run depth generaly 5-10cm, variety of current velocities	Riffle/run depth generally 1-5cm; primarily a single current velocity	Riffle/run depth <1cm; or riffle/run substrates concreted
6. Bank Stability[4] (facing downstream.) Score each bank LB SCORE 4 RB SCORE 5	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected. 10 9	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion. 8 7 6	Moderately unstable; 30-60% of bank in reach as areas of erosion; high erosion potential during floods. 5 4 3	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars. 2 1 0
7. Embeddedness SCORE 80 %	Percentage that gravel, cobble, and boulder particles are surrounded by fine sediment or flocculent material			
8. Shading SCORE 85 %	Percentage of segment that is shaded (duration is considered in scoring). 0% = fully exposed to sunlight all day in summer; 100% = fully and densely shaded all day in summer			
9. Riparian Buffer Zone Width (m)[5] LB 50 RB 50	Zone width in which human activity is not evident. 50m (164ft) is the maximum recorded value.			
10. Remoteness[6] SCORE 60	Roads greater than 400 meters (0.25 mi) from stream	Roads within 400 meters (0.25 mi) of stream; stream NOT accessible by trail	Roads within 400 meters (0.25 mi) of stream; stream accessible by trail	Roads adjacent to stream.
11. Aesthetic (trash) Rating[7] SCORE 17	Little or no human refuse visible from stream channel or riparian zone	Refuse present in minor amounts	Refuse present in moderate amounts	Refuse abundant and unsightly
12. Number of Woody Debris and Rootwads[8] SCORE 8	Count only woody debris and rootwads within the wetted portion of the sampling segment. Count only woody debris >10cm (4in) diameter and >1.5m (5ft) long and rootwads with trunk diameter (at chest height) >15cm (6in) that are functional habitat within the wetted portion of the stream.			

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS

STREAM NAME MP3A-REP- CABIN BRANCH		LOCATION LOTHIAN, AA CO., MD	
STATION #	REACH ID#	STREAM CLASS 3	
UTM N	UTM E	RIVER BASIN PATUXENT	
STORET #		AGENCY CEI	
INVESTIGATORS EW/DV			
FORM COMPLETED BY DV		DATE 3/31/16 TIME 2:00 (PM)	REASON FOR SURVEY BMI

Parameters to be evaluated in sampling reach

Habitat Parameter	Condition Category			
	Optimal	Suboptimal	Marginal	Poor
1. Epifaunal Substrate/ Available Cover	Greater than 50% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient).	30-50% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale).	10-30% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 10% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
SCORE 15	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
2. Pool Substrate Characterization	Mixture of substrate materials, with gravel and firm sand prevalent; root mats and submerged vegetation common.	Mixture of soft sand, mud, or clay; mud may be dominant; some root mats and submerged vegetation present.	All mud or clay or sand bottom; little or no root mat; no submerged vegetation.	Hard-pan clay or bedrock; no root mat or vegetation.
SCORE 14	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
3. Pool Variability	Even mix of large-shallow, large-deep, small-shallow, small-deep pools present.	Majority of pools large-deep; very few shallow.	Shallow pools much more prevalent than deep pools.	Majority of pools small-shallow or pools absent.
SCORE 10	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
4. Sediment Deposition	Little or no enlargement of islands or point bars and less than <20% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 20-50% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 50-80% of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; more than 80% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
SCORE 12	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
5. Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills >75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
SCORE 13	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS

Parameters to be evaluated broader than sampling reach

Habitat Parameter	Condition Category			
	Optimal	Suboptimal	Marginal	Poor
6. Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr) may be present, but recent channelization is not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.
SCORE 19	20 (19) 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
7. Channel Sinuosity	The bends in the stream increase the stream length 3 to 4 times longer than if it was in a straight line. (Note - channel braiding is considered normal in coastal plains and other low-lying areas. This parameter is not easily rated in these areas.)	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	Channel straight; waterway has been channelized for a long distance.
SCORE 17	20 19 18 (17) 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
8. Bank Stability (score each bank)	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.
SCORE 4 (LB)	Left Bank 10 9	8 7 6	5 (4) 3	2 1 0
SCORE 5 (RB)	Right Bank 10 9	8 7 6	(5) 4 3	2 1 0
9. Vegetative Protection (score each bank) Note: determine left or right side by facing downstream.	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
SCORE 10 (LB)	Left Bank (10) 9	8 7 6	5 4 3	2 1 0
SCORE 10 (RB)	Right Bank (10) 9	8 7 6	5 4 3	2 1 0
10. Riparian Vegetative Zone Width (score each bank riparian zone)	Width of riparian zone >18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone.	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6-12 meters; human activities have impacted zone a great deal.	Width of riparian zone <6 meters: little or no riparian vegetation due to human activities.
SCORE 10 (LB)	Left Bank (10) 9	8 7 6	5 4 3	2 1 0
SCORE 10 (RB)	Right Bank (10) 9	8 7 6	5 4 3	2 1 0

Total Score 149

v. 2009

MBSS SPRING HABITAT DATA SHEET

SITE — Watershed Code: MP | Segment: 42 | Type: 3 | Year: 2016

Reviewer: First CR / Second JT

DATE — Year: 16 | Month: 04 | Day: 11

15 Dist. from Nearest Road to Site (m)

16 Trash Rating 0 - 20

LANDUSE (Y/N)

Y	Old Field	Y	Residential
Y	Deciduous Forest	N	Commercial/Industrial
N	Coniferous Forest	N	Cropland
N	Wetland	Y	Pasture
N	Surface Mine	N	Orchard/Vineyard/Nursery
N	Landfill	N	Golf Course

RIPARIAN VEGETATION

(facing upstream)

	LEFT BANK	RIGHT BANK
Width (50m max)	50	50
Adjacent Land Cover	LN	LN
Vegetation Type	G R Y M	G R Y M
Buffer Breaks (Y/N)	Y	Y

	LEFT BANK	RIGHT BANK
Storm Drain		
Tile Drain		
Impervious Drainage		
Gully	M	M
Orchard		
Crop		
Pasture		
New Construction		
Dirt Road		
Gravel Road		
Raw Sewage		
Railroad		

Buffer Break Types (M = minor; S = severe)

ROAD CULVERT

Present in Segment (Y/N)	N
Sampleable? (Y/N)	
Width of Culvert (m)	
Length of Culvert (m)	

STREAM GRADIENT

(section crossed out)

	Location (m)	Height (m)
1		
2		
3		

CHANNELIZATION

N Evidence of Channel Straightening or Dredging (Y/N)

TYPE	EXTENT (m) LEFT BANK	BOTTOM	RIGHT BANK
Concrete			
Gabion			
Rip-Rap			
Earthen Berm		N/A	
Dredge Spoil Off Channel		N/A	
Pipe Culvert			

Actual Coordinates (If >30m distance between original coordinates and stream)

Lat

Lon

Stream Block Ht. (m)

Stream Block Type

Lat

Lon

v. 2009

MBSS SPRING INDEX PERIOD DATA SHEET

Page 2 of 7

SITE: Watershed Code MP | Segment 42 | Type 3 | Year 2016 | Reviewer: First CR / Second JT

DATE: Year 16 | Month 04 | Day 11

CREW: CARISSA REH / JANELLE TURNER

STREAM: MP42 / UNNAMED TRIB TO LYONS CREEK

TIME: 1430 (Military)

LOCALITY: LOTHIAN, AA CO., MD

SAMPLEABILITY

- [Y] Benthos
- [Y] Habitat Assessment
- [Y] Water Quality
- [N] Vernal Pool [A] (PRESENT/ABSENT)

OTHER (SPECIFY): N/A

SITE ACCESS ROUTE

PARK ALONG E BAY RD

SITE IS JUST DOWNSTREAM OF CULVERT

SAMPLE LABELS

Verified by: CR

QC LABEL

Watershed Code: MP | Segment: 42 (Letters only) | Type: 3 | Year: 2016

Dup. (D) or Blank (B): | Verified by:

TEMP. LOGGER

N/A

	(Y/N)	(TIME - Military)	#
WATER			#
AIR			#

LOCATION

PHOTODOCUMENTATION

Number	Title	Voucher (Y/N)
1 - 2	DS - US, DS	
3 - 4	MP - US, DS	
5 - 6	US - US, DS	
7	C. BURROW	

BENTHIC HABITAT SAMPLED

11	Riffle	01	Leaf Pack	04	Undercut Banks
04	Rootwad/Woody Debris		Macrophytes		Other

SAMPLING CONSID.: (2 NUM. ANODES)

STREAM WIDTH (m): 0 m | 75 m 14

v. 2009

MBSS SPRING FAUNA DATA SHEET

SITE Watershed Code: [ ][ ]MP | Segment: [ ]42 | Type: 3 | Year: 2016

Reviewer: First: CR / Second: JT

HERPETOFAUNA

☐ None Observed

Species	Lifestage (Adult, Juv., Larval, Egg)	SEEN (Y/N)	HEARD (Y/N)	NUMBER RETAINED	NUMBER PHOTOS TAKEN
ADULT FROG SPP.	☒ ☐ ☐ ☐	☒	☒	0	0
	☐ ☐ ☐ ☐	☐	☐		
	☐ ☐ ☐ ☐	☐	☐		
	☐ ☐ ☐ ☐	☐	☐		
	☐ ☐ ☐ ☐	☐	☐		
	☐ ☐ ☐ ☐	☐	☐		
	☐ ☐ ☐ ☐	☐	☐		

MUSSELS

☒ None Observed

Species	LIVE	DEAD	NUMBER RETAINED	NUMBER PHOTOS TAKEN
	☐	☐	☐☐	☐
	☐	☐	☐☐	☐
	☐	☐	☐☐	☐
	☐	☐	☐☐	☐
	☐	☐	☐☐	☐

Corbicula: LIVE ☐ DEAD ☐ NONE ☒

CRAYFISHES

☒ None Observed

Species	NUMBER RETAINED
	☐☐
	☐☐
	☐☐
	☐☐
	☐☐

Crayfish Burrows: P
(Absent, Present, Extensive)

COMMENTS

Physical Habitat Assessment and Water Quality Data Sheet

Site ID: MP42
Subwatershed: Lyons Creek 4
Length of Reach: 75m **Date:** 4/11/16
Team Members: CR/JT **Time:** 14:30

Weather
Current: SUNNY 62°
Past 24hrs: OVERCAST 50°
Past 48hrs: OVERCAST/RAIN 40°

Stream Character

P Meandering	P Channelized
A Braided	E Straight
P Riffle	E Run/Glide
P Deep Pool >.5m	E Silt/Clay
P Shallow Pool <.5m	P Sand
P Gravel	P Cobble
A Boulder >2m	A Boulder <2m
A Concrete/Gabion	A Bedrock
A Undercut Bank	P Rootwad
E Overhead Cover	A Storm Drain
A Effluent Discharge	A Human Refuse
A Emergent Vegetation	A Beaver Pond
A Floating Vegetation	

A=Absent P=Present E=Extensive

Bar Formation
☐ None ☐ Moderate
☑ Minor ☐ Extensive

Bank Erosion (see guidance sheet)

	Left Bank	Right Bank	Severity:
Extent (m)	20	15	
Severity	1	1	0=none
Avg. Height	1m	1m	1=min
			2=mod
			3=severe

Maximum stream depth (cm) 94

Benthic Habitat Sampled (20 total)	Sq. ft.
Riffle	11
Rootwad/Woody Debris	4
Leaf Pack	1
Submerged Vegetation	0
Undercut Banks	4
Other: N/A	0

Rootwads/Woody Debris

# Instream Woody Debris	3
# Dewatered Woody Debris	3
# Instream Rootwads	4
# Dewatered Rootwads	1

Stream Gradient

Location (ft)	Height (ft)	Water Depth (ft)

Parameter	Down-stream	Mid-stream	Up-stream
Description			
pH	6.96	6.91	7.15
Temperature (°C)	16.0	16.0	16.2
DO (mg/l)	10.47	10.51	10.5
Conductivity (uS/cm)	153.9	155.9	154.9
TDS (mg/l)	123.5	122.2	120.9
Turbidity (NTU)	29.3	11.6	11.3

Notes: BARO [redacted] 761.4 761.2
7632

Photographs/Observations:
LB RIPARIAN - WOODED/VEG FOR 215' ON AVG, MAINTAINED LAWN 15' +
RB ↑ SAME AS ABOVE
RB - 3 EROSIONAL DRAINAGE FEATURES
LB - 2 EROSIONAL DRAINAGE FEATURES
- VARIABLE SUBSTRATE - SILT, SAND, COBBLE/GRAVEL

DRW | WRW | DWD | WWD
1 | IIII | III | III

MBSS Physical Habitat Assessment Sheet

Stream Habitat Assessment Guidance Sheet				
Habitat Parameter	Optimal 16-20	Sub-Optimal 11-15	Marginal 6-10	Poor 0-5
1. Instream Habitat[a] SCORE 11	Greater than 50% of a variety of cobble, boulder, submerged logs, undercut banks, snags, rootwads, aquatic plants or other stable habitat	30-50% of stable habitat. Adequate habitat	10-30% mix of stable habitat. Habitat availability less than desireable	Less than 10% stable habitat. Lack of habitat is obvious
2. Epifaunal Substrate[a] SCORE 10	Preferred substrate abundant, stable, and at full colonization potential (riffles well developed and dominated by cobble; and/or woody debris prevalent, not new, and not transient	Abund. of cobble with gravel and/or boulders common; or woody debris, aquatic veg., undercut banks common but not prevalent/suited for full colonization	Large boulders and/or bedrock prevalent; cobble, woody debris, or other preferred surfaces uncommon	Stable substrate lacking; or particles are over 75% surrounded by fine sediment or flocculent material
3. Velocity/Depth Diversity[a] SCORE 12	Slow (<0.3m/s), deep (>0.5m); slow, shallow (<0.5m); fast (>0.3m/s), deep; fast, shallow habitats all present	Only 3 of the 4 habitat categories present	Only 2 of the 4 habitat categories present	Dominated by 1 velocity/depth category (usually pools)
4. Pool/Glide/Eddy Quality[a] SCORE 11	Complex cover/& or depth >1.5m; both deep (>0.5m)/shallows (<0.2m) present	Deep (>0.5m) areas present; but only moderate cover	Shallows (<0.2m) prevalent in pool/glide/eddy habitat; little cover	Max depth <0.2m in pool/glide/eddy habitat; or absent completely
5. Riffle/Run Quality[a] SCORE 8	Riffle/run depth generally >10cm, with maximum depth greater than 50 cm (maximum score); substrate stable (e.g. cobble, boulder) & variety of current velocities	Riffle/run depth generally 5-10cm, variety of current velocities	Riffle/run depth generally 1-5cm; primarily a single current velocity	Riffle/run depth <1cm; or riffle/run substrates concreted
6. Bank Stability[a] (facing downstream.) Score each bank LB SCORE 5 RB SCORE 5	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected. 10 9	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion. 8 7 6	Moderately unstable; 30-60% of bank in reach as areas of erosion; high erosion potential during floods. 5 4 3	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars. 2 1 0
7. Embeddedness SCORE 60 %	Percentage that gravel, cobble, and boulder particles are surrounded by fine sediment or flocculent material			
8. Shading SCORE 80 %	Percentage of segment that is shaded (duration is considered in scoring). 0% = fully exposed to sunlight all day in summer; 100% = fully and densely shaded all day in summer			
9. Riparian Buffer Zone Width (m)[a] LB 3 RB 3	Zone width in which human activity is not evident. 50m (164ft) is the maximum recorded value. 3m WOODED 3m + = MAINTAINED LAWN; BOTH BANKS			
10. Remoteness[a] SCORE 1	Roads greater than 400 meters (0.25 mi) from stream	Roads within 400 meters (0.25 mi) of stream; stream NOT accessible by trail	Roads within 400 meters (0.25 mi) of stream; stream accessible by trail	Roads adjacent to stream.
11. Aesthetic (trash) Rating[a] SCORE 16	Little or no human refuse visible from stream channel or riparian zone	Refuse present in minor amounts	Refuse present in moderate amounts	Refuse abundant and unsightly
12. Number of Woody Debris and Rootwads[a] SCORE 7	Count only woody debris and rootwads within the wetted portion of the sampling segment. Count only woody debris >10cm (4in) diameter and >1.5m (5ft) long and rootwads with trunk diameter (at chest height) >15cm (6in) that are functional habitat within the wetted portion of the stream.			

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS

STREAM NAME MP42		LOCATION LOTHIAN, AA CO., MD	
STATION # _____ REACH ID# _____		STREAM CLASS III	
UTM N _____ UTM E		RIVER BASIN PATUXENT RIVER	
STORET #		AGENCY CEI	
INVESTIGATORS CR/JT			
FORM COMPLETED BY CR	DATE 4/11/16 TIME 14:30 (PM)	REASON FOR SURVEY BMI SAMPLING	

Parameters to be evaluated in sampling reach

Habitat Parameter	Condition Category			
	Optimal	Suboptimal	Marginal	Poor
1. Epifaunal Substrate/ Available Cover	Greater than 50% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient).	30-50% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale).	10-30% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 10% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
SCORE 10	20 19 18 17 16	15 14 13 12 (11)	10 9 8 7 6	5 4 3 2 1 0
2. Pool Substrate Characterization	Mixture of substrate materials, with gravel and firm sand prevalent; root mats and submerged vegetation common.	Mixture of soft sand, mud, or clay; mud may be dominant; some root mats and submerged vegetation present.	All mud or clay or sand bottom; little or no root mat; no submerged vegetation.	Hard-pan clay or bedrock; no root mat or vegetation.
SCORE 11	20 19 18 17 16	15 14 13 12 (11)	10 9 8 7 6	5 4 3 2 1 0
3. Pool Variability	Even mix of large-shallow, large-deep, small-shallow, small-deep pools present.	Majority of pools large-deep; very few shallow.	Shallow pools much more prevalent than deep pools.	Majority of pools small-shallow or pools absent.
SCORE 11	20 19 18 17 16	15 14 13 12 (11)	10 9 8 7 6	5 4 3 2 1 0
4. Sediment Deposition	Little or no enlargement of islands or point bars and less than <20% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 20-50% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 50-80% of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; more than 80% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
SCORE 11	20 19 18 17 16	15 14 13 12 (11)	10 9 8 7 6	5 4 3 2 1 0
5. Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills >75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
SCORE 9	20 19 18 17 16	15 14 13 12 11	10 (9) 8 7 6	5 4 3 2 1 0

52

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS

Parameters to be evaluated broader than sampling reach

Habitat Parameter	Condition Category			
	Optimal	Suboptimal	Marginal	Poor
6. Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr) may be present, but recent channelization is not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.
SCORE 20	(20) 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
7. Channel Sinuosity	The bends in the stream increase the stream length 3 to 4 times longer than if it was in a straight line. (Note - channel braiding is considered normal in coastal plains and other low-lying areas. This parameter is not easily rated in these areas.)	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	Channel straight; waterway has been channelized for a long distance.
SCORE 6	20 19 18 17 16	15 14 13 12 11	10 9 8 7 (6)	5 4 3 2 1 0
8. Bank Stability (score each bank)	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.
SCORE 6 (LB)	**Left Bank** 10 9	8 7 (6)	5 4 3	2 1 0
SCORE 6 (RB)	**Right Bank** 10 9	8 7 (6)	5 4 3	2 1 0
9. Vegetative Protection (score each bank) Note: determine left or right side by facing downstream.	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
SCORE 4 (LB)	**Left Bank** 10 9	8 7 6	5 (4) 3	2 1 0
SCORE 4 (RB)	**Right Bank** 10 9	8 7 6	5 (4) 3	2 1 0
10. Riparian Vegetative Zone Width (score each bank riparian zone)	Width of riparian zone >18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone.	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6-12 meters; human activities have impacted zone a great deal.	Width of riparian zone <6 meters: little or no riparian vegetation due to human activities.
SCORE 1 (LB)	**Left Bank** 10 9	8 7 6	5 4 3	2 (1) 0
SCORE 1 (RB)	**Right Bank** 10 9	8 7 6	5 4 3	2 (1) 0

3m WIDE
3m + = MAINTAINED LAWN

Total Score 100

v. 2009

MBSS SPRING HABITAT DATA SHEET

Page 1 of 7

SITE — Watershed Code: MP | Segment: 043 | Type: 2 | Year: 2016

Reviewer: First: JS / Second: DV

DATE — Year: 16 | Month: 04 | Day: 19

150 Dist. from Nearest Road to Site (m)

16 Trash Rating 0 - 20

LANDUSE (Y/N)

M	Old Field	N	Residential
Y	Deciduous Forest	N	Commercial/Industrial
N	Coniferous Forest	M	Cropland
N	Wetland	N	Pasture
N	Surface Mine	N	Orchard/Vineyard/Nursery
N	Landfill	N	Golf Course

RIPARIAN VEGETATION
(facing upstream)

	LEFT BANK	RIGHT BANK
Width (50m max)	50	50
Adjacent Land Cover	FR	FR
Vegetation Type	MMRO	MMRO
Buffer Breaks (Y/N)	M	M

ROAD CULVERT

Present in Segment (Y/N): M

Sampleable? (Y/N):

Width of Culvert (m):

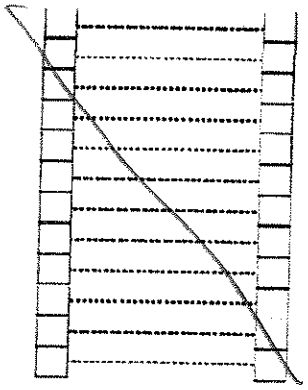
Length of Culvert (m):

STREAM GRADIENT

	Location (m)	Height (m)
1		
2		
3		

LEFT BANK / RIGHT BANK

Storm Drain
Tile Drain
Impervious Drainage
Gully
Orchard
Crop
Pasture
New Construction
Dirt Road
Gravel Road
Raw Sewage
Railroad



Buffer Break Types
(M = minor; S = severe)

CHANNELIZATION

N Evidence of Channel Straightening or Dredging (Y/N)

TYPE	EXTENT (m) LEFT BANK	BOTTOM	RIGHT BANK
Concrete			
Gabion			
Rip-Rap			
Earthen Berm		N/A	
Dredge Spoil Off Channel		N/A	
Pipe Culvert			

Actual Coordinates
(If >30m distance between original coordinates and stream)

Lat 39.769306

Lon 76.619720

Stream Block Ht. (m):

Stream Block Type:

Lat:

Lon:

v. 2009

MBSS SPRING INDEX PERIOD DATA SHEET

Page 1 of 7

SITE: Watershed Code MP | Segment 043 | Type 2 | Year 2016

Reviewer: First JS / Second DV

DATE: Year 16 | Month 04 | Day 19

CREW: JS | DV

STREAM: Lyons Creek

TIME: 1400 (Military)

LOCALITY: Tracy's Landing

SAMPLEABILITY

- [Y] Benthos
- [Y] Habitat Assessment
- [Y] Water Quality
- [N] Vernal Pool [ ] (PRESENT/ABSENT)

OTHER (SPECIFY)

SITE ACCESS ROUTE

Park on McKendree Rd at Lyons Creek. Walk to site

SAMPLE LABELS

Verified by: _____

QC LABEL

Watershed Code: MP | Segment: 043 (Latters only) | Type: 2 | Year: 2016

Dup. (D) or Blank (B): [ ] Verified by: _____

TEMP. LOGGER

	(Y/N)	(TIME - Military)	#
WATER			#
AIR			#

LOCATION _____

PHOTODOCUMENTATION

Number	Title	Voucher (Y/N)

BENTHIC HABITAT SAMPLED

- [15] Riffle
- [11] Rootwad/Woody Debris
- [04] Leaf Pack
- [00] Macrophytes
- [14] Undercut Banks
- [02] Other _____

SAMPLING CONSID.: ([ ] NUM. ANODES)

STREAM WIDTH (m): 10 (0 m) | 10 (75 m)

MP043

v. 2009

MBSS SPRING FAUNA DATA SHEET

SITE Watershed Code: MP | Segment: 043 | Type: 2 | Year: 2016

Reviewer: First: JS / Second: DV

HERPETOFAUNA

☐ None Observed

Species	Lifestage (Adult, Juv, Larval, Egg)	SEEN (Y/N)	HEARD (Y/N)	NUMBER RETAINED	NUMBER PHOTOS TAKEN
GREY TREE FROG	☐ ☐ ☐ ☐	N	Y	0	0
	☐ ☐ ☐ ☐	☐	☐	☐	☐
	☐ ☐ ☐ ☐	☐	☐	☐	☐
	☐ ☐ ☐ ☐	☐	☐	☐	☐
	☐ ☐ ☐ ☐	☐	☐	☐	☐
	☐ ☐ ☐ ☐	☐	☐	☐	☐
	☐ ☐ ☐ ☐	☐	☐	☐	☐

MUSSELS

☒ None Observed

Species	LIVE	DEAD	NUMBER RETAINED	NUMBER PHOTOS TAKEN
	☐	☐	☐☐	☐
	☐	☐	☐☐	☐
	☐	☐	☐☐	☐
	☐	☐	☐☐	☐
	☐	☐	☐☐	☐

Corbicula: LIVE ☐ DEAD ☐ NONE ☐

CRAYFISHES

☑ None Observed

Species	NUMBER RETAINED
	☐☐
	☐☐
	☐☐
	☐☐
	☐☐

Crayfish Burrows: P

(Absent, Present, Extensive)

COMMENTS

Physical Habitat Assessment and Water Quality Data Sheet

Site ID: MP43
Subwatershed: LYONS
Length of Reach: 75 **Date:** 4/19
Team Members: SS/DN **Time:** 2:00

Weather
Current: 70's SUNNY
Past 24hrs: PARTLY SUNNY
Past 48hrs: PARTLY SUNNY

Parameter	Down-stream	Mid-stream	Up-stream
Description			
pH	6.66	6.56	6.46
Temperature (°C)	18.24	19.07	19.21
DO (mg/l)	9.91	9.30	9.77
Conductivity (uS/cm)	159	159	159
TDS (mg/l) g/L	.116	116	116
Turbidity (NTU)	5.4	8.2	6.4

Notes: _____

Stream Character

[P] Meandering	[A] Channelized
[A] Braided	[A] Straight
[P] Riffle	[P] Run/Glide
[A] Deep Pool >.5m	[P] Silt/Clay
[P] Shallow Pool <.5m	[P] Sand
[P] Gravel	[P] Cobble
[A] Boulder >2m	[A] Boulder <2m
[A] Concrete/Gabion	[A] Bedrock
[P] Undercut Bank	[P] Rootwad
[P] Overhead Cover	[A] Storm Drain
[A] Effluent Discharge	[P] Human Refuse
[A] Emergent Vegetation	[A] Beaver Pond
[A] Floating Vegetation	

A=Absent P=Present E=Extensive

Bar Formation
[ ] None [ ] Moderate
[✓] Minor [ ] Extensive

Bank Erosion (see guidance sheet)

	Left Bank	Right Bank
Extent (m)	15	5
Severity	2	1
Avg. Height	3'	2'

Severity: 0=none 1=min 2=mod 3=severe

Maximum stream depth (cm) 25

Benthic Habitat Sampled (20 total)

	Sq. ft.
Riffle	11
Rootwad/Woody Debris	4
Leaf Pack	4
Submerged Vegetation	0
Undercut Banks	0
Other: _____	

Rootwads/Woody Debris

# Instream Woody Debris	4
# Dewatered Woody Debris	1
# Instream Rootwads	5
# Dewatered Rootwads	0

Stream Gradient

Location (ft)	Height (ft)	Water Depth (ft)

Photographs/Observations:

MP43 5/7

MBSS Physical Habitat Assessment Sheet

Stream Habitat Assessment Guidance Sheet				
Habitat Parameter	Optimal 16-20	Sub-Optimal 11-15	Marginal 6-10	Poor 0-5
1. Instream Habitat[1] SCORE 12	Greater than 50% of a variety of cobble, boulder, submerged logs, undercut banks, snags, rootwads, aquatic plants or other stable habitat	30-50% of stable habitat. Adequate habitat	10-30% mix of stable habitat. Habitat availability less than desireable	Less than 10% stable habitat. Lack of habitat is obvious
2. Epifaunal Substrate[1] SCORE 13	Preferred substrate abundant, stable, and at full colonization potential (riffles well developed and dominated by cobble; and/or woody debris prevalent, not new, and not transient	Abund. of cobble with gravel and/or boulders common; or woody debris, aquatic veg., undercut banks common but not prevalent/suited for full colonization	Large boulders and/or bedrock prevalent; cobble, woody debris, or other preferred surfaces uncommon	Stable substrate lacking; or particles are over 75% surrounded by fine sediment or flocculent material
3. Velocity/Depth Diversity[2] SCORE 13	Slow (<0.3m/s), deep (>0.5m); slow, shallow (<0.5m); fast (>0.3m/s), deep; fast, shallow habitats all present	Only 3 of the 4 habitat categories present	Only 2 of the 4 habitat categories present	Dominated by 1 velocity/depth category (usually pools)
4. Pool/Glide/Eddy Quality[2] SCORE 10	Complex cover/IL/or depth >1.5m; both deep (>0.5m)/shallows (<0.2m) present	Deep (>0.5m) areas present; but only moderate cover	Shallows (<0.2m) prevalent in pool/glide/eddy habitat; little cover	Max depth <0.2m in pool/glide/eddy habitat; or absent completely
5. Riffle/Run Quality[2] SCORE 11	Riffle/run depth generally >10cm, with maximum depth greater than 50 cm (maximum score); substrate stable (e.g. cobble, boulder) & variety of current velocities	Riffle/run depth generally 5-10cm, variety of current velocities	Riffle/run depth generally 1-5cm; primarily a single current velocity	Riffle/run depth <1cm; or riffle/run substrates concreted
6. Bank Stability[3] (facing downstream.) Score each bank LB SCORE 7 RB SCORE 7	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected. 10 9	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion. 8 7 6	Moderately unstable; 30-60% of bank in reach as areas of erosion; high erosion potential during floods. 5 4 3	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars. 2 1 0
7. Embeddedness SCORE 80 %	Percentage that gravel, cobble, and boulder particles are surrounded by fine sediment or flocculent material			
8. Shading SCORE 95 %	Percentage of segment that is shaded (duration is considered in scoring). 0% = fully exposed to sunlight all day in summer, 100% = fully and densely shaded all day in summer			
9. Riparian Buffer Zone Width (m)[4] LB 50 RB 50	Zone width in which human activity is not evident. 50m (164ft) is the maximum recorded value.			
10. Remoteness SCORE 14	Roads greater than 400 meters (0.25 mi) from stream	Roads within 400 meters (0.25 mi) of stream; stream NOT accessible by trail.	Roads within 400 meters (0.25 mi) of stream; stream accessible by trail.	Roads adjacent to stream.
11. Aesthetic (trash) Rating[4] SCORE 15	Little or no human refuse visible from stream channel or riparian zone	Refuse present in minor amounts	Refuse present in moderate amounts	Refuse abundant and unsightly
12. Number of Woody Debris and Rootwads[4] SCORE 9	Count only woody debris and rootwads within the wetted portion of the sampling segment. Count only woody debris >10cm (4in) diameter and >1.5m (5ft) long and rootwads with trunk diameter (at chest height) >15cm (6in) that are functional habitat within the wetted portion of the stream.			

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS

6/7

STREAM NAME MP43	LOCATION Lothian
STATION # _____ REACH ID# _____	STREAM CLASS 2
UTM N _____ UTM E	RIVER BASIN MP
STORET #	AGENCY Century
INVESTIGATORS JS/DV	
FORM COMPLETED BY DV	DATE 4/19 TIME 2 (PM)
REASON FOR SURVEY BMI	

Parameters to be evaluated in sampling reach

Habitat Parameter	Condition Category			
	Optimal	Suboptimal	Marginal	Poor
1. Epifaunal Substrate/ Available Cover	Greater than 50% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient).	30-50% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale).	10-30% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 10% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
SCORE 12	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
2. Pool Substrate Characterization	Mixture of substrate materials, with gravel and firm sand prevalent; root mats and submerged vegetation common.	Mixture of soft sand, mud, or clay; mud may be dominant; some root mats and submerged vegetation present.	All mud or clay or sand bottom; little or no root mat; no submerged vegetation.	Hard-pan clay or bedrock; no root mat or vegetation.
SCORE 16	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
3. Pool Variability	Even mix of large-shallow, large-deep, small-shallow, small-deep pools present.	Majority of pools large-deep; very few shallow.	Shallow pools much more prevalent than deep pools.	Majority of pools small-shallow or pools absent.
SCORE 9	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
4. Sediment Deposition	Little or no enlargement of islands or point bars and less than <20% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 20-50% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 50-80% of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; more than 80% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
SCORE 13	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
5. Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills >75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
SCORE 12	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0

MP43 7/7

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS

Parameters to be evaluated broader than sampling reach

Habitat Parameter	Condition Category			
	Optimal	Suboptimal	Marginal	Poor
6. Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr) may be present, but recent channelization is not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.
SCORE 17	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
7. Channel Sinuosity	The bends in the stream increase the stream length 3 to 4 times longer than if it was in a straight line. (Note - channel braiding is considered normal in coastal plains and other low-lying areas. This parameter is not easily rated in these areas.)	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	Channel straight; waterway has been channelized for a long distance.
SCORE 13	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
8. Bank Stability (score each bank)	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.
SCORE 7 (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE 7 (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0
9. Vegetative Protection (score each bank) Note: determine left or right side by facing downstream.	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
SCORE 6 (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE 7 (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0
10. Riparian Vegetative Zone Width (score each bank riparian zone)	Width of riparian zone >18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone.	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6-12 meters; human activities have impacted zone a great deal.	Width of riparian zone <6 meters: little or no riparian vegetation due to human activities.
SCORE 10 (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE 10 (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0

Total Score 140

Form # EL2 - _____

v. 2009

MBSS SPRING HABITAT DATA SHEET

Page 1 of 7

SITE Watershed Code: MP | Segment: 44 | Type: 2 | Year: 2016

Reviewer: First: JT / Second: CR

DATE: Year: 16 | Month: 04 | Day: 11

900 Dist. from Nearest Road to Site (m)

16 Trash Rating 0 - 20

LANDUSE (Y/N)

N	Old Field	N	Residential
Y	Deciduous Forest	N	Commercial/Industrial
N	Coniferous Forest	N	Cropland
N	Wetland	N	Pasture
N	Surface Mine	N	Orchard/Vineyard/Nursery
N	Landfill	N	Golf Course

RIPARIAN VEGETATION
(facing upstream)

	LEFT BANK	RIGHT BANK
Width (50m max)	50	50
Adjacent Land Cover	OF	FR
Vegetation Type	GRY	RYMO
Buffer Breaks (Y/N)	N	N

ROAD CULVERT

Present in Segment (Y/N): N

Sampleable? (Y/N):

Width of Culvert (m):

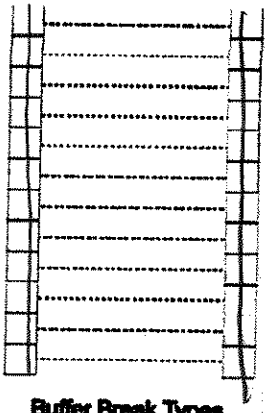
Length of Culvert (m):

STREAM GRADIENT

	Position (m)	Height (m)
1		
2		
3		

Buffer Breaks

	LEFT BANK	RIGHT BANK
Storm Drain		
Tile Drain		
Impervious Drainage		
Gully		
Orchard		
Crop		
Pasture		
New Construction		
Dirt Road		
Gravel Road		
Raw Sewage		
Railroad		



Buffer Break Types
(M = minor; S = severe)

CHANNELIZATION

N Evidence of Channel Straightening or Dredging (Y/N)

TYPE	EXTENT (m) N/A		
	LEFT BANK	BOTTOM	RIGHT BANK
Concrete			
Gabion			
Rip-Rap			
Earthen Berm		N/A	
Dredge Spoil Off Channel		N/A	
Pipe Culvert			

Actual Coordinates
(If >30m distance between original coordinates and stream)

Lat

Lon

Stream Block Ht. (m)

Stream Block Type

Lat

Lon

v. 2009

MBSS SPRING INDEX PERIOD DATA SHEET

SITE (Watershed Code / Segment / Type / Year): MP / 44 / 2 / 2016

Reviewer (First / Second): CR / JT

DATE (Year / Month / Day): 16 / 04 / 11

CREW: CR/JT

STREAM: MP 44

TIME: 1242 (Military)

LOCALITY: Lothian, MD

SAMPLEABILITY

- [Y] Benthos
- [Y] Habitat Assessment
- [Y] Water Quality
- [N] Vernal Pool [A] (PRESENT/ABSENT)

OTHER (SPECIFY): N/A

SITE ACCESS ROUTE

Park 2 cul-de-sac and walk through field to site

SAMPLE LABELS

Verified by: CR

QC LABEL

Watershed Code: MP | Segment: 44 | Type: | Year: 2016

(Letters only)

Dup. (D) or Blank (B): | Verified by:

TEMP. LOGGER

	(Y/N)	(TIME - Military)	#
WATER			#
AIR			#

LOCATION

PHOTODOCUMENTATION

Number	Title	Voucher (Y/N)
	Midpoint US/DS	
	Upstream US/DS	
	Downstream US/DS	
	Wood frog	
	Pickerel Frog	
	juvenile fish	

BENTHIC HABITAT SAMPLED

06	Riffle 46	06	Leaf Pack 46	03	Undercut Banks 3
05	Rootwad/Woody Debris 45		Macrophytes		Other

SAMPLING CONSID.: (1 NUM. ANODES)

STREAM WIDTH (m): 0 m 06 | 75 m 06

v. 2009

MBSS SPRING FAUNA DATA SHEET

SITE Watershed Code MP | Segment 44 | Type 1 | Year 2016

Reviewer: First JT / Second CR

HERPETOFAUNA

☐ None Observed

Species	Lifestage (Adult, Juv, Larval, Egg)	SEEN (Y/N)	HEARD (Y/N)	NUMBER RETAINED	NUMBER PHOTOS TAKEN
Wood frog	Juv	Y		Ø	2
Pickerel frog	Juv	Y		Ø	1
fish (unidentified)	Juv	Y		Ø	1

MUSSELS

☒ None Observed

Species	LIVE	DEAD	NUMBER RETAINED	NUMBER PHOTOS TAKEN

Corbicula: LIVE ☐ DEAD ☐ NONE ☒

CRAYFISHES

☒ None Observed

Species	NUMBER RETAINED
~~juvenile observed, not retained~~	

Crayfish Burrows ☒ (Absent, Present, Extensive)

COMMENTS no burrows observed but juveniles retained

Physical Habitat Assessment and Water Quality Data Sheet

Site ID: MP44
Subwatershed: Lyons Creek 9
Length of Reach: 75m **Date:** 4/11/16
Team Members: CB/JT **Time:** 13:00

Weather
Current: cloudy ~50F
Past 24hrs: clear, cold
Past 48hrs: some rain, clear

Parameter	Down-stream	Mid-stream	Up-stream
Description			
pH	6.06	6.25	6.06
Temperature (°C)	12.3	12.9	13.2
DO (mg/l)	9.39	9.69	9.52
Conductivity (uS/cm)	111.6	106.6	112.2
TDS (mg/l)	95.55	92.95	94.25
Turbidity (NTU)	28.4	5.04	4.55

Notes: Barometer = 763.5 mm Hg

Stream Character

[E] Meandering	[E] Channelized	
[A] Braided	[A] Straight	
[P] Riffle	[P] Run/Glide	
[A] Deep Pool >.5m	[P] Silt/Clay	
[P] Shallow Pool <.5m	[A] Sand	
[P] Gravel	[P] Cobble	
[A] Boulder >2m	[A] Boulder <2m	
[A] Concrete/Gabion	[A] Bedrock	
[P] Undercut Bank	[P] Rootwad	
[P] Overhead Cover	[A] Storm Drain	
[A] Effluent Discharge	[A] Human Refuse	
[P] Emergent Vegetation	[A] Beaver Pond	
[A] Floating Vegetation		

A=Absent P=Present E=Extensive

Bar Formation
[ ] None [X] Moderate
[X] Minor [ ] Extensive

Bank Erosion (see guidance sheet)

	Left Bank	Right Bank
Extent (m)	35	35
Severity	1	1
Avg. Height	60cm	60cm

Severity: 0=none 1=min 2=mod 3=severe

Maximum stream depth (cm): 45 cm

Benthic Habitat Sampled (20 total)

	Sq. ft.
Riffle	6
Rootwad/Woody Debris	5
Leaf Pack	6
Submerged Vegetation	0
Undercut Banks	3
Other: N/A	0

Rootwads/Woody Debris

# Instream Woody Debris	4
# Dewatered Woody Debris	0
# Instream Rootwads	3
# Dewatered Rootwads	3

Stream Gradient

Location (ft)	Height (ft)	Water Depth (ft)

Photographs/Observations:
Pics of wood frog + pickerel frog
Pics of invertebrates
Midpoint US/DS pics
Upstream US/DS pics
Downstream US/DS pics

MBSS Physical Habitat Assessment Sheet

Stream Habitat Assessment Guidance Sheet				
Habitat Parameter	Optimal 16-20	Sub-Optimal 11-15	Marginal 6-10	Poor 0-5
1. Instream Habitat[a] SCORE 11	Greater than 50% of a variety of cobble, boulder, submerged logs, undercut banks, snags, rootwads, aquatic plants or other stable habitat	30-50% of stable habitat. Adequate habitat	10-30% mix of stable habitat. Habitat availability less than desireable	Less than 10% stable habitat. Lack of habitat is obvious
2. Epifaunal Substrate[a] SCORE 11	Preferred substrate abundant, stable, and at full colonization potential (riffles well developed and dominated by cobble; and/or woody debris prevalent, not new, and not transient	Abund. of cobble with gravel and/or boulders common; or woody debris, aquatic veg., undercut banks common but not prevalent/suited for full colonization	Large boulders and/or bedrock prevalent; cobble, woody debris, or other preferred surfaces uncommon	Stable substrate lacking; or particles are over 75% surrounded by fine sediment or flocculent material
3. Velocity/Depth Diversity[a] SCORE 10	Slow (<0.3m/s), deep (>0.5m); slow, shallow (<0.5m); fast (>0.3m/s), deep; fast, shallow habitats all present	Only 3 of the 4 habitat categories present	Only 2 of the 4 habitat categories present	Dominated by 1 velocity/depth category (usually pools)
4. Pool/Glide/Eddy Quality[a] SCORE 10	Complex cover/& /or depth >1.5m; both deep (>0.5m)/shallows (<0.2m) present	Deep (>0.5m) areas present; but only moderate cover	Shallows (<0.2m) prevalent in pool/glide/eddy habitat; little cover	Max depth <0.2m in pool/glide/eddy habitat; or absent completely
5. Riffle/Run Quality[a] SCORE 9	Riffle/run depth generally >10cm, with maximum depth greater than 50 cm (maximum score); substrate stable (e.g. cobble, boulder) & variety of current velocities	Riffle/run depth generally 5-10cm, variety of current velocities	Riffle/run depth generally 1-5cm; primarily a single current velocity	Riffle/run depth <1cm; or riffle/run substrates concreted
6. Bank Stability[a] (facing downstream.) Score each bank LB SCORE 5 RB SCORE 5	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected. 10 9	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion. 8 7 6	Moderately unstable; 30-60% of bank in reach as areas of erosion; high erosion potential during floods. 5 4 3	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars. 2 1 0
7. Embeddedness SCORE 50 %	Percentage that gravel, cobble, and boulder particles are surrounded by fine sediment or flocculent material			
8. Shading SCORE 75 %	Percentage of segment that is shaded (duration is considered in scoring). 0% = fully exposed to sunlight all day in summer; 100% = fully and densely shaded all day in summer			
9. Riparian Buffer Zone Width (m)[a] LB 50 RB 50	Zone width in which human activity is not evident. 50m (164ft) is the maximum recorded value.			
10. Remoteness[a] SCORE 10	Roads greater than 400 meters (0.25 mi) from stream	Roads within 400 meters (0.25 mi) of stream; stream NOT accessible by trail	Roads within 400 meters (0.25 mi) of stream; stream accessible by trail	Roads adjacent to stream.
11. Aesthetic (trash) Rating[a] SCORE 16	Little or no human refuse visible from stream channel or riparian zone	Refuse present in minor amounts	Refuse present in moderate amounts	Refuse abundant and unsightly
12. Number of Woody Debris and Rootwads[a] SCORE 7	Count only woody debris and rootwads within the wetted portion of the sampling segment. Count only woody debris >10cm (4in) diameter and >1.5m (5ft) long and rootwads with trunk diameter (at chest height) >15cm (6in) that are functional habitat within the wetted portion of the stream.			

PARTIAL PATH OF CUL DE SAC

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS

STREAM NAME MP44		LOCATION Lothian MD	
STATION #	REACH ID#	STREAM CLASS PERENNIAL	
UTM N	UTM E	RIVER BASIN Patuxent River	
STORET #		AGENCY CBI	
INVESTIGATORS CR JT			
FORM COMPLETED BY JT	DATE 4/11/16 TIME 1:00 (PM)	REASON FOR SURVEY MBSS	

Parameters to be evaluated in sampling reach

Habitat Parameter	Condition Category			
	Optimal	Suboptimal	Marginal	Poor
1. Epifaunal Substrate/ Available Cover	Greater than 50% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient).	30-50% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale).	10-30% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 10% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
SCORE 11	20 19 18 17 16	15 14 13 12 (11)	10 9 8 7 6	5 4 3 2 1 0
2. Pool Substrate Characterization	Mixture of substrate materials, with gravel and firm sand prevalent; root mats and submerged vegetation common.	Mixture of soft sand, mud, or clay; mud may be dominant; some root mats and submerged vegetation present.	All mud or clay or sand bottom; little or no root mat; no submerged vegetation.	Hard-pan clay or bedrock; no root mat or vegetation.
SCORE 10	20 19 18 17 16	15 14 13 12 11	(10) 9 8 7 6	5 4 3 2 1 0
3. Pool Variability	Even mix of large-shallow, large-deep, small-shallow, small-deep pools present.	Majority of pools large-deep; very few shallow.	Shallow pools much more prevalent than deep pools.	Majority of pools small-shallow or pools absent.
SCORE 8	20 19 18 17 16	15 14 13 12 11	10 9 (8) 7 6	5 4 3 2 1 0
4. Sediment Deposition	Little or no enlargement of islands or point bars and less than <20% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 20-50% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 50-80% of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; more than 80% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
SCORE 13	20 19 18 17 16	15 14 (13) 12 11	10 9 8 7 6	5 4 3 2 1 0
5. Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills >75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
SCORE 8	20 19 18 17 16	15 14 13 12 11	10 9 (8) 7 6	5 4 3 2 1 0

50

Form # EL - _____

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS

Parameters to be evaluated broader than sampling reach

Habitat Parameter	Condition Category			
	Optimal	Suboptimal	Marginal	Poor
6. Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr) may be present, but recent channelization is not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.
SCORE 20	(20) 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
7. Channel Sinuosity	The bends in the stream increase the stream length 3 to 4 times longer than if it was in a straight line. (Note - channel braiding is considered normal in coastal plains and other low-lying areas. This parameter is not easily rated in these areas.)	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	Channel straight; waterway has been channelized for a long distance.
SCORE 16	20 19 18 17 (16)	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
8. Bank Stability (score each bank)	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.
SCORE 5 (LB)	**Left Bank** 10 9	8 7 6	(5) 4 3	2 1 0
SCORE 5 (RB)	**Right Bank** 10 9	8 7 6	(5) 4 3	2 1 0
9. Vegetative Protection (score each bank) Note: determine left or right side by facing downstream.	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
SCORE 5 (LB)	**Left Bank** 10 9	8 7 6	(5) 4 3	2 1 0
SCORE 5 (RB)	**Right Bank** 10 9	8 7 6	(5) 4 3	2 1 0
10. Riparian Vegetative Zone Width (score each bank riparian zone)	Width of riparian zone >18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone.	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6-12 meters; human activities have impacted zone a great deal.	Width of riparian zone <6 meters: little or no riparian vegetation due to human activities.
SCORE 10 (LB)	**Left Bank** (10) 9	8 7 6	5 4 3	2 1 0
SCORE 10 (RB)	**Right Bank** (10) 9	8 7 6	5 4 3	2 1 0

76

Total Score 126

v. 2009 MP48

MBSS SPRING HABITAT DATA SHEET

Page 1 of 7

SITE Watershed Code: MP | Segment: 048 | Type: 2 | Year: 2016

Reviewer: First: EW / Second: CR

DATE Year: 16 | Month: 04 | Day: 20

25 Dist. from Nearest Road to Site (m)

08 Trash Rating 0 - 20

LANDUSE (Y/N)

	Old Field	Y	Residential
SC	Deciduous Forest		Commercial/Industrial
	Coniferous Forest		Cropland
	Wetland		Pasture
	Surface Mine		Orchard/Vineyard/Nursery
	Landfill		Golf Course

ROAD CULVERT

Present in Segment (Y/N): N

Sampleable? (Y/N):

Width of Culvert (m):

Length of Culvert (m):

footbridge immediately US of reach

STREAM GRADIENT

	Location (m)	Height (m)
1		
2		
3		

RIPARIAN VEGETATION
(facing upstream)

	LEFT BANK	RIGHT BANK
Width (50m max)	SD	SO
Adjacent Land Cover	FR	LN
Vegetation Type	YMRL	YRGL
Buffer Breaks (Y/N)	N	Y

	LEFT BANK	RIGHT BANK
Storm Drain		
Tile Drain		
Impervious Drainage		
Gully		
Orchard		
Crop		
Pasture		
New Construction		
Dirt Road		
Gravel Road		M
Raw Sewage		
Railroad		

Buffer Break Types
(M = minor; S = severe)

CHANNELIZATION

N Evidence of Channel Straightening or Dredging (Y/N)

TYPE	EXTENT (m)		
	LEFT BANK	BOTTOM	RIGHT BANK
Concrete			
Gebion			
Rip-Rap			
Earthen Berm		N/A	
Dredge Spoil Off Channel		N/A	
Pipe Culvert			

Culvert US of Reach

Actual Coordinates
(If >30m distance between original coordinates and stream)

Lat 38.759235

Lon -76.598509

Stream Block Ht. (m)

Stream Block Type

Lat

Lon

v. 2009

MBSS SPRING INDEX PERIOD DATA SHEET

Page 2 of 7

SITE: Watershed Code [ ][ ][M][P] Segment [0][4][8] Type [2] Year [2][0][1][6]

Reviewer: First EW / Second CR

DATE: Year [1][6] Month [0][4] Day [2][0]

CREW: EW/CR

STREAM: Lyons creek Unnamed trib 2 order

TIME: [1][4][5][4] (Military)

LOCALITY:

SAMPLEABILITY

- [Y] Benthos
- [Y] Habitat Assessment
- [Y] Water Quality
- [N] Vernal Pool [ ] (PRESENT/ABSENT)

OTHER (SPECIFY)

SITE ACCESS ROUTE

SAMPLE LABELS

Verified by: EW

QC LABEL

Watershed Code [ ][ ][M][P] Segment [0][4][8] (Letters only) Type [ ] Year [2][0][1][6]

Dup. (D) or Blank (B): [ ] Verified by:

TEMP. LOGGER

	(Y/N)	(TIME - Military)		
WATER	[Y]	[1][4][5][4]	#	[3]
AIR	[X]	[ ][ ][ ][ ]	#	[ ][ ][ ][ ][ ][ ][ ]

LOCATION: US/mid/DS

PHOTODOCUMENTATION

Number	Title	Voucher (Y/N)
[ ][ ][ ][ ]		
[ ][ ][ ][ ]		
[ ][ ][ ][ ]		
[ ][ ][ ][ ]		
[ ][ ][ ][ ]		
[ ][ ][ ][ ]		
[ ][ ][ ][ ]		
[ ][ ][ ][ ]		

BENTHIC HABITAT SAMPLED

- [1][6] Riffle
- [1][2] Rootwad/Woody Debris
- [ ][2] Leaf Pack
- [ ][ ] Macrophytes
- [ ][ ] Undercut Banks
- [ ][ ] Other

SAMPLING CONSID.: ([X] NUM. ANODES)

STREAM WIDTH (m): [ ][ ][0][9] 0 m [ ][ ][1][4] 75 m

v. 2009

MBSS SPRING FAUNA DATA SHEET

SITE Watershed Code [ ][ ][M][P] Segment [0][4][8] Type [ ] Year [2][0][1][6]

Reviewer: First EW / Second CR

HERPETOFAUNA

☐ None Observed

Species	Lifestage: Adult	Juv.	Larval	Egg	SEEN (Y/N)	HEARD (Y/N)	NUMBER RETAINED	NUMBER PHOTOS TAKEN
7 small gray frog	☐	☒	☐	☐	Y	Y	☐	1
	☐	☐	☐	☐	☐	☐	☐	☐
	☐	☐	☐	☐	☐	☐	☐	☐
	☐	☐	☐	☐	☐	☐	☐	☐
	☐	☐	☐	☐	☐	☐	☐	☐
	☐	☐	☐	☐	☐	☐	☐	☐
	☐	☐	☐	☐	☐	☐	☐	☐

MUSSELS

☒ None Observed

Species	LIVE	DEAD	NUMBER RETAINED	NUMBER PHOTOS TAKEN
	☐	☐	☐☐	☐
	☐	☐	☐☐	☐
	☐	☐	☐☐	☐
	☐	☐	☐☐	☐
	☐	☐	☐☐	☐

Corbicula LIVE ☐ DEAD ☐ NONE ☐

CRAYFISHES

☒ None Observed

Species	NUMBER RETAINED
	☐☐
	☐☐
	☐☐
	☐☐
	☐☐

Crayfish Burrows [P]
(Absent, Present, Extensive)

COMMENTS

Physical Habitat Assessment and Water Quality Data Sheet

Site ID: MP48
Subwatershed: Lyons Creek 7
Length of Reach: 73m **Date:** 4/20/11a
Team Members: EW/CR **Time:** 2:45?

Weather
Current: Sunny 70°F
Past 24hrs: Sunny
Past 48hrs: ↓

Stream Character

P Meandering	A Channelized
A Braided	A Straight
P Riffle	P Run/Glide
A Deep Pool >.5m	P Silt/Clay
→ P Shallow Pool <.5m	E Sand
P Gravel	A Cobble
A Boulder >2m	A Boulder <2m
A Concrete/Gabion	A Bedrock
P Undercut Bank	P Rootwad
P Overhead Cover	A Storm Drain
A Effluent Discharge	P Human Refuse
A Emergent Vegetation	A Beaver Pond
A Floating Vegetation	

A=Absent P=Present E=Extensive

Parameter	Down-stream	Mid-stream	Up-stream
Description			
pH	6.99	7.06	7.35
Temperature (°C)	17.77	17.66	17.50
DO (mg/l)	10.28	10.12	10.37
Conductivity (uS/cm)	256	261	260
TDS (mg/l)	193	198	197
Turbidity (NTU)	66.9	17.8	11

Notes:

Bar Formation
☐ None ☒ Moderate
☐ Minor ☐ Extensive

Bank Erosion (see guidance sheet)

	Left Bank	Right Bank
Extent (m)	25	20
Severity	2	2
Avg. Height	4'	3.5'

Severity: 0=none 1=min 2=mod 3=severe

Maximum stream depth (cm) 15.24

Benthic Habitat Sampled (20 total)

	Sq. ft.
Riffle	0
Rootwad/Woody Debris	12
Leaf Pack	2
Submerged Vegetation	2
Undercut Banks	2
Other:	2

Rootwads/Woody Debris

# Instream Woody Debris	4
# Dewatered Woody Debris	4
# Instream Rootwads	3
# Dewatered Rootwads	6

Stream Gradient

Location (ft)	Height (ft)	Water Depth (ft)

Photographs/Observations:
US/DS US end
Flag
US/DS Mid
US/DS Lower
Tall pole

MBSS Physical Habitat Assessment Sheet

Stream Habitat Assessment Guidance Sheet

Habitat Parameter	Optima: 16-20	Sub-Optimal 11-15	Marginal 6-10	Poor 0-5
1. Instream Habitat* SCORE 6	Greater than 50% of a variety of cobble, boulder, submerged logs, undercut banks, snags, rootwads, aquatic plants or other stable habitat	30-50% of stable habitat. Adequate habitat	10-30% mix of stable habitat. Habitat availability less than desireable	Less than 10% stable habitat. Lack of habitat is obvious
2. Epifaunal Substrate* SCORE 5	Preferred substrate abundant, stable, and at full colonization potential (riffles wet developed and dominated by cobble; and/or woody debris prevalent, not new, and not transient	Abund. of cobble with gravel and/or boulders common; or woody debris, aquatic veg., undercut banks common but not prevalent/suited for full colonization	Large boulders and/or bedrock prevalent; cobble, woody debris, or other preferred surfaces uncommon	Stable substrate lacking; or particles are over 75% surrounded by fine sediment or flocculent material
3. Velocity/Depth Diversity* SCORE 6	Slow (<0.3m/s), deep (>0.5m); slow, shallow (<0.5m); fast (>0.3m/s), deep; fast, shallow habitats all present	Only 3 of the 4 habitat categories present	Only 2 of the 4 habitat categories present	Dominated by 1 velocity/depth category (usually pools)
4. Pool/Glide/Eddy Quality* SCORE 5	Complex cover/&/or depth >1.5m; both deep (>0.5m)/shallows (<0.2m) present	Deep (>0.5m) areas present; but only moderate cover	Shallows (<0.2m) prevalent in pool/glide/eddy habitat; little cover	Max depth <0.2m in pool/glide/eddy habitat; or absent completely
5. Riffle/Run Quality* SCORE 8	Riffle/run depth generally >10cm, with maximum depth greater than 50 cm (maximum score); substrate stable (e.g. cobble, boulder) & variety of current velocities	Riffle/run depth generally 5-10cm, variety of current velocities	Riffle/run depth generally 1-5cm; primarily a single current velocity	Riffle/run depth <1cm; or riffle/run substrates concreted
6. Bank Stability* (facing downstream.) Score each bank. LB SCORE 6 RB SCORE 6	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected. 10 9	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion. 8 7 6	Moderately unstable; 30-60% of bank in reach as areas of erosion; high erosion potential during floods. 5 4 3	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars. 2 1 0
7. Embeddedness SCORE 90 %	Percentage that gravel, cobble, and boulder particles are surrounded by fine sediment or flocculent material			
8. Shading SCORE 80 %	Percentage of segment that is shaded (duration is considered in scoring). 0% = fully exposed to sunlight all day in summer; 100% = fully and densely shaded all day in summer			
9. Riparian Buffer Zone Width (m)* LB 50 RB 50	Zone width in which human activity is not evident. 50m (164ft) is the maximum recorded value.			
10. Remoteness SCORE 2	Roads greater than 400 meters (0.25 mi) from stream	Roads within 400 meters (0.25 mi) of stream; stream NOT accessible by trail.	Roads within 400 meters (0.25 mi) of stream; stream accessible by trail.	Roads adjacent to stream.
11. Aesthetic (trash) Rating* SCORE 6	Little or no human refuse visible from stream channel or riparian zone	Refuse present in minor amounts	Refuse present in moderate amounts	Refuse abundant and unsightly
12. Number of Woody Debris and Rootwads* SCORE 7	Count only woody debris and rootwads within the wetted portion of the sampling segment. Count only woody debris >10cm (4in) diameter and >1.5m (5ft) long and rootwads with trunk diameter (at chest height) >15cm (6in) that are functional habitat within the wetted portion of the stream.			

MP4B

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS

STREAM NAME	Unnamed trib to LC	LOCATION	MA Co.
STATION #	REACH ID#	STREAM CLASS	2nd / PERENNIAL
UTM N	UTM E	RIVER BASIN	MP
STORET #		AGENCY	CEI
INVESTIGATORS	EW/CR		
FORM COMPLETED BY	EW	DATE 4/20/16 TIME 2:54 PM	REASON FOR SURVEY BMI SAMPLING

Parameters to be evaluated in sampling reach

Habitat Parameter	Condition Category			
	Optimal	Suboptimal	Marginal	Poor
1. Epifaunal Substrate/ Available Cover	Greater than 50% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient).	30-50% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale).	10-30% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 10% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
SCORE 8	20 19 18 17 16	15 14 13 12 11	10 9 (8) 7 6	5 4 3 2 1 0
2. Pool Substrate Characterization	Mixture of substrate materials, with gravel and firm sand prevalent; root mats and submerged vegetation common.	Mixture of soft sand, mud, or clay; mud may be dominant; some root mats and submerged vegetation present.	All mud or clay or sand bottom; little or no root mat; no submerged vegetation.	Hard-pan clay or bedrock; no root mat or vegetation.
SCORE 7	20 19 18 17 16	15 14 13 12 11	10 9 8 (7) 6	5 4 3 2 1 0
3. Pool Variability	Even mix of large-shallow, large-deep, small-shallow, small-deep pools present.	Majority of pools large-deep; very few shallow.	Shallow pools much more prevalent than deep pools.	Majority of pools small-shallow or pools absent.
SCORE 2	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 (2) 1 0
4. Sediment Deposition	Little or no enlargement of islands or point bars and less than <20% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 20-50% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 50-80% of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; more than 80% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
SCORE 6	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
5. Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills >75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
SCORE 16	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0

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HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS

Parameters to be evaluated broader than sampling reach

Habitat Parameter	Condition Category			
	Optimal	Suboptimal	Marginal	Poor
6. Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr) may be present, but recent channelization is not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.
SCORE 15	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
7. Channel Sinuosity	The bends in the stream increase the stream length 3 to 4 times longer than if it was in a straight line. (Note - channel braiding is considered normal in coastal plains and other low-lying areas. This parameter is not easily rated in these areas.)	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	Channel straight; waterway has been channelized for a long distance.
SCORE 17	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
8. Bank Stability (score each bank)	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.
SCORE 7 (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE 7 (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0
9. Vegetative Protection (score each bank) Note: determine left or right side by facing downstream.	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
SCORE 6 (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE 7 (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0
10. Riparian Vegetative Zone Width (score each bank riparian zone)	Width of riparian zone >18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone.	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6-12 meters; human activities have impacted zone a great deal.	Width of riparian zone <6 meters: little or no riparian vegetation due to human activities.
SCORE 9 (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE 9 (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0

75

Total Score 114

Form # EL2 - _____

v. 2009

MBSS SPRING HABITAT DATA SHEET

Page 1 of 2

SITE Watershed Code: MP | Segment: 50 | Type: | Year: 2016

Reviewer: First: JS / Second: CR

DATE Year: 16 | Month: 04 | Day: 18

100 Dist. from Nearest Road to Site (m)

14 Trash Rating 0 - 20

LANDUSE (Y/N)

Y	Old Field	Y	Residential
Y	Deciduous Forest	N	Commercial/Industrial
N	Coniferous Forest	N	Cropland
N	Wetland	N	Pasture
N	Surface Mine	N	Orchard/Vineyard/Nursery
N	Landfill	N	Golf Course

RIPARIAN VEGETATION
(facing upstream)

	LEFT BANK	RIGHT BANK
Width (50m max)	50	50
Adjacent Land Cover	LN	LN
Vegetation Type	MYLG	MYLG

Buffer Breaks (Y/N): LEFT BANK: Y | RIGHT BANK: N

ROAD CULVERT

Present in Segment (Y/N): N

Sampleable? (Y/N):

Width of Culvert (m):

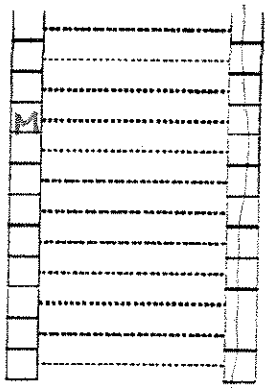
Length of Culvert (m):

STREAM GRADIENT

	Elevation (m)	Height (m)
1		
2		
3		

LEFT BANK / RIGHT BANK

Storm Drain
Tile Drain
Impervious Drainage
Gully
Orchard
Crop
Pasture
New Construction
Dirt Road
Gravel Road
Raw Sewage
Railroad



Buffer Break Types
(M = minor; S = severe)

CHANNELIZATION

N Evidence of Channel Straightening or Dredging (Y/N)

TYPE	EXTENT (m) LEFT BANK	BOTTOM	RIGHT BANK
Concrete			
Gebion			
Rip-Rap			
Earthen Berm		N/A	
Dredge Spoil Off Channel		N/A	
Pipe Culvert			

Actual Coordinates
(If >30m distance between original coordinates and stream)

Lat:

Lon:

Stream Block Ht. (m):

Stream Block Type:

Lat:

Lon:

v. 2009

MBSS SPRING INDEX PERIOD DATA SHEET

SITE (Watershed Code) MP (Segment) 50 (Type) (Year) 2016

Reviewer: (First) JS / (Second) CR

DATE (Year) 16 (Month) 04 (Day) 18

CREW: JOSEPH SMITH | CARISSA REED

STREAM: MPSO

TIME 1110 (Military)

LOCALITY: AA Co. MD

SAMPLEABILITY

- [Y] Benthos
- [Y] Habitat Assessment
- [Y] Water Quality
- [N] Vernal Pool [A] (PRESENT/ABSENT)

OTHER (SPECIFY): N/A

SITE ACCESS ROUTE

PARK ALONG

SITE IS 100m UPSTREAM FROM ROAD

SAMPLE LABELS

Verified by: CR

QC LABEL

(Watershed Code) MP (Segment) S0 (Letters only) (Type) 2 (Year) 2016

Dup. (D) or Blank (B): [ ] Verified by: _____

TEMP. LOGGER

N/A

	(Y/N)	(TIME - Military)	#
WATER			#
AIR			#

LOCATION _____

PHOTODOCUMENTATION

Number	Title	Voucher (Y/N)
	MP - US, DS	
	US - US, DS	
	DS - US, DS	
	OVERVIEW - LB/RB	

BENTHIC HABITAT SAMPLED

02	Riffle	14	Leaf Pack	03	Undercut Banks
01	Rootwad/Woody Debris		Macrophytes		Other _____

SAMPLING CONSID.: (1 NUM. ANODES) _____

STREAM WIDTH (m): 0 m 09 | 75 m 14

v. 2009

MBSS SPRING FAUNA DATA SHEET

SITE Watershed Code: MP | Segment: S0 | Type: | Year: 2016

Reviewer: First: JS / Second: CR

HERPETOFAUNA

☐ None Observed

Species	Lifestage (Adult, Juv., Larval, Egg)	SEEN (Y/N)	HEARD (Y/N)	NUMBER RETAINED	NUMBER PHOTOS TAKEN
2 NORTHERN 2-LINED SALAMANDER	Juv.	☒	☐	0	0
		☐	☐		
		☐	☐		
		☐	☐		
		☐	☐		
		☐	☐		
		☐	☐		

MUSSELS

☒ None Observed

Species	LIVE	DEAD	NUMBER RETAINED	NUMBER PHOTOS TAKEN
	☐	☐		
	☐	☐		
	☐	☐		
	☐	☐		
	☐	☐		

Corbicula: LIVE ☐ DEAD ☐ NONE ☒

CRAYFISHES

☒ None Observed

Species	NUMBER RETAINED

Crayfish Burrows: A

(Absent, Present, Extensive)

COMMENTS

SHARK TOOTH FOUND

Physical Habitat Assessment and Water Quality Data Sheet

Site ID: MPSQ
Subwatershed: Lyons Creek 8
Length of Reach: 75m **Date:** 4/18/16
Team Members: TS/CF **Time:** 11:10 AM

Weather
Current: SUNNY 65° F
Past 24hrs: SUNNY 65° F
Past 48hrs: SUNNY 60° F

Stream Character

P Meandering	A Channelized
A Braided	P Straight
P Riffle	P Run/Glide
A Deep Pool >.5m	P Silt/Clay
P Shallow Pool <.5m	P Sand
P Gravel	A Cobble
A Boulder >2m	A Boulder <2m
A Concrete/Gabion	A Bedrock
P Undercut Bank	P Rootwad
A Overhead Cover	A Storm Drain
A Effluent Discharge	P Human Refuse
A Emergent Vegetation	A Beaver Pond
A Floating Vegetation	

A=Absent P=Present E=Extensive

Parameter	Down-stream	Mid-stream	Up-stream
Description			
pH	7.63	7.02	7.85
Temperature (°C)	14.57	14.51	14.48
DO (mg/l)	12.99	13.7	12.71
Conductivity (uS/cm)	272	240	286
TDS (mg/l)	221	221	227
Turbidity (NTU)	10.4	1.1	2.0
Notes: BARO mmHg	768.3	768.6	PH=7.0

Bar Formation
☐ None ☐ Minor ☒ Moderate ☐ Extensive

Bank Erosion (see guidance sheet)

	Left Bank	Right Bank
Extent (m)	0m	0m
Severity	1	1
Avg. Height	0.5m	0.5m

Severity: 0=none 1=min 2=mod 3=severe

Maximum stream depth (cm) BANKFULL 20cm

Benthic Habitat Sampled (20 total)

	Sq. ft.
Riffle	2
Rootwad/Woody Debris	1
Leaf Pack	14
Submerged Vegetation	0
Undercut Banks	3
Other: N/A	0

Rootwads/Woody Debris

# Instream Woody Debris	3
# Dewatered Woody Debris	6
# Instream Rootwads	3
# Dewatered Rootwads	2

Stream Gradient

Location (ft)	Height (ft)	Water Depth (ft)

Photographs/Observations:

- HEALTHY MATURE MID-SUCCESSIONAL DEC. FOREST BUFFER
- HUMAN DISRUPTION MODERATE
- SITE ADJACENT TO ROAD
- SANDS LOAM & SUBSTRATE
- SHARK TOOTH ROCK 10.
- MULTIPLE GROUNDWATER SEEPS ALONG LEFT BANK
- BARK & LEAF LITTER TRAIL N2 0' FROM LEFT BANK

MBSS Physical Habitat Assessment Sheet

Stream Habitat Assessment Guidance Sheet				
Habitat Parameter	Optimal 16-20	Sub-Optimal 11-15	Marginal 6-10	Poor 0-5
1. Instream Habitat[a] SCORE 7	Greater than 50% of a variety of cobble, boulder, submerged logs, undercut banks, snags, rootwads, aquatic plants or other stable habitat	30-50% of stable habitat. Adequate habitat	10-30% mix of stable habitat. Habitat availability less than desireable	Less than 10% stable habitat. Lack of habitat is obvious
2. Epifaunal Substrate[a] SCORE 7	Preferred substrate abundant, stable, and at full colonization potential (riffles well developed and dominated by cobble; and/or woody debris prevalent, not new, and not transient	Abund. of cobble with gravel and/or boulders common; or woody debris, aquatic veg., undercut banks common but not prevalent/suited for full colonization	Large boulders and/or bedrock prevalent; cobble, woody debris, or other preferred surfaces uncommon	Stable substrate lacking; or particles are over 75% surrounded by fine sediment or flocculent material
3. Velocity/Depth Diversity[a] SCORE 7	Slow (<0.3m/s), deep (>0.5m); slow, shallow (<0.5m); fast (>0.3m/s), deep; fast, shallow habitats all present	Only 3 of the 4 habitat categories present	Only 2 of the 4 habitat categories present	Dominated by 1 velocity/depth category (usually pools)
4. Pool/Glide/Eddy Quality[a] SCORE 7	Complex cover&/or depth >1.5m; both deep (>0.5m)/shallows (<0.2m) present	Deep (>0.5m) areas present; but only moderate cover	Shallows (<0.2m) prevalent in pool/glide/eddy habitat; little cover	Max depth <0.2m in pool/glide/eddy habitat; or absent completely
5. Riffle/Run Quality[a] SCORE 6	Riffle/run depth generally >10cm, with maximum depth greater than 50 cm (maximum score); substrate stable (e.g. cobble, boulder) & variety of current velocities	Riffle/run depth generally 5-10cm, variety of current velocities	Riffle/run depth generally 1-5cm; primarily a single current velocity	Riffle/run depth <1cm; or riffle/run substrates concreted
6. Bank Stability[a] (facing downstream.) Score each bank LB SCORE 6 RB SCORE 6	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected. 10 9	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion. 8 7 6	Moderately unstable; 30-60% of bank in reach as areas of erosion; high erosion potential during floods. 5 4 3	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars. 2 1 0
7. Embeddedness SCORE 40 %	Percentage that gravel, cobble, and boulder particles are surrounded by fine sediment or flocculent material			
8. Shading SCORE 70 %	Percentage of segment that is shaded (duration is considered in scoring). 0% = fully exposed to sunlight all day in summer, 100% = fully and densely shaded all day in summer			
9. Riparian Buffer Zone Width (m)[a] LB 50 RB 50	Zone width in which human activity is not evident. 50m (164ft) is the maximum recorded value.			
10. Remoteness[a] SCORE 2	Roads greater than 400 meters (0.25 mi) from stream	Roads within 400 meters (0.25 mi) of stream; stream NOT accessible by trail.	Roads within 400 meters (0.25 mi) of stream; stream accessible by trail.	Roads adjacent to stream.
11. Aesthetic (trash) Rating[a] SCORE 14	Little or no human refuse visible from stream channel or riparian zone	Refuse present in minor amounts	Refuse present in moderate amounts	Refuse abundant and unsightly
12. Number of Woody Debris and Rootwads[a] SCORE 6	Count only woody debris and rootwads within the wetted portion of the sampling segment. Count only woody debris >10cm (4in) diameter and >1.5m (5ft) long and rootwads with trunk diameter (at chest height) >15cm (6in) that are functional habitat within the wetted portion of the stream.			

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS

STREAM NAME	MP50	LOCATION	AA CO, MD
STATION #	REACH ID#	STREAM CLASS	
UTM N	UTM E	RIVER BASIN	PATUXENT RIVER
STORET #		AGENCY	CEI
INVESTIGATORS	JS/CR		
FORM COMPLETED BY	CR	DATE 4/8/16 TIME 11:10 PM	REASON FOR SURVEY EMI SAMPLING

Parameters to be evaluated in sampling reach

Habitat Parameter	Condition Category			
	Optimal	Suboptimal	Marginal	Poor
1. Epifaunal Substrate/ Available Cover	Greater than 50% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient).	30-50% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale).	10-30% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 10% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
SCORE 7	20 19 18 17 16	15 14 13 12 11	10 9 8 (7) 6	5 4 3 2 1 0
2. Pool Substrate Characterization	Mixture of substrate materials, with gravel and firm sand prevalent; root mats and submerged vegetation common.	Mixture of soft sand, mud, or clay; mud may be dominant; some root mats and submerged vegetation present.	All mud or clay or sand bottom; little or no root mat; no submerged vegetation.	Hard-pan clay or bedrock; no root mat or vegetation.
SCORE 7	20 19 18 17 16	15 14 13 12 11	10 9 8 (7) 6	5 4 3 2 1 0
3. Pool Variability	Even mix of large-shallow, large-deep, small-shallow, small-deep pools present.	Majority of pools large-deep; very few shallow.	Shallow pools much more prevalent than deep pools.	Majority of pools small-shallow or pools absent.
SCORE 7	20 19 18 17 16	15 14 13 12 11	10 9 8 (7) 6	5 4 3 2 1 0
4. Sediment Deposition	Little or no enlargement of islands or point bars and less than <20% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 20-50% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 50-80% of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; more than 80% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
SCORE 14	20 19 18 17 16	15 (14) 13 12 11	10 9 8 7 6	5 4 3 2 1 0
5. Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills >75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
SCORE 7	20 19 18 17 16	15 14 13 12 11	10 9 8 (7) 6	5 4 3 2 1 0

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS

Parameters to be evaluated broader than sampling reach

Habitat Parameter	Condition Category			
	Optimal	Suboptimal	Marginal	Poor
6. Channel Alteration NO CHANNEL-IZATION SCORE 20	Channelization or dredging absent or minimal; stream with normal pattern. (20) 19 18 17 16	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr) may be present, but recent channelization is not present. 15 14 13 12 11	Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted. 10 9 8 7 6	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely. 5 4 3 2 1 0
7. Channel Sinuosity SCORE 11	The bends in the stream increase the stream length 3 to 4 times longer than if it was in a straight line. (Note - channel braiding is considered normal in coastal plains and other low-lying areas. This parameter is not easily rated in these areas.) 20 19 18 17 16	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line. 15 14 13 12 (11)	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line. 10 9 8 7 6	Channel straight; waterway has been channelized for a long distance. 5 4 3 2 1 0
8. Bank Stability (score each bank) SCORE 6 (LB) SCORE 8 (RB)	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected. Left Bank 10 9 Right Bank 10 9	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion. 8 7 (6) (8) 7 6	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods. 5 4 3 5 4 3	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars. 2 1 0 2 1 0
9. Vegetative Protection (score each bank) Note: determine left or right side by facing downstream. SCORE 6 (LB) SCORE 9 (RB)	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally. Left Bank 10 9 Right Bank 10 (9)	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining. 8 7 (6) 8 7 6	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining. 5 4 3 5 4 3	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height. 2 1 0 2 1 0
10. Riparian Vegetative Zone Width (score each bank riparian zone) SCORE 9 (LB) SCORE 9 (RB)	Width of riparian zone >18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone. Left Bank 10 9 Right Bank 10 9	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally. 8 7 6 8 7 6	Width of riparian zone 6-12 meters; human activities have impacted zone a great deal. 5 4 3 5 4 3	Width of riparian zone <6 meters: little or no riparian vegetation due to human activities. 2 1 0 2 1 0

Total Score 120

v. 2009

MPS1

MBSS SPRING HABITAT DATA SHEET

SITE — Watershed Code: MP | Segment: S1 | Type: 3 | Year: 2016

Reviewer: First: EW / Second: CR

DATE — Year: 16 | Month: 04 | Day: 20

200 Dist. from Nearest Road to Site (m)

19 Trash Rating 0 - 20

LANDUSE (Y/N)

N	Old Field	N	Residential
Y	Deciduous Forest	N	Commercial/Industrial
N	Coniferous Forest	N	Cropland
Y	Wetland	N	Pasture
N	Surface Mine	N	Orchard/Vineyard/Nursery
N	Landfill	N	Golf Course

RIPARIAN VEGETATION
(facing upstream)

	LEFT BANK	RIGHT BANK
Width (50m max)	50	50
Adjacent Land Cover	DO	DO
Vegetation Type	YRG	YRG
Buffer Breaks (Y/N)	N	N

ROAD CULVERT

Present in Segment (Y/N): N

Sampleable? (Y/N):

Width of Culvert (m):

Length of Culvert (m):

STREAM GRADIENT

	Location (m)	Height (m)
1		
2		
3		

Buffer Breaks

	LEFT BANK	RIGHT BANK
Storm Drain		
Tile Drain		
Impervious Drainage		
Gully		
Orchard		
Crop		
Pasture		
New Construction		
Dirt Road		
Gravel Road		
Raw Sewage		
Railroad		

Buffer Break Types
(M = minor; S = severe)

CHANNELIZATION

N Evidence of Channel Straightening or Dredging (Y/N)

TYPE	EXTENT (m) LEFT BANK	BOTTOM	RIGHT BANK
Concrete			
Gabion			
Rip-Rap			
Earthen Berm		N/A	
Dredge Spoil Off Channel		N/A	
Pipe Culvert			

Actual Coordinates
(if >30m distance between original coordinates and stream)

Lat

Lon

Stream Block Ht. (m)

Stream Block Type

Lat

Lon

v. 2009

MBSS SPRING INDEX PERIOD DATA SHEET

SITE — Watershed Code: MP | Segment: SI | Type: 3 | Year: 2016

Reviewer: First: EW / Second: CR

DATE — Year: 16 | Month: 04 | Day: 20

CREW: EW/CR

STREAM: Lyons Creek

TIME 1023 (Military)

LOCALITY: LOTHIAN, AA CO, MD

SAMPLEABILITY

- Y Benthos
- Y Habitat Assessment
- Y Water Quality
- / Vernal Pool 4 (PRESENT/ABSENT)

OTHER (SPECIFY)

SITE ACCESS ROUTE

Greenridge Drive

SAMPLE LABELS

Verified by: EW

QC LABEL

Watershed Code: MP | Segment: SI (Letters only) | Type: 3 | Year: 2016

Dup. (D) or Blank (B): ___ Verified by: ___

TEMP. LOGGER

	(Y/N)	(TIME - Military)	#
WATER	Y	1023	3
AIR	N/A		

LOCATION

PHOTODOCUMENTATION

Number	Title	Voucher (Y/N)
	6 on GPS	
	Mid US/DS	
	DS US/DS	
	US US/DS	

BENTHIC HABITAT SAMPLED

6	Riffle	4	Leaf Pack	X	Undercut Banks
8	Rootwad/Woody Debris	2	Macrophytes	X	Other

SAMPLING CONSID.: (X NUM. ANODES)

STREAM WIDTH (m): 0 m: 7 | 75 m: 3

MPS1

v. 2009

MBSS SPRING FAUNA DATA SHEET

SITE Watershed Code: MP | Segment: 51 | Type: 3 | Year: 2016

Reviewer: First: EW / Second: CR

HERPETOFAUNA

☒ None Observed

Species	Lifestage: Adult	Juv.	Larval	Egg	SEEN (Y/N)	HEARD (Y/N)	NUMBER RETAINED	NUMBER PHOTOS TAKEN

MUSSELS

☒ None Observed

Species	LIVE	DEAD	NUMBER RETAINED	NUMBER PHOTOS TAKEN

Corbicula: LIVE ☐ DEAD ☐ NONE ☐

CRAYFISHES

☐ None Observed

Species	NUMBER RETAINED
TBD	01

Crayfish Burrows ☒ Extensive

(Absent, Present, Extensive)

COMMENTS

Physical Habitat Assessment and Water Quality Data Sheet

Site ID: MP 51
Subwatershed: Lyons Creek
Length of Reach: 75 m **Date:** 4/20/16
Team Members: EW/CE **Time:** 10:23AM

Weather
Current: Sunny 70°F
Past 24hrs: Sunny
Past 48hrs: Sunny / 70's

Parameter	Down-stream	Mid-stream	Up-stream
Description			
pH	6.56	6.57	6.65
Temperature (°C)	14.27	14.21	14.30
DO (mg/l)	10.82	10.53	10.44
Conductivity (uS/cm)	198	198	197
TDS (mg/l)	162	162	160
Turbidity (NTU)	6.5	6.5	6.5

Notes: Trib confluence immediately US of reach

Stream Character

[P] Meandering	[A] Channelized
[A] Braided	[A] Straight
[P] Riffle	[P] Run/Glide
[A] Deep Pool >.5m	[P] Silt/Clay
[P] Shallow Pool <.5m	[P] Sand
[P] Gravel	[A] Cobble
[A] Boulder >2m	[A] Boulder <2m
[A] Concrete/Gabion	[A] Bedrock
[A] Undercut Bank	[P] Rootwad
[P] Overhead Cover	[A] Storm Drain
[A] Effluent Discharge	[A] Human Refuse
[P] Emergent Vegetation	[A] Beaver Pond
[P] Floating Vegetation	

A=Absent P=Present E=Extensive

Bar Formation
[X] None [ ] Moderate
[ ] Minor [ ] Extensive

Bank Erosion (see guidance sheet)

	Left Bank	Right Bank	Severity:
Extent (m)	20	40	
Severity	1	1	0=none
Avg. Height	3.5'	3.5'	1=min
			2=mod
			3=severe

Maximum stream depth (cm) 46

Benthic Habitat Sampled (20 total)

	Sq. ft.
Riffle	6
Rootwad/Woody Debris	8
Leaf Pack	4
Submerged Vegetation	2
Undercut Banks	0
Other:	0

Rootwads/Woody Debris

# Instream Woody Debris	IIII
# Dewatered Woody Debris	III
# Instream Rootwads	II
# Dewatered Rootwads	I

Stream Gradient

Location (ft)	Height (ft)	Water Depth (ft)

Photographs/Observations:
US/DS mid
US/DS DS end } on GPS
US/DS US end

MBSS Physical Habitat Assessment Sheet

Stream Habitat Assessment Guidance Sheet				
Habitat Parameter	Optimal 16-20	Sub-Optimal 11-15	Marginal 6-10	Poor 0-5
1. Instream Habitat[a] SCORE 13	Greater than 50% of a variety of cobble, boulder, submerged logs, undercut banks, snags, rootwads, aquatic plants or other stable habitat	30-50% of stable habitat. Adequate habitat	10-30% mix of stable habitat. Habitat availability less than desireable	Less than 10% stable habitat. Lack of habitat is obvious
2. Epifaunal Substrate[a] SCORE 11	Preferred substrate abundant, stable, and at full colonization potential (riffles well developed and dominated by cobble; and/or woody debris prevalent, not new, and not transient	Abund. of cobble with gravel and/or boulders common; or woody debris, aquatic veg., undercut banks common but not prevalent/suited for full colonization	Large boulders and/or bedrock prevalent; cobble, woody debris, or other preferred surfaces uncommon	Stable substrate lacking; or particles are over 75% surrounded by fine sediment or flocculent material
3. Velocity/Depth Diversity[a] SCORE 9	Slow (<0.3m/s), deep (>0.5m); slow, shallow (<0.5m); fast (>0.3m/s), deep; fast, shallow habitats all present	Only 3 of the 4 habitat categories present	Only 2 of the 4 habitat categories present	Dominated by 1 velocity/depth category (usually pools)
4. Pool/Glide/Eddy Quality[a] SCORE 9	Complex cover/& or depth >1.5m; both deep (>0.5m)/shallows (<0.2m) present	Deep (>0.5m) areas present; but only moderate cover	Shallows (<0.2m) prevalent in pool/glide/eddy habitat; little cover	Max depth <0.2m in pool/glide/eddy habitat; or absent completely
5. Riffle/Run Quality[a] SCORE 13	Riffle/run depth generally >10cm, with maximum depth greater than 50 cm (maximum score); substrate stable (e.g. cobble, boulder) & variety of current velocities	Riffle/run depth generally 5-10cm, variety of current velocities	Riffle/run depth generally 1-5cm; primarily a single current velocity	Riffle/run depth <1cm; or riffle/run substrates concreted
6. Bank Stability[a] (facing downstream.) Score each bank LB SCORE 8 7 RB SCORE 8	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected. 10 9	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion. 8 7 6	Moderately unstable; 30-60% of bank in reach as areas of erosion; high erosion potential during floods. 5 4 3	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars. 2 1 0
7. Embeddedness SCORE 80 %	Percentage that gravel, cobble, and boulder particles are surrounded by fine sediment or flocculent material			
8. Shading SCORE 20 %	Percentage of segment that is shaded (duration is considered in scoring). 0% = fully exposed to sunlight all day in summer, 100% = fully and densely shaded all day in summer			
9. Riparian Buffer Zone Width (m)[a] LB 50 RB 50	Zone width in which human activity is not evident. 50m (164ft) is the maximum recorded value.			
10. Remoteness SCORE 9	Roads greater than 400 meters (0.25 mi) from stream	Roads within 400 meters (0.25 mi) of stream; stream NOT accessible by trail.	Roads within 400 meters (0.25 mi) of stream; stream accessible by trail.	Roads adjacent to stream.
11. Aesthetic (trash) Rating[a] SCORE 18	Little or no human refuse visible from stream channel or riparian zone	Refuse present in minor amounts	Refuse present in moderate amounts	Refuse abundant and unsightly
12. Number of Woody Debris and Rootwads[a] SCORE 8	Count only woody debris and rootwads within the wetted portion of the sampling segment. Count only woody debris >10cm (4in) diameter and >1.5m (5ft) long and rootwads with trunk diameter (at chest height) >15cm (6in) that are functional habitat within the wetted portion of the stream.			

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS

STREAM NAME MPS1	LOCATION Harwood
STATION # _____ REACH ID# _____	STREAM CLASS Perennial 3?
UTM N _____ UTM E	RIVER BASIN Lyons Creek / MP
STORET #	AGENCY CEI
INVESTIGATORS EW/CR	
FORM COMPLETED BY EW	DATE 4/20 TIME 10:23 AM
REASON FOR SURVEY BMI SAMPLING	

Parameters to be evaluated in sampling reach

Habitat Parameter	Condition Category			
	Optimal	Suboptimal	Marginal	Poor
1. Epifaunal Substrate/ Available Cover	Greater than 50% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient).	30-50% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale).	10-30% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 10% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
SCORE 11	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
2. Pool Substrate Characterization	Mixture of substrate materials, with gravel and firm sand prevalent; root mats and submerged vegetation common.	Mixture of soft sand, mud, or clay; mud may be dominant; some root mats and submerged vegetation present.	All mud or clay or sand bottom; little or no root mat; no submerged vegetation.	Hard-pan clay or bedrock; no root mat or vegetation.
SCORE 13	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
3. Pool Variability	Even mix of large-shallow, large-deep, small-shallow, small-deep pools present.	Majority of pools large-deep; very few shallow.	Shallow pools much more prevalent than deep pools.	Majority of pools small-shallow or pools absent.
SCORE 9	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
4. Sediment Deposition	Little or no enlargement of islands or point bars and less than <20% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 20-50% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 50-80% of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; more than 80% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
SCORE 6	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
5. Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills >75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
SCORE 14	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0

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HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS

Parameters to be evaluated broader than sampling reach

Habitat Parameter	Condition Category			
	Optimal	Suboptimal	Marginal	Poor
6. Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr) may be present, but recent channelization is not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.
SCORE 19	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
7. Channel Sinuosity	The bends in the stream increase the stream length 3 to 4 times longer than if it was in a straight line. (Note - channel braiding is considered normal in coastal plains and other low-lying areas. This parameter is not easily rated in these areas.)	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	Channel straight; waterway has been channelized for a long distance.
SCORE 12	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
8. Bank Stability (score each bank)	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.
SCORE 7 (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE 8 (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0
9. Vegetative Protection (score each bank) Note: determine left or right side by facing downstream.	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
SCORE 6 (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE 8 (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0
10. Riparian Vegetative Zone Width (score each bank riparian zone)	Width of riparian zone >18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone.	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6-12 meters; human activities have impacted zone a great deal.	Width of riparian zone <6 meters: little or no riparian vegetation due to human activities.
SCORE 10 (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE 10 (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0

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Total Score ~~130~~ 133

v. 2009

MBSS SPRING HABITAT DATA SHEET

Page 1 of 3

SITE — Watershed Code: MP | Segment: S3 | Type: | Year: 2016

Reviewer: First: JT / Second: CR

DATE — Year: 16 | Month: 04 | Day: 15

1000 Dist. from Nearest Road to Site (m)

15 Trash Rating 0 - 20

LANDUSE (Y/N)

N	Old Field	N	Residential
Y	Deciduous Forest	N	Commercial/Industrial
N	Coniferous Forest	N	Cropland
Y	Wetland	N	Pasture
N	Surface Mine	N	Orchard/Vineyard/Nursery
N	Landfill	N	Golf Course

ROAD CULVERT

Present in Segment (Y/N): N

Sampleable? (Y/N):

Width of Culvert (m):

Length of Culvert (m):

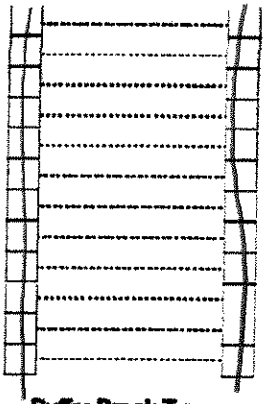
STREAM GRADIENT

	Location (m)	Height (m)
1		
2		
3		

RIPARIAN VEGETATION
(facing upstream)

	LEFT BANK	RIGHT BANK
Width (50m max)	50	50
Adjacent Land Cover	OF	PA
Vegetation Type	GYRM	GYBM
Buffer Breaks (Y/N)	N	N

	LEFT BANK	RIGHT BANK
Storm Drain		
Tile Drain		
Impervious Drainage		
Gully		
Orchard		
Crop		
Pasture		
New Construction		
Dirt Road		
Gravel Road		
Raw Sewage		
Railroad		



Buffer Break Types
(M = minor; S = severe)

CHANNELIZATION

N Evidence of Channel Straightening or Dredging (Y/N)

TYPE	EXTENT (m)		
	LEFT BANK	BOTTOM	RIGHT BANK
Concrete			
Gabion			
Rip-Rap			
Earthen Berm		N/A	
Dredge Spoil Off Channel		N/A	
Pipe Culvert			

Actual Coordinates
(If >30m distance between original coordinates and stream)

Lat

Lon

Stream Block Ht. (m)

Stream Block Type

Lat

Lon

v. 2009

MBSS SPRING INDEX PERIOD DATA SHEET

Page 2 of 7

SITE: Watershed Code MP | Segment S3 | Type | Year 2016

Reviewer: First JT / Second CR

DATE: Year 16 | Month 04 | Day 13

CREW: CR/JT

STREAM: MPS3

TIME: 1200 (Military)

LOCALITY: Lothian MD

SAMPLEABILITY

- [✓] Benthos
- [✓] Habitat Assessment
- [✓] Water Quality
- [X] Vernal Pool [A] (QUALITY ASSESSMENT)

OTHER (SPECIFY)

SITE ACCESS ROUTE

Farm property driveway off Fishers station road

SAMPLE LABELS

Verified by: CR

QC LABEL

Watershed Code MP | Segment S3 (Letters only) | Type | Year 2016

Dup. (D) or Blank (B): | Verified by:

TEMP. LOGGER

	(Y/N)	(TIME - Military)	#
WATER			#
AIR			#

LOCATION

PHOTODOCUMENTATION

Number	Title	Voucher (Y/N)
	Midpoint US/DS	
	Upstream US/DS	
	Downstream US/DS	

BENTHIC HABITAT SAMPLED

- [07] Riffle
- [07] Rootwad/Woody Debris
- [06] Leaf Pack
- [ ] Macrophytes
- [ ] Undercut Banks
- [ ] Other

SAMPLING CONSID.: (NUM. ANODES)

STREAM WIDTH (m): 0 m | 75 m

v. 2009

MBSS SPRING FAUNA DATA SHEET

SITE Watershed Code MP | Segment 53 | Type | Year 2014

Reviewer: First JT / Second CR

HERPETOFAUNA

☐ None Observed

Species	Lifestage (Adult, Juv, Larval, Egg)	SEEN (Y/N)	HEARD (Y/N)	NUMBER RETAINED	NUMBER PHOTOS TAKEN
salamander		/			

MUSSELS

☒ None Observed

Species	LIVE	DEAD	NUMBER RETAINED	NUMBER PHOTOS TAKEN

Corbicula: LIVE ☐ DEAD ☐ NONE ☐

CRAYFISHES

☐ None Observed

Species	NUMBER RETAINED
M: Adult caught + returned x2	
♀: White River crawfish	02

Crayfish Burrows: P

(Absent, Present, Extensive)

COMMENTS

Physical Habitat Assessment and Water Quality Data Sheet

Site ID: MPS3
Subwatershed: Lyons Creek 10
Length of Reach: 75 **Date:** 4/15/16
Team Members: CA/JT **Time:** 12:00 PM

Weather
Current: clear, ~50°F
Past 24hrs: clear
Past 48hrs: clear

Stream Character

- [P] Meandering
- [A] Braided
- [P] Riffle
- [A] Deep Pool >.5m
- [P] Shallow Pool <.5m
- [A] Gravel
- [A] Boulder >2m
- [A] Concrete/Gabion
- [P] Undercut Bank
- [P] Overhead Cover
- [A] Effluent Discharge
- [P] Emergent Vegetation
- [A] Floating Vegetation
- [A] Channelized
- [A] Straight
- [P] Run/Glide
- [P] Silt/Clay
- [P] Sand
- [A] Cobble
- [A] Boulder <2m
- [A] Bedrock
- [A] Rootwad
- [A] Storm Drain
- [A] Human Refuse
- [A] Beaver Pond

A=Absent P=Present E=Extensive

Bar Formation

- [ ] None
- [x] Minor
- [ ] Moderate
- [ ] Extensive

Bank Erosion (see guidance sheet)

	Left Bank	Right Bank	Severity
Extent (m)	75	75	
Severity	2	1	0=none
Avg. Height	~~5 ft~~	~~5 ft~~	1=min
	5 ft	5ft	2=mod
			3=severe

Maximum stream depth (cm) 30cm

Benthic Habitat Sampled (20 total)	Sq. ft.
Riffle	7
Rootwad/Woody Debris	3
Leaf Pack	6
Submerged Vegetation	0
Undercut Banks	0
Other:	

Rootwads/Woody Debris

# Instream Woody Debris	2
# Dewatered Woody Debris	1
# Instream Rootwads	3
# Dewatered Rootwads	3

Stream Gradient

Location (ft)	Height (ft)	Water Depth (ft)

Parameter	Down-stream	Mid-stream	Up-stream
Description			
pH	7.12	7.11	7.1
Temperature (°C)	12.2	11.9	12.1
DO (mg/l)	12.62	13.18	13.0
Conductivity (uS/cm)	126.5	125	126.0
TDS (mg/l)	198.55	107.9	106.55
Turbidity (NTU)	6.36	7.05	5.26

Notes:

Photographs/Observations:
midpoint US/DS
downstream US/DS
upstream US/DS

MBSS Physical Habitat Assessment Sheet

Stream Habitat Assessment Guidance Sheet				
Habitat Parameter	Optimal 16-20	Sub-Optimal 11-15	Marginal 6-10	Poor 0-5
1. Instream Habitat* SCORE 6	Greater than 50% of a variety of cobble, boulder, submerged logs, undercut banks, snags, rootwads, aquatic plants or other stable habitat	30-50% of stable habitat. Adequate habitat	10-30% mix of stable habitat. Habitat availability less than desireable	Less than 10% stable habitat. Lack of habitat is obvious
2. Epifaunal Substrate* SCORE 5	Preferred substrate abundant, stable, and at full colonization potential (riffles well developed and dominated by cobble; and/or woody debris prevalent, not new, and not transient	Abund. of cobble with gravel and/or boulders common; or woody debris, aquatic veg., undercut banks common but not prevalent/suited for full colonization	Large boulders and/or bedrock prevalent; cobble, woody debris, or other preferred surfaces uncommon	Stable substrate lacking; or particles are over 75% surrounded by fine sediment or flocculent material
3. Velocity/Depth Diversity* SCORE 6	Slow (<0.3m/s), deep (>0.5m); slow, shallow (<0.5m); fast (>0.3m/s), deep; fast, shallow habitats all present	Only 3 of the 4 habitat categories present	Only 2 of the 4 habitat categories present	Dominated by 1 velocity/depth category (usually pools)
4. Pool/Glide/Eddy Quality* SCORE 7	Complex cover/& /or depth >1.5m; both deep (>0.5m)/shallows (<0.2m) present	Deep (>0.5m) areas present; but only moderate cover	Shallows (<0.2m) prevalent in pool/glide/eddy habitat; little cover	Max depth <0.2m in pool/glide/eddy habitat; or absent completely
5. Riffle/Run Quality* SCORE 5	Riffle/run depth generally >10cm, with maximum depth greater than 50 cm (maximum score); substrate stable (e.g. cobble, boulder) & variety of current velocities	Riffle/run depth generally 5-10cm, variety of current velocities	Riffle/run depth generally 1-5cm; primarily a single current velocity	Riffle/run depth <1cm; or riffle/run substrates concreted
6. Bank Stability* (facing downstream.) Score each bank LB SCORE 5 RB SCORE 2	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected. 10 9	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion. 8 7 6	Moderately unstable; 30-60% of bank in reach as areas of erosion; high erosion potential during floods. 5 4 3	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars. 2 1 0
7. Embeddedness SCORE 75 %	Percentage that gravel, cobble, and boulder particles are surrounded by fine sediment or flocculent material			
8. Shading* SCORE 75 %	Percentage of segment that is shaded (duration is considered in scoring). 0% = fully exposed to sunlight all day in summer; 100% = fully and densely shaded all day in summer			
9. Riparian Buffer Zone Width (m)* LB 50 RB 50	Zone width in which human activity is not evident. 50m (164ft) is the maximum recorded value.			
10. Remoteness* SCORE 20	Roads greater than 400 meters (0.25 mi) from stream	Roads within 400 meters (0.25 mi) of stream; stream NOT accessible by trail	Roads within 400 meters (0.25 mi) of stream; stream accessible by trail	Roads adjacent to stream.
11. Aesthetic (trash) Rating* SCORE 15	Little or no human refuse visible from stream channel or riparian zone	Refuse present in minor amounts	Refuse present in moderate amounts	Refuse abundant and unsightly
12. Number of Woody Debris and Rootwads* SCORE 5	Count only woody debris and rootwads within the wetted portion of the sampling segment. Count only woody debris >10cm (4in) diameter and >1.5m (5ft) long and rootwads with trunk diameter (at chest height) >15cm (6in) that are functional habitat within the wetted portion of the stream.			

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS

STREAM NAME MPSS	LOCATION Lothian, MD	
STATION # _____ REACH ID# _____	STREAM CLASS	
UTM N _____ UTM E	RIVER BASIN Patuxent River	
STORET #	AGENCY CEI	
INVESTIGATORS CP/JT		
FORM COMPLETED BY JT	DATE 4/5/16 TIME 12:00 PM	REASON FOR SURVEY MBSS

Parameters to be evaluated in sampling reach

Habitat Parameter	Condition Category			
	Optimal	Suboptimal	Marginal	Poor
1. Epifaunal Substrate/ Available Cover	Greater than 50% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient).	30-50% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale).	10-30% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 10% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
SCORE 7	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
2. Pool Substrate Characterization	Mixture of substrate materials, with gravel and firm sand prevalent; root mats and submerged vegetation common.	Mixture of soft sand, mud, or clay; mud may be dominant; some root mats and submerged vegetation present.	All mud or clay or sand bottom; little or no root mat; no submerged vegetation.	Hard-pan clay or bedrock; no root mat or vegetation.
SCORE 8	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
3. Pool Variability	Even mix of large-shallow, large-deep, small-shallow, small-deep pools present.	Majority of pools large-deep; very few shallow.	Shallow pools much more prevalent than deep pools.	Majority of pools small-shallow or pools absent.
SCORE 7	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
4. Sediment Deposition	Little or no enlargement of islands or point bars and less than <20% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 20-50% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 50-80% of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; more than 80% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
SCORE 9	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
5. Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills >75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
SCORE 8	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0

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HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS

Parameters to be evaluated broader than sampling reach

Habitat Parameter	Condition Category			
	Optimal	Suboptimal	Marginal	Poor
6. Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr) may be present, but recent channelization is not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.
SCORE 19	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
7. Channel Sinuosity	The bends in the stream increase the stream length 3 to 4 times longer than if it was in a straight line. (Note - channel braiding is considered normal in coastal plains and other low-lying areas. This parameter is not easily rated in these areas.)	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	Channel straight; waterway has been channelized for a long distance.
SCORE 7	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
8. Bank Stability (score each bank)	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.
SCORE 4 (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE 6 (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0
9. Vegetative Protection (score each bank) Note: determine left or right side by facing downstream.	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
SCORE 5 (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE 5 (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0
10. Riparian Vegetative Zone Width (score each bank riparian zone)	Width of riparian zone >18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone.	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6-12 meters; human activities have impacted zone a great deal.	Width of riparian zone <6 meters: little or no riparian vegetation due to human activities.
SCORE 10 (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE 10 (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0

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Total Score 105

v. 2009

MBSS SPRING HABITAT DATA SHEET

Page 1 of 7

SITE — Watershed Code: MP | Segment: 71A | Type: S | Year: 2016

Reviewer: First: JT / Second: AB

DATE — Year: 16 | Month: 04 | Day: 06

500 Dist. from Nearest Road to Site (m)

12 Trash Rating 0 - 20

LANDUSE (Y/N)

N	Old Field	Y	Residential
Y	Deciduous Forest	N	Commercial/Industrial
N	Coniferous Forest	N	Cropland
N	Wetland	Y	Pasture
N	Surface Mine	N	Orchard/Vineyard/Nursery
N	Landfill	N	Golf Course

RIPARIAN VEGETATION
(facing upstream)

	LEFT BANK	RIGHT BANK
Width (50m max)	40	30
Adjacent Land Cover	FR	FR
Vegetation Type	RYMO	RYMO
Buffer Breaks (Y/N)	N	N

ROAD CULVERT

Present in Segment (Y/N): N

Sampleable? (Y/N):

Width of Culvert (m):

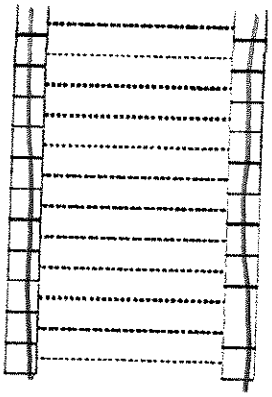
Length of Culvert (m):

STREAM GRADIENT

	Elevation (m)	Height (m)
1		
2		
3		

Buffer Breaks

	LEFT BANK	RIGHT BANK
Storm Drain		
Tile Drain		
Impervious Drainage		
Gully		
Orchard		
Crop		
Pasture		
New Construction		
Dirt Road		
Gravel Road		
Raw Sewage		
Railroad		



Buffer Break Types
(M = minor; S = severe)

CHANNELIZATION

N Evidence of Channel Straightening or Dredging (Y/N)

TYPE	EXTENT (m)		
	LEFT BANK	BOTTOM	RIGHT BANK
Concrete			
Gabion			
Rip-Rap			
Earthen Berm		N/A	
Dredge Spoil Off Channel		N/A	
Pipe Culvert			

Actual Coordinates
(If >30m distance between original coordinates and stream)

Lat

Lon

Stream Block Ht. (m)

Stream Block Type

Lat

Lon

v. 2009

MBSS SPRING INDEX PERIOD DATA SHEET

SITE Watershed Code: MP | Segment: 71A | Type: 3 | Year: 2016

Reviewer: First: JT / Second: HB

DATE: Year: 16 | Month: 04 | Day: 06

CREW: HB/JT

STREAM: MP71A

TIME: 1247 (Military)

LOCALITY: Harwood, MD

SAMPLEABILITY

- [Y] Benthos
- [Y] Habitat Assessment
- [Y] Water Quality
- [N] Vernal Pool [A] (ASSESSMENT)

OTHER (SPECIFY)

SITE ACCESS ROUTE

Access via driving/walking across farm property off Berry place.

SAMPLE LABELS

Verified by: HB

QC LABEL

Watershed Code: MP | Segment: 71A (Letters only) | Type: 3 | Year: 2016

Dup. (D) or Blank (B): D Verified by: HB

TEMP. LOGGER

	(Y/N)	(TIME - Military)	#
WATER			#
AIR			#

LOCATION

PHOTODOCUMENTATION

Number	Title	Voucher (Y/N)
	MP - US/DS	
	US - US/DS	
	DS - US/DS	

BENTHIC HABITAT SAMPLED

- [07] Riffle
- [16] Rootwad/Woody Debris
- [03] Leaf Pack
- [ ] Macrophytes
- [ ] Undercut Banks
- [ ] Other

SAMPLING CONSID.: ( ) NUM. ANODES

STREAM WIDTH (m): 0 m | 75 m

v. 2009

MBSS SPRING FAUNA DATA SHEET

SITE Watershed Code: MP | Segment: 71A | Type: 3 | Year: 2016

Reviewer: First: JT / Second: HB

[X] None Observed

HERPETOFAUNA

Species	Lifestage (Adult, Juv., Larval, Egg)	SEEN (Y/N)	HEARD (Y/N)	NUMBER RETAINED	NUMBER PHOTOS TAKEN

[X] None Observed

MUSSELS

Species	LIVE	DEAD	NUMBER RETAINED	NUMBER PHOTOS TAKEN

Corbicula: LIVE [ ] DEAD [ ] NONE [ ]

[✓] None Observed

CRAYFISHES

Species	NUMBER RETAINED
~~[illegible]~~	

Crayfish Burrows: P

(Absent, Present, Extensive)

COMMENTS

Physical Habitat Assessment and Water Quality Data Sheet

Site ID: MP71A
Subwatershed: Rock Branch
Length of Reach: 75m **Date:** 4/6/16
Team Members: MB/IT **Time:** 1250

Weather
Current: clear, 50°F
Past 24hrs: clear, 50°F
Past 48hrs: clear, some rain showers

Stream Character

- [P] Meandering
- [A] Braided
- [A] Riffle
- [A] Deep Pool >.5m
- [P] Shallow Pool <.5m
- [A] Gravel
- [A] Boulder >2m
- [A] Concrete/Gabion
- [P] Undercut Bank
- [P] Overhead Cover
- [A] Effluent Discharge
- [P] Emergent Vegetation
- [A] Floating Vegetation
- [A] Channelized
- [A] Straight
- [A] Run/Glide
- [P] Silt/Clay
- [P] Sand
- [A] Cobble
- [A] Boulder <2m
- [A] Bedrock
- [P] Rootwad
- [A] Storm Drain
- [A] Human Refuse
- [A] Beaver Pond

A=Absent *P=Present* *E=Extensive*

Bar Formation

- [X] None
- [ ] Minor
- [ ] Moderate
- [ ] Extensive

Bank Erosion (see guidance sheet)

	Left Bank	Right Bank
Extent (m)	75	75
Severity	1	1
Avg. Height	60cm	60cm

Severity: 0=none 1=min 2=mod 3=severe

Maximum stream depth (cm): 30

Benthic Habitat Sampled (20 total)

	Sq. ft.
Riffle	7
Rootwad/Woody Debris	10
Leaf Pack	3
Submerged Vegetation	0
Undercut Banks	0
Other:	0

Rootwads/Woody Debris

# Instream Woody Debris	2
# Dewatered Woody Debris	5
# Instream Rootwads	2
# Dewatered Rootwads	1

Stream Gradient

Location (ft)	Height (ft)	Water Depth (ft)

Parameter	Down-stream	Mid-stream	Up-stream
Description			
pH	6.97	6.7	6.65
Temperature (°C)	10.7	10.6	10.6
DO (mg/l)	12.61	11.96	11.97
Conductivity (uS/cm)	126.9	127	127.1
TDS (mg/l)	113.1	113.1	113.1
Turbidity (NTU)	11.5	10.1	10.4

Notes:

Photographs/Observations:
M - US/DS
U - US/DS
D - US/DS

MBSS Physical Habitat Assessment Sheet

Stream Habitat Assessment Guidance Sheet				
Habitat Parameter	Optimal 16-20	Sub-Optimal 11-15	Marginal 6-10	Poor 0-5
1. Instream Habitat* SCORE 7	Greater than 50% of a variety of cobble, boulder, submerged logs, undercut banks, snags, rootwads, aquatic plants or other stable habitat	30-50% of stable habitat. Adequate habitat	10-30% mix of stable habitat. Habitat availability less than desireable	Less than 10% stable habitat. Lack of habitat is obvious
2. Epifaunal Substrate* SCORE 5	Preferred substrate abundant, stable, and at full colonization potential (riffles well developed and dominated by cobble; and/or woody debris prevalent, not new, and not transient	Abund. of cobble with gravel and/or boulders common; or woody debris, aquatic veg., undercut banks common but not prevalent/suited for full colonization	Large boulders and/or bedrock prevalent; cobble, woody debris, or other preferred surfaces uncommon	Stable substrate lacking; or particles are over 75% surrounded by fine sediment or flocculent material
3. Velocity/Depth Diversity* SCORE 6	Slow (<0.3m/s), deep (>0.5m); slow, shallow (<0.5m); fast (>0.3m/s), deep; fast, shallow habitats all present	Only 3 of the 4 habitat categories present	Only 2 of the 4 habitat categories present	Dominated by 1 velocity/depth category (usually pools)
4. Pool/Glide/Eddy Quality* SCORE 6	Complex cover/E/or depth >1.5m; both deep (>0.5m)/shallows (<0.2m) present	Deep (>0.5m) areas present; but only moderate cover	Shallows (<0.2m) prevalent in pool/glide/eddy habitat; little cover	Max depth <0.2m in pool/glide/eddy habitat; or absent completely
5. Riffle/Run Quality* SCORE 6	Riffle/run depth generally >10cm, with maximum depth greater than 50 cm (maximum score); substrate stable (e.g. cobble, boulder) & variety of current velocities	Riffle/run depth generally 5-10cm, variety of current velocities	Riffle/run depth generally 1-5cm; primarily a single current velocity	Riffle/run depth <1cm; or riffle/run substrates concreted
6. Bank Stability* (facing downstream.) Score each bank LB SCORE 5 RB SCORE 5	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected. 10 9	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion. 8 7 6	Moderately unstable; 30-60% of bank in reach as areas of erosion; high erosion potential during floods. 5 4 3	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars. 2 1 0
7. Embeddedness SCORE 50 %	Percentage that gravel, cobble, and boulder particles are surrounded by fine sediment or flocculent material			
8. Shading SCORE 75 %	Percentage of segment that is shaded (duration is considered in scoring). 0% = fully exposed to sunlight all day in summer; 100% = fully and densely shaded all day in summer			
9. Riparian Buffer Zone Width (m)* LB 30 RB 40	Zone width in which human activity is not evident. 50m (164ft) is the maximum recorded value.			
10. Remoteness* SCORE 10	Roads greater than 400 meters (0.25 mi) from stream	Roads within 400 meters (0.25 mi) of stream; stream NOT accessible by trail.	Roads within 400 meters (0.25 mi) of stream; stream accessible by trail.	Roads adjacent to stream.
11. Aesthetic (trash) Rating* SCORE 12	Little or no human refuse visible from stream channel or riparian zone	Refuse present in minor amounts	Refuse present in moderate amounts	Refuse abundant and unsightly
12. Number of Woody Debris and Rootwads* SCORE 14	Count only woody debris and rootwads within the wetted portion of the sampling segment. Count only woody debris >10cm (4in) diameter and >1.5m (5ft) long and rootwads with trunk diameter (at chest height) >15cm (6in) that are functional habitat within the wetted portion of the stream.			

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS

STREAM NAME MPTA	LOCATION Harwood MD
STATION # _____ REACH ID# _____	STREAM CLASS Perennial
UTM N _____ UTM E	RIVER BASIN Patuxent
STORET #	AGENCY CE
INVESTIGATORS KB/JT	
FORM COMPLETED BY JT	DATE 4/6/16 TIME 1:00 (PM)
REASON FOR SURVEY MBSS	

Parameters to be evaluated in sampling reach

Habitat Parameter	Condition Category			
	Optimal	Suboptimal	Marginal	Poor
1. Epifaunal Substrate/ Available Cover	Greater than 50% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient).	30-50% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale).	10-30% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 10% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
SCORE 9	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
2. Pool Substrate Characterization	Mixture of substrate materials, with gravel and firm sand prevalent; root mats and submerged vegetation common.	Mixture of soft sand, mud, or clay; mud may be dominant; some root mats and submerged vegetation present.	All mud or clay or sand bottom; little or no root mat; no submerged vegetation.	Hard-pan clay or bedrock; no root mat or vegetation.
SCORE 10	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
3. Pool Variability	Even mix of large-shallow, large-deep, small-shallow, small-deep pools present.	Majority of pools large-deep; very few shallow.	Shallow pools much more prevalent than deep pools.	Majority of pools small-shallow or pools absent.
SCORE 8	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
4. Sediment Deposition	Little or no enlargement of islands or point bars and less than <20% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 20-50% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 50-80% of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; more than 80% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
SCORE 8	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
5. Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills >75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
SCORE 10	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0

US

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS

Parameters to be evaluated broader than sampling reach

Habitat Parameter	Condition Category			
	Optimal	Suboptimal	Marginal	Poor
6. Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr) may be present, but recent channelization is not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.
SCORE 18	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
7. Channel Sinuosity	The bends in the stream increase the stream length 3 to 4 times longer than if it was in a straight line. (Note - channel braiding is considered normal in coastal plains and other low-lying areas. This parameter is not easily rated in these areas.)	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	Channel straight; waterway has been channelized for a long distance.
SCORE 12	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
8. Bank Stability (score each bank)	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.
SCORE 6 (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE 6 (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0
9. Vegetative Protection (score each bank) Note: determine left or right side by facing downstream.	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
SCORE 7 (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE 7 (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0
10. Riparian Vegetative Zone Width (score each bank riparian zone)	Width of riparian zone >18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone.	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6-12 meters; human activities have impacted zone a great deal.	Width of riparian zone <6 meters: little or no riparian vegetation due to human activities.
SCORE 10 (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE 10 (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0

76

Total Score 121

v. 2009

MBSS SPRING HABITAT DATA SHEET

Page 1 of 7

SITE — Watershed Code: MP | Segment: 71A | Type: 3 | Year: 2016 | QC

Reviewer: First KB / Second JT

DATE — Year: 16 | Month: 04 | Day: 06

590 Dist. from Nearest Road to Site (m)

15 Trash Rating 0 - 20

LANDUSE (Y/N)

N	Old Field	Y	Residential
Y	Deciduous Forest	N	Commercial/Industrial
N	Coniferous Forest	Y	Cropland
N	Wetland	Y	Pasture
N	Surface Mine	N	Orchard/Vineyard/Nursery
N	Landfill	N	Golf Course

RIPARIAN VEGETATION
(facing upstream)

	LEFT BANK	RIGHT BANK
Width (50m max)	50	15
Adjacent Land Cover	FA	HA
Vegetation Type	Y R M L	Y R M L
Buffer Breaks (Y/N)	M	N

ROAD CULVERT

Present in Segment (Y/N): N

Sampleable? (Y/N):

Width of Culvert (m):

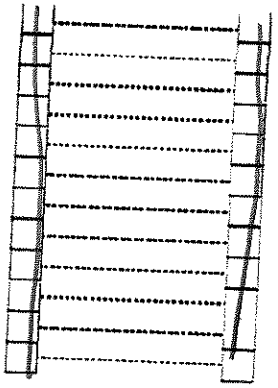
Length of Culvert (m):

STREAM GRADIENT

	Elevation (m)	Height (m)
1		
2		
3		

LEFT BANK / RIGHT BANK

Storm Drain
Tile Drain
Impervious Drainage
Gully
Orchard
Crop
Pasture
New Construction
Dirt Road
Gravel Road
Raw Sewage
Railroad



Buffer Break Types
(M = minor; S = severe)

CHANNELIZATION

N Evidence of Channel Straightening or Dredging (Y/N)

TYPE	EXTENT (m) LEFT BANK	BOTTOM	RIGHT BANK
Concrete			
Gabion			
Rip-Rap			
Earthen Berm		N/A	
Dredge Spoil Off Channel		N/A	
Pipe Culvert			

Actual Coordinates
(If >30m distance between original coordinates and stream)

Lat

Lon

Stream Block Ht. (m)

Stream Block Type

Lat

Lon

v. 2009

MBSS SPRING INDEX PERIOD DATA SHEET

Page 2 of 7

SITE: Watershed Code MP | Segment 711A | Type 3 | Year 2016 — QC

Reviewer: First KB / Second JT

DATE: Year 16 | Month 04 | Day 06

CREW: KB/JT

STREAM: Trib to Rock Branch

TIME: 1330 (Military)

LOCALITY: Harwood, MD

SAMPLEABILITY

- ✓ Benthos
- ✓ Habitat Assessment
- ✓ Water Quality
- Vernal Pool [A] (PRESENT/ABSENT)

OTHER (SPECIFY)

SITE ACCESS ROUTE

Farm road off Barn Place, thru field to woods

SAMPLE LABELS

Verified by: KB

QC LABEL

Watershed Code MP | Segment 711A (Letters only) | Type 3 | Year 2016

Dup. (D) or Blank (B): D Verified by: KB

TEMP. LOGGER

	(Y/N)	(TIME - Military)	#
WATER			#
AIR			#

LOCATION

PHOTODOCUMENTATION

Number	Title	Voucher (Y/N)
	M - US/DS	
	D - US/DS	
	U - US/DS	

BENTHIC HABITAT SAMPLED

- 02 Riffle
- 10 Rootwad/Woody Debris
- 08 Leaf Pack
- Macrophytes
- Undercut Banks
- Other

SAMPLING CONSID.: (NUM. ANODES)

STREAM WIDTH (m): 0 m | 75 m

v. 2009

MBSS SPRING FAUNA DATA SHEET

SITE Watershed Code: MP | Segment: 7 1 A (QC) | Type: 3 | Year: 2016

Reviewer: First: MB / Second: JT

HERPETOFAUNA

☒ None Observed

Species	Lifestage (Adult, Juv., Larval, Egg)	SEEN (Y/N)	HEARD (Y/N)	NUMBER RETAINED	NUMBER PHOTOS TAKEN
	☐ ☐ ☐ ☐	☐	☐	☐	☐
	☐ ☐ ☐ ☐	☐	☐	☐	☐
	☐ ☐ ☐ ☐	☐	☐	☐	☐
	☐ ☐ ☐ ☐	☐	☐	☐	☐
	☐ ☐ ☐ ☐	☐	☐	☐	☐
	☐ ☐ ☐ ☐	☐	☐	☐	☐
	☐ ☐ ☐ ☐	☐	☐	☐	☐

MUSSELS

☒ None Observed

Species	LIVE	DEAD	NUMBER RETAINED	NUMBER PHOTOS TAKEN
	☐	☐	☐☐	☐
	☐	☐	☐☐	☐
	☐	☐	☐☐	☐
	☐	☐	☐☐	☐
	☐	☐	☐☐	☐

Corbicula: LIVE ☐ DEAD ☐ NONE ☐

CRAYFISHES

☑ None Observed

Species	NUMBER RETAINED
	☐☐
	☐☐
	☐☐
	☐☐
	☐☐

Crayfish Burrows ☐
(Absent, Present, Extensive)

COMMENTS

Physical Habitat Assessment and Water Quality Data Sheet

Site ID: MP 71A-QC
Subwatershed: Mack Branch
Length of Reach: 75m **Date:** 4/6/16
Team Members: KR/ST **Time:** 1350

Weather
Current: Sunny, 50°F
Past 24hrs: sunny, 50°F
Past 48hrs: rain showers, 50°F

Parameter	Down-stream	Mid-stream	Up-stream
Description			
pH	6.53	6.47	6.36
Temperature (°C)	11.6	11.5	11.3
DO (mg/l)	11.3	11.66	11.29
Conductivity (uS/cm)	130.2	130.5	134.8
TDS (mg/l)	115.75	114.4	115.7
Turbidity (NTU)	15.1	7.1	12.2

Notes: Barometer 776.3 mm Hg

Stream Character

P Meandering	A Channelized	
A Braided	A Straight	
P Riffle	P Run/Glide	
A Deep Pool >.5m	P Silt/Clay	
P Shallow Pool <.5m	P Sand	
P Gravel	P Cobble	
A Boulder >2m	A Boulder <2m	
A Concrete/Gabion	A Bedrock	
A Undercut Bank	A Rootwad	
P Overhead Cover	A Storm Drain	
A Effluent Discharge	A Human Refuse	
P Emergent Vegetation	A Beaver Pond	
A Floating Vegetation		

A=Absent P=Present E=Extensive

Bar Formation
☑ None ☐ Moderate
☐ Minor ☐ Extensive

Bank Erosion (see guidance sheet)

	Left Bank	Right Bank	Severity:
Extent (m)	50	75	
Severity	1	1	0=none
Avg. Height	0.5m	0.5m	1=min
			2=mod
Maximum stream depth (cm)	45		3=severe

Benthic Habitat Sampled (20 total)	Sq. ft.
Riffle	4
Rootwad/Woody Debris	10
Leaf Pack	6
Submerged Vegetation	8
Undercut Banks	6
Other:	6

Rootwads/Woody Debris

# Instream Woody Debris	4
# Dewatered Woody Debris	5
# Instream Rootwads	1
# Dewatered Rootwads	5

Stream Gradient

Location (ft)	Height (ft)	Water Depth (ft)

Photographs/Observations:
M - US/DS
U - US/DS
D - US/DS

MBSS Physical Habitat Assessment Sheet

Stream Habitat Assessment Guidance Sheet				
Habitat Parameter	Optimal 16-20	Sub-Optimal 11-15	Marginal 6-10	Poor 0-5
1. Instream Habitat[1] SCORE 9	Greater than 50% of a variety of cobble, boulder, submerged logs, undercut banks, snags, rootwads, aquatic plants or other stable habitat	30-50% of stable habitat. Adequate habitat	10-30% mix of stable habitat. Habitat availability less than desireable	Less than 10% stable habitat. Lack of habitat is obvious
2. Epifaunal Substrate[2] SCORE 5	Preferred substrate abundant, stable, and at full colonization potential (riffles well developed and dominated by cobble; and/or woody debris prevalent, not new; and not transient	Abund. of cobble with gravel and/or boulders common; or woody debris, aquatic veg., undercut banks common but not prevalent/suited for full colonization	Large boulders and/or bedrock prevalent; cobble, woody debris, or other preferred surfaces uncommon	Stable substrate lacking; or particles are over 75% surrounded by fine sediment or flocculent material
3. Velocity/Depth Diversity[3] SCORE 11	Slow (<0.3m/s), deep (>0.5m); slow, shallow (<0.5m); fast (>0.3m/s), deep; fast, shallow habitats all present	Only 3 of the 4 habitat categories present	Only 2 of the 4 habitat categories present	Dominated by 1 velocity/depth category (usually pools)
4. Pool/Glide/Eddy Quality[4] SCORE 7	Complex cover/&/or depth >1.5m; both deep (>0.5m)/shallows (<0.2m) present	Deep (>0.5m) areas present; but only moderate cover	Shallows (<0.2m) prevalent in pool/glide/eddy habitat; little cover	Max depth <0.2m in pool/glide/eddy habitat; or absent completely
5. Riffle/Run Quality[5] SCORE 7	Riffle/run depth generally >10cm, with maximum depth greater than 50 cm (maximum score); substrate stable (e.g. cobble, boulder) & variety of current velocities	Riffle/run depth generally 5-10cm, variety of current velocities	Riffle/run depth generally 1-5cm; primarily a single current velocity	Riffle/run depth <1cm; or riffle/run substrates concreted
6. Bank Stability[6] (facing downstream.) Score each bank LB SCORE 2 RB SCORE 4	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected. 10 9	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion. 8 7 6	Moderately unstable; 30-60% of bank in reach as areas of erosion; high erosion potential during floods. 5 4 3	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars. 2 1 0
7. Embeddedness SCORE 75 %	Percentage that gravel, cobble, and boulder particles are surrounded by fine sediment or flocculent material			
8. Shading SCORE 75 %	Percentage of segment that is shaded (duration is considered in scoring). 0% = fully exposed to sunlight all day in summer; 100% = fully and densely shaded all day in summer			
9. Riparian Buffer Zone Width (m)[7] LB 15 RB 30	Zone width in which human activity is not evident. 50m (164ft) is the maximum recorded value.			
10. Remoteness[8] SCORE 16	Roads greater than 400 meters (0.25 mi) from stream	Roads within 400 meters (0.25 mi) of stream; stream NOT accessible by trail.	Roads within 400 meters (0.25 mi) of stream; stream accessible by trail.	Roads adjacent to stream.
11. Aesthetic (trash) Rating[9] SCORE 13	Little or no human refuse visible from stream channel or riparian zone	Refuse present in minor amounts	Refuse present in moderate amounts	Refuse abundant and unsightly
12. Number of Woody Debris and Rootwads[10] SCORE 5	Count only woody debris and rootwads within the wetted portion of the sampling segment. Count only woody debris >10cm (4in) diameter and >1.5m (5ft) long and rootwads with trunk diameter (at chest height) >15cm (6in) that are functional habitat within the wetted portion of the stream.			

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS

STREAM NAME MD71A - QC	LOCATION Harwood, MD
STATION # _____ REACH ID# _____	STREAM CLASS Perennial
UTM N _____ UTM E	RIVER BASIN Patuxent
STORET #	AGENCY CE1
INVESTIGATORS NB/JT	
FORM COMPLETED BY NB	DATE 4/6/16 TIME 1330 PM
REASON FOR SURVEY MBSS	

Parameters to be evaluated in sampling reach

Habitat Parameter	Condition Category			
	Optimal	Suboptimal	Marginal	Poor
1. Epifaunal Substrate/ Available Cover	Greater than 50% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient).	30-50% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale).	10-30% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 10% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
SCORE 8	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
2. Pool Substrate Characterization	Mixture of substrate materials, with gravel and firm sand prevalent; root mats and submerged vegetation common.	Mixture of soft sand, mud, or clay; mud may be dominant; some root mats and submerged vegetation present.	All mud or clay or sand bottom; little or no root mat; no submerged vegetation.	Hard-pan clay or bedrock; no root mat or vegetation.
SCORE 9	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
3. Pool Variability	Even mix of large-shallow, large-deep, small-shallow, small-deep pools present.	Majority of pools large-deep; very few shallow.	Shallow pools much more prevalent than deep pools.	Majority of pools small-shallow or pools absent.
SCORE 8	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
4. Sediment Deposition	Little or no enlargement of islands or point bars and less than <20% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 20-50% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 50-80% of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; more than 80% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
SCORE 8	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
5. Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills >75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
SCORE 13	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0

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Form # EL - _____

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS

Parameters to be evaluated broader than sampling reach

Habitat Parameter	Condition Category			
	Optimal	Suboptimal	Marginal	Poor
6. Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr) may be present, but recent channelization is not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.
SCORE 16	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
7. Channel Sinuosity	The bends in the stream increase the stream length 3 to 4 times longer than if it was in a straight line. (Note - channel braiding is considered normal in coastal plains and other low-lying areas. This parameter is not easily rated in these areas.)	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	Channel straight; waterway has been channelized for a long distance.
SCORE 11	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
8. Bank Stability (score each bank)	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.
SCORE 2 (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE 4 (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0
9. Vegetative Protection (score each bank) Note: determine left or right side by facing downstream.	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
SCORE 2 (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE 4 (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0
10. Riparian Vegetative Zone Width (score each bank riparian zone)	Width of riparian zone >18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone.	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6-12 meters; human activities have impacted zone a great deal.	Width of riparian zone <6 meters: little or no riparian vegetation due to human activities.
SCORE 7 (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE 9 (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0

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Total Score 103

v. 2009

MBSS SPRING HABITAT DATA SHEET

Page 1 of 7

SITE — Watershed Code: NP | Segment: 79A | Type: 1 | Year: 2016

Reviewer: First: KB / Second: JT

DATE — Year: 16 | Month: 04 | Day: 22

40 Dist. from Nearest Road to Site (m)

10 Trash Rating 0 - 20

LANDUSE (Y/N)

N	Old Field	Y	Residential
Y	Deciduous Forest	N	Commercial/Industrial
N	Coniferous Forest	N	Cropland
N	Wetland	N	Pasture
N	Surface Mine	N	Orchard/Vineyard/Nursery
N	Landfill	N	Golf Course

ROAD CULVERT

Present in Segment (Y/N): N

Sampleable? (Y/N):

Width of Culvert (m):

Length of Culvert (m):

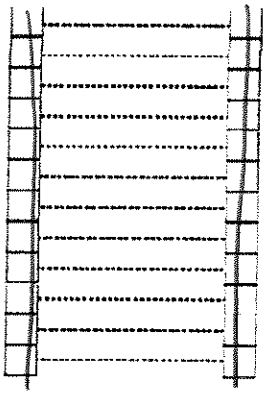
STREAM GRADIENT

	Location (m)	Height (m)
1		
2		
3		

RIPARIAN VEGETATION
(facing upstream)

	LEFT BANK	RIGHT BANK
Width (50m max)	50	50
Adjacent Land Cover	HD	FR
Vegetation Type	YMRG	YMRG
Buffer Breaks (Y/N)	N	N

	LEFT BANK	RIGHT BANK
Storm Drain		
Tile Drain		
Impervious Drainage		
Gully		
Orchard		
Crop		
Pasture		
New Construction		
Dirt Road		
Gravel Road		
Raw Sewage		
Railroad		



Buffer Break Types
(M = minor; S = severe)

CHANNELIZATION

N Evidence of Channel Straightening or Dredging (Y/N)

TYPE	EXTENT (m)		
	LEFT BANK	BOTTOM	RIGHT BANK
Concrete			
Gebion			
Rip-Rap			
Earthen Berm		N/A	
Dredge Spoil Off Channel		N/A	
Pipe Culvert			

Actual Coordinates
(If >30m distance between original coordinates and stream)

Lat:

Lon:

Stream Block Ht. (m):

Stream Block Type:

Lat:

Lon:

v. 2009

MBSS SPRING INDEX PERIOD DATA SHEET

SITE Watershed Code MP | Segment 79A | Type 1 | Year 2016

Reviewer: First KB / Second JT

DATE Year 16 Month 04 Day 22

CREW: KB/JT

STREAM: Tab to Fem Br.

TIME 1330 (Military)

LOCALITY: Lothian, MD

SAMPLEABILITY

- [1] Benthos
- [1] Habitat Assessment
- [1] Water Quality
- [ ] Vernal Pool [A] (PRESENT/ABSENT)

OTHER (SPECIFY)

SITE ACCESS ROUTE

Driveway to stream crossing. Enter woods to east past Tab confluence.

SAMPLE LABELS

Verified by: KB

QC LABEL

Watershed Code MP | Segment 79A (Letters only) | Type 1 | Year 2016

Dup. (D) or Blank (B): [ ] Verified by: _____

TEMP. LOGGER

	(Y/N)	(TIME - Military)	
WATER	[ ]	[ ][ ][ ][ ]	# [ ][ ][ ][ ][ ][ ][ ]
AIR	[ ]	[ ][ ][ ][ ]	# [ ][ ][ ][ ][ ][ ][ ]

LOCATION _____

PHOTODOCUMENTATION

Number	Title	Voucher (Y/N)
[ ][ ][ ][ ]	H-US/DS	[ ]
[ ][ ][ ][ ]	D-US/DS	[ ]
[ ][ ][ ][ ]	V-US/DS	[ ]
[ ][ ][ ][ ]		[ ]
[ ][ ][ ][ ]		[ ]
[ ][ ][ ][ ]		[ ]
[ ][ ][ ][ ]		[ ]
[ ][ ][ ][ ]		[ ]

BENTHIC HABITAT SAMPLED

[1][1]	Riffle	[0][3]	Leaf Pack	[ ][0]	Undercut Banks
[0][6]	Rootwad/Woody Debris	[ ][0]	Macrophytes	[ ][0]	Other _____

SAMPLING CONSID.: ([ ] NUM. ANODES) _____

STREAM WIDTH (m) [ ][ ][ ][ ] 0 m [ ][ ][ ][ ] 75 m

v. 2009

MBSS SPRING FAUNA DATA SHEET

SITE Watershed Code [ ][ ][M][P] Segment [7][9][A] Type [1] Year [2][0][1][6]

Reviewer: First KB / Second JT

HERPETOFAUNA

☐ None Observed

Species	Lifestage (Adult, Juv, Larval, Egg)	SEEN (Y/N)	HEARD (Y/N)	NUMBER RETAINED	NUMBER PHOTOS TAKEN
Green/Gray tree frog	☐☐☐☐	N	Y	0	0
	☐☐☐☐	☐	☐	☐	☐
	☐☐☐☐	☐	☐	☐	☐
	☐☐☐☐	☐	☐	☐	☐
	☐☐☐☐	☐	☐	☐	☐
	☐☐☐☐	☐	☐	☐	☐
	☐☐☐☐	☐	☐	☐	☐

MUSSELS

☑ None Observed

Species	LIVE	DEAD	NUMBER RETAINED	NUMBER PHOTOS TAKEN
	☐	☐	☐☐	☐
	☐	☐	☐☐	☐
	☐	☐	☐☐	☐
	☐	☐	☐☐	☐
	☐	☐	☐☐	☐

Corbicula LIVE ☐ DEAD ☐ NONE ☐

CRAYFISHES

☑ None Observed

Species	NUMBER RETAINED
	☐☐
	☐☐
	☐☐
	☐☐
	☐☐

Crayfish Burrows [A]
(Absent, Present, Extensive)

COMMENTS

Physical Habitat Assessment and Water Quality Data Sheet

Site ID: MP79A
Subwatershed: Ferry Branch
Length of Reach: 75m **Date:** 4/22/16
Team Members: KB/ST **Time:** 1330

Weather
Current: Cloudy, 70°
Past 24hrs: Sunny, 75°
Past 48hrs: Sunny, 75°

Stream Character

- [P] Meandering
- [A] Braided
- [P] Riffle
- [A] Deep Pool >.5m
- [P] Shallow Pool <.5m
- [P] Gravel
- [A] Boulder >2m
- [A] Concrete/Gabion
- [E] Undercut Bank
- [P] Overhead Cover
- [A] Effluent Discharge
- [A] Emergent Vegetation
- [A] Floating Vegetation
- [A] Channelized
- [A] Straight
- [P] Run/Glide
- [P] Silt/Clay
- [P] Sand
- [P] Cobble
- [A] Boulder <2m
- [A] Bedrock
- [A] Rootwad
- [A] Storm Drain
- [P] Human Refuse
- [A] Beaver Pond

A=Absent P=Present E=Extensive

Parameter	Down-stream	Mid-stream	Up-stream
Description			
pH	6.99	7.12	6.96
Temperature (°C)	16.1	16.1	16.2
DO (mg/l)	10.52	10.78	9.47
Conductivity (uS/cm)	150.3	150.5	151.6
TDS (mg/l)	117.65	118.3	118.95
Turbidity (NTU)	7.26	8.95	5.5

Notes:

Bar Formation

- [ ] None
- [x] Minor
- [ ] Moderate
- [ ] Extensive

Bank Erosion (see guidance sheet)

	Left Bank	Right Bank
Extent (m)	75	75
Severity	3	3
Avg. Height	91	91

Severity: 0=none 1=min 2=mod 3=severe

Maximum stream depth (cm) 30

Benthic Habitat Sampled (20 total)

	Sq. ft.
Riffle	11
Rootwad/Woody Debris	6
Leaf Pack	3
Submerged Vegetation	
Undercut Banks	
Other:	

Rootwads/Woody Debris

# Instream Woody Debris	5
# Dewatered Woody Debris	3
# Instream Rootwads	0
# Dewatered Rootwads	5

Stream Gradient

Location (ft)	Height (ft)	Water Depth (ft)

Photographs/Observations:
M - US/DS
D - US/DS
U - US/DS

MBSS Physical Habitat Assessment Sheet

Stream Habitat Assessment Guidance Sheet				
Habitat Parameter	Optimal 16-20	Sub-Optimal 11-15	Marginal 6-10	Poor 0-5
1. Instream Habitat* SCORE 11	Greater than 50% of a variety of cobble, boulder, submerged logs, undercut banks, snags, rootwads, aquatic plants or other stable habitat	30-50% of stable habitat. Adequate habitat	10-30% mix of stable habitat. Habitat availability less than desireable	Less than 10% stable habitat. Lack of habitat is obvious
2. Epifaunal Substrate* SCORE 13	Preferred substrate abundant, stable, and at full colonization potential (riffles well developed and dominated by cobble; and/or woody debris prevalent, not new, and not transient	Abund. of cobble with gravel and/or boulders common; or woody debris, aquatic veg., undercut banks common but not prevalent/suited for full colonization	Large boulders and/or bedrock prevalent; cobble, woody debris, or other preferred surfaces uncommon	Stable substrate lacking; or particles are over 75% surrounded by fine sediment or flocculent material
3. Velocity/Depth Diversity* SCORE 13	Slow (<0.3m/s), deep (>0.5m); slow, shallow (<0.5m); fast (>0.3m/s), deep; fast, shallow habitats all present	Only 3 of the 4 habitat categories present	Only 2 of the 4 habitat categories present	Dominated by 1 velocity/depth category (usually pools)
4. Pool/Glide/Eddy Quality* SCORE 10	Complex cover&/or depth >1.5m; both deep (>0.5m)/shallows (<0.2m) present.	Deep (>0.5m) areas present; but only moderate cover	Shallows (<0.2m) prevalent in pool/glide/eddy habitat; little cover	Max depth <0.2m in pool/glide/eddy habitat; or absent completely
5. Riffle/Run Quality* SCORE 11	Riffle/run depth generally >10cm, with maximum depth greater than 50 cm (maximum score); substrate stable (e.g. cobble, boulder) & variety of current velocities	Riffle/run depth generally 5-10cm, variety of current velocities	Riffle/run depth generally 1-5cm; primarily a single current velocity	Riffle/run depth <1cm; or riffle/run substrates concreted
6. Bank Stability* (facing downstream) Score each bank LB SCORE 1 RB SCORE 1	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected. 10 9	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion. 8 7 6	Moderately unstable; 30-60% of bank in reach as areas of erosion; high erosion potential during floods. 5 4 3	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars. 2 1 0
7. Embeddedness SCORE 50 %	Percentage that gravel, cobble, and boulder particles are surrounded by fine sediment or flocculent material			
8. Shading SCORE 80 %	Percentage of segment that is shaded (duration is considered in scoring). 0% = fully exposed to sunlight all day in summer; 100% = fully and densely shaded all day in summer			
9. Riparian Buffer Zone Width (m)* LB 50 RB 50	Zone width in which human activity is not evident. 50m (164ft) is the maximum recorded value.			
10. Remoteness* SCORE 5	Roads greater than 400 meters (0.25 mi) from stream	Roads within 400 meters (0.25 mi) of stream; stream NOT accessible by trail.	Roads within 400 meters (0.25 mi) of stream; stream accessible by trail.	Roads adjacent to stream.
11. Aesthetic (trash) Rating* SCORE 10	Little or no human refuse visible from stream channel or riparian zone	Refuse present in minor amounts	Refuse present in moderate amounts	Refuse abundant and unsightly
12. Number of Woody Debris and Rootwads* SCORE 5	Count only woody debris and rootwads within the wetted portion of the sampling segment. Count only woody debris >10cm (4in) diameter and >1.5m (5ft) long and rootwads with trunk diameter (at chest height) >15cm (6in) that are functional habitat within the wetted portion of the stream.			

X's driveway

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS

STREAM NAME MP79A		LOCATION Lothian, MD	
STATION #	REACH ID#	STREAM CLASS Perennial	
UTM N	UTM E	RIVER BASIN Patuxent	
STORET #		AGENCY CEI	
INVESTIGATORS KB / JT			
FORM COMPLETED BY KB	DATE 4/22/16 TIME - 1345 PM	REASON FOR SURVEY MBSS	

Parameters to be evaluated in sampling reach

Habitat Parameter	Condition Category			
	Optimal	Suboptimal	Marginal	Poor
1. Epifaunal Substrate/ Available Cover	Greater than 50% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient).	30-50% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale).	10-30% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 10% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
SCORE 14	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
2. Pool Substrate Characterization	Mixture of substrate materials, with gravel and firm sand prevalent; root mats and submerged vegetation common.	Mixture of soft sand, mud, or clay; mud may be dominant; some root mats and submerged vegetation present.	All mud or clay or sand bottom; little or no root mat; no submerged vegetation.	Hard-pan clay or bedrock; no root mat or vegetation.
SCORE 16	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
3. Pool Variability	Even mix of large-shallow, large-deep, small-shallow, small-deep pools present.	Majority of pools large-deep; very few shallow.	Shallow pools much more prevalent than deep pools.	Majority of pools small-shallow or pools absent.
SCORE 10	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
4. Sediment Deposition	Little or no enlargement of islands or point bars and less than <20% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 20-50% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 50-80% of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; more than 80% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
SCORE 10	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
5. Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills >75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
SCORE 9	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0

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Form # EL - _____

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS

Parameters to be evaluated broader than sampling reach

Habitat Parameter	Condition Category			
	Optimal	Suboptimal	Marginal	Poor
6. Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr) may be present, but recent channelization is not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.
SCORE 17	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
7. Channel Sinuosity	The bends in the stream increase the stream length 3 to 4 times longer than if it was in a straight line. (Note - channel braiding is considered normal in coastal plains and other low-lying areas. This parameter is not easily rated in these areas.)	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	Channel straight; waterway has been channelized for a long distance.
SCORE 14	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
8. Bank Stability (score each bank)	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.
SCORE 2 (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE 2 (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0
9. Vegetative Protection (score each bank) Note: determine left or right side by facing downstream.	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
SCORE 2 (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE 2 (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0
10. Riparian Vegetative Zone Width (score each bank riparian zone)	Width of riparian zone >18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone.	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6-12 meters; human activities have impacted zone a great deal.	Width of riparian zone <6 meters: little or no riparian vegetation due to human activities.
SCORE 9 (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE 9 (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0

57

Total Score 116

v. 2009

MBSS SPRING HABITAT DATA SHEET

SITE — Watershed Code: NP | Segment: 86A | Type: 2 | Year: 2010

Reviewer: First: KB / Second: JA

DATE — Year: 10 | Month: 04 | Day: 14

400 Dist. from Nearest Road to Site (m)

12 Trash Rating 0 - 20

LANDUSE (Y/N)

N	Old Field	Y	Residential
Y	Deciduous Forest	N	Commercial/Industrial
N	Coniferous Forest	N	Cropland
N	Wetland	N	Pasture
N	Surface Mine	N	Orchard/Vineyard/Nursery
N	Landfill	N	Golf Course

RIPARIAN VEGETATION
(facing upstream)

	LEFT BANK	RIGHT BANK
Width (50m max)	50	50
Adjacent Land Cover	HO	HO
Vegetation Type	YRMG	YRMG
Buffer Breaks (Y/N)	N	N

ROAD CULVERT

Present in Segment (Y/N): N

Sampleable? (Y/N):

Width of Culvert (m):

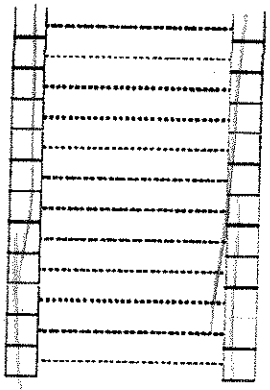
Length of Culvert (m):

STREAM GRADIENT

	Location (m)	Height (m)
1		
2		
3		

LEFT BANK / RIGHT BANK

Storm Drain
Tile Drain
Impervious Drainage
Gully
Orchard
Crop
Pasture
New Construction
Dirt Road
Gravel Road
Raw Sewage
Railroad



Buffer Break Types
(M = minor; S = severe)

CHANNELIZATION

N Evidence of Channel Straightening or Dredging (Y/N)

TYPE	EXTENT (m)		
	LEFT BANK	BOTTOM	RIGHT BANK
Concrete			
Gabion			
Rip-Rap			
Earthen Berm		N/A	
Dredge Spoil Off Channel		N/A	
Pipe Culvert			

Actual Coordinates
(if >30m distance between original coordinates and stream)

Lat
Lon

Stream Block Ht. (m)

Stream Block Type

Lat
Lon

v. 2009

MBSS SPRING INDEX PERIOD DATA SHEET

SITE — Watershed Code: MP | Segment: 86A | Type: 2 | Year: 2016

Reviewer: First KB / Second JA

DATE — Year: 16 | Month: 04 | Day: 14

CREW: KB/JA

STREAM: MP86A

TIME: 1345 (Military)

LOCALITY: Lothian, MD

SAMPLEABILITY

- [x] Benthos
- [x] Habitat Assessment
- [x] Water Quality
- [ ] Vernal Pool — A (PRESENT/ABSENT)

OTHER (SPECIFY)

SITE ACCESS ROUTE

SAMPLE LABELS

Verified by: KB

QC LABEL

Watershed Code: MP | Segment: 86A (Letters only) | Type: 2 | Year: 2016

Dup. (D) or Blank (B): ___ Verified by: ___

TEMP. LOGGER

	(Y/N)	(TIME - Military)	#
WATER			
AIR			

LOCATION

PHOTODOCUMENTATION

Number	Title	Voucher (Y/N)
	M-US/DS	
	D-US/DS	
	U-US/DS	

BENTHIC HABITAT SAMPLED

04	Riffle	10	Leaf Pack	00	Undercut Banks
06	Rootwad/Woody Debris	00	Macrophytes	05	Other

SAMPLING CONSID.: (NUM. ANODES)

STREAM WIDTH (m) — 0 m: ___ 75 m: ___

v. 2009

MBSS SPRING FAUNA DATA SHEET

SITE — Watershed Code: MP | Segment: 846A | Type: 2 | Year: 2016

Reviewer: First: KB / Second: JA

HERPETOFAUNA

☐ None Observed

Species	Lifestage: Adult	Lifestage: Juv.	Lifestage: Larval	Lifestage: Egg	SEEN (Y/N)	HEARD (Y/N)	NUMBER RETAINED	NUMBER PHOTOS TAKEN
unknown frog x2	☐	☑	☐	☐	Y	N	0	0
salamander x2 - N. two-lined	☐	☑	☐	☐	Y	N	0	0
	☐	☐	☐	☐	☐	☐	☐	☐
	☐	☐	☐	☐	☐	☐	☐	☐
	☐	☐	☐	☐	☐	☐	☐	☐
	☐	☐	☐	☐	☐	☐	☐	☐
	☐	☐	☐	☐	☐	☐	☐	☐

MUSSELS

☒ None Observed

Species	LIVE	DEAD	NUMBER RETAINED	NUMBER PHOTOS TAKEN
	☐	☐	☐☐	☐
	☐	☐	☐☐	☐
	☐	☐	☐☐	☐
	☐	☐	☐☐	☐
	☐	☐	☐☐	☐

Corbicula — LIVE ☐ DEAD ☐ NONE ☐

CRAYFISHES

☒ None Observed

Species	NUMBER RETAINED
	☐☐
	☐☐
	☐☐
	☐☐
	☐☐

Crayfish Burrows ☒ P

(Absent, Present, Extensive)

COMMENTS

Physical Habitat Assessment and Water Quality Data Sheet

Site ID: MP810A
Subwatershed: Ferry Branch 3
Length of Reach: 75m Date: 4/14/10
Team Members: KB/JA Time: 1:45 pm

Weather
Current: Sunny 60°
Past 24hrs: Sunny 60°
Past 48hrs: Sunny 100° some rain

Stream Character

- P Meandering
- A Braided
- P Riffle
- A Deep Pool >.5m
- P Shallow Pool <.5m
- P Gravel
- A Boulder >2m
- A Concrete/Gabion
- P Undercut Bank
- P Overhead Cover
- A Effluent Discharge
- A Emergent Vegetation
- P Floating Vegetation
- A Channelized
- A Straight
- P Run/Glide
- E Silt/Clay
- P Sand
- A Cobble
- A Boulder <2m
- A Bedrock
- Rootwad
- A Storm Drain
- P Human Refuse
- A Beaver Pond

A=Absent P=Present E=Extensive

Parameter	Down-stream	Mid-stream	Up-stream
Description			
pH	6.73	7.42	10.58
Temperature (°C)	14.7	14.6	14.5
DO (mg/l)	10.62	10.48	9.07
Conductivity (uS/cm)	248	203.4	307.1
TDS (mg/l)	200.2	165.1	249.6
Turbidity (NTU)	72.2	9.16	13

Notes: ___

Bar Formation

- [x] None
- [ ] Minor
- [ ] Moderate
- [ ] Extensive

Photographs/Observations:

M - 05/05
D - 05/05
U - 05/05

Bank Erosion (see guidance sheet)

	Left Bank	Right Bank
Extent (m)	75	75
Severity	1	1
Avg. Height (m)	30.5	30.5

Severity: 0=none 1=min 2=mod 3=severe

Maximum stream depth (cm) 12

12 × 2.54

2.54
× 2
5.08
+ 5.40
30.48

Benthic Habitat Sampled (20 total) Sq. ft.

	Sq. ft.
Riffle	4
Rootwad/Woody Debris	6
Leaf Pack	10
Submerged Vegetation	0
Undercut Banks	0
Other:	0

Rootwads/Woody Debris

# Instream Woody Debris	1
# Dewatered Woody Debris	2
# Instream Rootwads	0
# Dewatered Rootwads	2

Stream Gradient (crossed out)

Location (ft)	Height (ft)	Water Depth (ft)

MBSS Physical Habitat Assessment Sheet

Stream Habitat Assessment Guidance Sheet				
Habitat Parameter	Optimal 16-20	Sub-Optimal 11-15	Marginal 6-10	Poor 0-5
1. Instream Habitat* SCORE 11	Greater than 50% of a variety of cobble, boulder, submerged logs, undercut banks, snags, rootwads, aquatic plants or other stable habitat	30-50% of stable habitat. Adequate habitat	10-30% mix of stable habitat. Habitat availability less than desireable	Less than 10% stable habitat. Lack of habitat is obvious
2. Epifaunal Substrate* SCORE 5	Preferred substrate abundant, stable, and at full colonization potential (riffles well developed and dominated by cobble; and/or woody debris prevalent, not new, and not transient	Abund. of cobble with gravel and/or boulders common; or woody debris, aquatic veg., undercut banks common but not prevalent/suited for full colonization	Large boulders and/or bedrock prevalent; cobble, woody debris, or other preferred surfaces uncommon	Stable substrate lacking; or particles are over 75% surrounded by fine sediment or flocculent material
3. Velocity/Depth Diversity* SCORE 10	Slow (<0.3m/s), deep (>0.5m); slow, shallow (<0.5m); fast (>0.3m/s), deep; fast, shallow habitats all present	Only 3 of the 4 habitat categories present	Only 2 of the 4 habitat categories present	Dominated by 1 velocity/depth category (usually pools)
4. Pool/Glide/Eddy Quality* SCORE 7	Complex cover/& /or depth >1.5m; both deep (>0.5m)/shallows (<0.2m) present	Deep (>0.5m) areas present; but only moderate cover	Shallows (<0.2m) prevalent in pool/glide/eddy habitat; little cover	Max depth <0.2m in pool/glide/eddy habitat; or absent completely
5. Riffle/Run Quality* SCORE 8	Riffle/run depth generally >10cm, with maximum depth greater than 50 cm (maximum score); substrate stable (e.g. cobble, boulder) & variety of current velocities	Riffle/run depth generally 5-10cm, variety of current velocities	Riffle/run depth generally 1-5cm; primarily a single current velocity	Riffle/run depth <1cm; or riffle/run substrates concreted
6. Bank Stability* (facing downstream.) Score each bank LB SCORE 4 RB SCORE 4	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected. 10 9	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion. 8 7 6	Moderately unstable; 30-60% of bank in reach as areas of erosion; high erosion potential during floods. 5 4 3	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars. 2 1 0
7. Embeddedness SCORE 75 %	Percentage that gravel, cobble, and boulder particles are surrounded by fine sediment or flocculent material			
8. Shading SCORE 80 %	Percentage of segment that is shaded (duration is considered in scoring). 0% = fully exposed to sunlight all day in summer; 100% = fully and densely shaded all day in summer			
9. Riparian Buffer Zone Width (m)* LB 25 RB 50	Zone width in which human activity is not evident. 50m (164ft) is the maximum recorded value.			
10. Remoteness* SCORE 8	Roads greater than 400 meters (0.25 mi) from stream	Roads within 400 meters (0.25 mi) of stream; stream NOT accessible by trail	Roads within 400 meters (0.25 mi) of stream; stream accessible by trail.	Roads adjacent to stream.
11. Aesthetic (trash) Rating* SCORE 14	Little or no human refuse visible from stream channel or riparian zone	Refuse present in minor amounts	Refuse present in moderate amounts	Refuse abundant and unsightly
12. Number of Woody Debris and Rootwads* SCORE 1	Count only woody debris and rootwads within the wetted portion of the sampling segment. Count only woody debris >10cm (4in) diameter and >1.5m (5ft) long and rootwads with trunk diameter (at chest height) >15cm (6in) that are functional habitat within the wetted portion of the stream.			

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS

STREAM NAME MP 86 A	LOCATION Lothian, MD
STATION # 86A REACH ID# _____	STREAM CLASS Perennial
UTM N_____ UTM E	RIVER BASIN Patuxent
STORET #	AGENCY CEI
INVESTIGATORS KB/JA	
FORM COMPLETED BY JA	DATE 4/14/10 TIME 1145 (PM)
REASON FOR SURVEY MBSS	

Parameters to be evaluated in sampling reach

Habitat Parameter	Condition Category			
	Optimal	Suboptimal	Marginal	Poor
1. Epifaunal Substrate/ Available Cover	Greater than 50% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient).	30-50% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale).	10-30% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 10% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
SCORE 8	20 19 18 17 16	15 14 13 12 11	10 9 (8) 7 6	5 4 3 2 1 0
2. Pool Substrate Characterization	Mixture of substrate materials, with gravel and firm sand prevalent; root mats and submerged vegetation common.	Mixture of soft sand, mud, or clay; mud may be dominant; some root mats and submerged vegetation present.	All mud or clay or sand bottom; little or no root mat; no submerged vegetation.	Hard-pan clay or bedrock; no root mat or vegetation.
SCORE 11	20 19 18 17 16	15 14 13 12 (11)	10 9 8 7 6	5 4 3 2 1 0
3. Pool Variability	Even mix of large-shallow, large-deep, small-shallow, small-deep pools present.	Majority of pools large-deep; very few shallow.	Shallow pools much more prevalent than deep pools.	Majority of pools small-shallow or pools absent.
SCORE 5	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	(5) 4 3 2 1 0
4. Sediment Deposition	Little or no enlargement of islands or point bars and less than <20% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 20-50% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 50-80% of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; more than 80% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
SCORE 8	20 19 18 17 16	15 14 13 12 11	10 9 (8) 7 6	5 4 3 2 1 0
5. Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills >75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
SCORE 13	20 19 18 17 16	15 14 (13) 12 11	10 9 8 7 6	5 4 3 2 1 0

45

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS

Parameters to be evaluated broader than sampling reach

Habitat Parameter	Condition Category			
	Optimal	Suboptimal	Marginal	Poor
6. Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr) may be present, but recent channelization is not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.
SCORE 18	20 19 (18) 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
7. Channel Sinuosity	The bends in the stream increase the stream length 3 to 4 times longer than if it was in a straight line. (Note - channel braiding is considered normal in coastal plains and other low-lying areas. This parameter is not easily rated in these areas.)	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	Channel straight; waterway has been channelized for a long distance.
SCORE 13	20 19 18 17 16	15 14 (13) 12 11	10 9 8 7 6	5 4 3 2 1 0
8. Bank Stability (score each bank)	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.
SCORE 5 (LB)	Left Bank 10 9	8 7 6	(5) 4 3	2 1 0
SCORE 5 (RB)	Right Bank 10 9	8 7 6	(5) 4 3	2 1 0
9. Vegetative Protection (score each bank) Note: determine left or right side by facing downstream.	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
SCORE 2 (LB)	Left Bank 10 9	8 7 6	5 4 3	(2) 1 0
SCORE 2 (RB)	Right Bank 10 9	8 7 6	5 4 3	(2) 1 0
10. Riparian Vegetative Zone Width (score each bank riparian zone)	Width of riparian zone >18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone.	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6-12 meters; human activities have impacted zone a great deal.	Width of riparian zone <6 meters: little or no riparian vegetation due to human activities.
SCORE 7 (LB)	Left Bank 10 9	8 (7) 6	5 4 3	2 1 0
SCORE 9 (RB)	Right Bank 10 (9)	8 7 6	5 4 3	2 1 0

Total Score 106

Form # EL2 - _____

v. 2009

MBSS SPRING HABITAT DATA SHEET

Page 1 of 7

SITE — Watershed Code: MP | Segment: 88A | Type: 1 | Year: 2010

Reviewer: First JS / Second JA

DATE — Year: 10 | Month: 04 | Day: 15

100 Dist. from Nearest Road to Site (m)

8 Trash Rating 0 - 20

LANDUSE (Y/N)

Y	Old Field	Y	Residential
Y	Deciduous Forest	N	Commercial/Industrial
N	Coniferous Forest	N	Cropland
N	Wetland	Y	Pasture
N	Surface Mine	N	Orchard/Vineyard/Nursery
N	Landfill	N	Golf Course

RIPARIAN VEGETATION
(facing upstream)

	LEFT BANK	RIGHT BANK
Width (50m max)	20	5
Adjacent Land Cover	AG	LN . FARM
Vegetation Type	YRGL	YRGL
Buffer Breaks (Y/N)	N	N

ROAD CULVERT

Present in Segment (Y/N): N

Sampleable? (Y/N):

Width of Culvert (m):

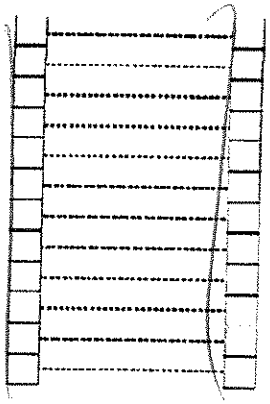
Length of Culvert (m):

STREAM GRADIENT

	Position (m)	Height (m)
1		
2		
3		

LEFT BANK / RIGHT BANK

Storm Drain
Tile Drain
Impervious Drainage
Gully
Orchard
Crop
Pasture
New Construction
Dirt Road
Gravel Road
Raw Sewage
Railroad



Buffer Break Types
(M = minor; S = severe)

CHANNELIZATION

N Evidence of Channel Straightening or Dredging (Y/N)

TYPE	EXTENT (m) LEFT BANK	BOTTOM	RIGHT BANK
Concrete			
Gabion			
Rip-Rap			
Earthen Berm		N/A	
Dredge Spoil Off Channel		N/A	
Pipe Culvert			

Actual Coordinates
(If >30m distance between original coordinates and stream)

Lat
Lon

Stream Block Ht. (m)

Stream Block Type

Lat
Lon

v. 2009

MBSS SPRING INDEX PERIOD DATA SHEET

SITE Watershed Code [ ][ ]MP Segment 88A Type 2 Year 2010

Reviewer: First JS / Second JA

DATE Year 10 Month 04 Day 15

CREW: JS/JA

STREAM:

TIME 1200 pm (Military)

LOCALITY:

SAMPLEABILITY

- [X] Benthos
- [X] Habitat Assessment
- [X] Water Quality
- [ ] Vernal Pool [A] (PRESENT/ABSENT)

OTHER (SPECIFY)

SITE ACCESS ROUTE

Road into woods, follow back until hit stream. midpoint is the force

SAMPLE LABELS

Verified by: JS

QC LABEL

Watershed Code [ ][ ]MP Segment 88A (Letters only) Type 2 Year 2010

Dup. (D) or Blank (B): [ ] Verified by:

TEMP. LOGGER

	(Y/N)	(TIME - Military)	#
WATER			#
AIR			#

LOCATION

PHOTODOCUMENTATION

Number	Title	Voucher (Y/N)

BENTHIC HABITAT SAMPLED

01	Riffle	19	Leaf Pack	00	Undercut Banks
00	Rootwad/Woody Debris	00	Macrophytes	00	Other

SAMPLING CONSID.: ([ ] NUM. ANODES)

STREAM WIDTH (m): 0 m 02 | 75 m 02

v. 2009

MBSS SPRING FAUNA DATA SHEET

SITE Watershed Code: [ ][ ][N][J] Segment: [P][8][A] Type: [2] Year: [2][0][1][6]

Reviewer: First JS / Second JA

HERPETOFAUNA

☐ None Observed

Species	Lifestage (Adult, Juv, Larval, Egg)	SEEN (Y/N)	HEARD (Y/N)	NUMBER RETAINED	NUMBER PHOTOS TAKEN
grayTree frog	☐☐☐☐	N	Y	0	0
	☐☐☐☐	☐	☐	☐	☐
	☐☐☐☐	☐	☐	☐	☐
	☐☐☐☐	☐	☐	☐	☐
	☐☐☐☐	☐	☐	☐	☐
	☐☐☐☐	☐	☐	☐	☐
	☐☐☐☐	☐	☐	☐	☐

MUSSELS

☒ None Observed

Species	LIVE	DEAD	NUMBER RETAINED	NUMBER PHOTOS TAKEN
	☐	☐	☐☐	☐
	☐	☐	☐☐	☐
	☐	☐	☐☐	☐
	☐	☐	☐☐	☐
	☐	☐	☐☐	☐

Corbicula: LIVE ☐ DEAD ☐ NONE ☐

CRAYFISHES

☒ None Observed

Species	NUMBER RETAINED
	☐☐
	☐☐
	☐☐
	☐☐
	☐☐

Crayfish Burrows ☒ (Absent, Present, Extensive)

COMMENTS

4/15/16 Pg 4/7. JS/JA
MP88A

Physical Habitat Assessment and Water Quality Data Sheet

Site ID: MP88A
Subwatershed: Ferry Branch 3
Length of Reach: 75m **Date:** 4/15/16
Team Members: JS/JA **Time:** 2:00

Weather
Current: Sunny 60°
Past 24hrs: Sunny 60°
Past 48hrs: Sunny 60°

Parameter	Down-stream	Mid-stream	Up-stream
Description			
pH	5.82	6.03	5.44
Temperature (°C)	14.03	12.57	10.80
DO (mg/l)	10.34	9.77	10.33
Conductivity (uS/cm)	329	282	451
TDS (mg/l)	209	229	402
Turbidity (NTU)	10.4	11.9	1.9

Notes:

Photographs/Observations:

Stream Character
- P Meandering
- A Braided
- P Riffle
- A Deep Pool >.5m
- P Shallow Pool <.5m
- A Gravel
- A Boulder >2m
- A Concrete/Gabion
- P Undercut Bank
- P Overhead Cover
- A Effluent Discharge
- E Emergent Vegetation
- P Floating Vegetation
- A Channelized
- P Straight
- P Run/Glide
- P Silt/Clay
- P Sand
- A Cobble
- A Boulder <2m
- P Bedrock
- P Rootwad
- A Storm Drain
- P Human Refuse
- A Beaver Pond

A=Absent P=Present E=Extensive

Bar Formation
- ☒ None
- ☐ Minor
- ☐ Moderate
- ☐ Extensive

Bank Erosion (see guidance sheet)

	Left Bank	Right Bank
Extent (m)	75	75
Severity	3	3
Avg. Height (m)	2.5	2.5

Severity: 0=none 1=min 2=mod 3=severe

Maximum stream depth (cm) 10

Benthic Habitat Sampled (20 total)	Sq. ft.
Riffle	1
Rootwad/Woody Debris	9
Leaf Pack	10
Submerged Vegetation	0
Undercut Banks	0
Other:	

Rootwads/Woody Debris

# Instream Woody Debris	6
# Dewatered Woody Debris	3
# Instream Rootwads	1
# Dewatered Rootwads	2

Stream Gradient

Location (ft)	Height (ft)	Water Depth (ft)

Pg 5/7 JD/JA MPBA 4/15/16

MBSS Physical Habitat Assessment Sheet

Stream Habitat Assessment Guidance Sheet

Habitat Parameter	Optimal: 16-20	Sub-Optimal 11-15	Marginal 6-10	Poor 0-5
1. Instream Habitat[a] SCORE 4	Greater than 50% of a variety of cobble, boulder, submerged logs, undercut banks, snags, rootwads, aquatic plants or other stable habitat	30-50% of stable habitat. Adequate habitat	10-30% mix of stable habitat. Habitat availability less than desireable	Less than 10% stable habitat. Lack of habitat is obvious
2. Epifaunal Substrate[a] SCORE 5	Preferred substrate abundant, stable, and at full colonization potential (riffles well developed and dominated by cobble; and/or woody debris prevalent, not new, and not transient	Abund. of cobble with gravel and/or boulders common; or woody debris, aquatic veg., undercut banks common but not prevalent/suited for full colonization	Large boulders and/or bedrock prevalent; cobble, woody debris, or other preferred surfaces uncommon	Stable substrate lacking; or particles are over 75% surrounded by fine sediment or flocculent material
3. Velocity/Depth Diversity SCORE 5	Slow (<0.3m/s), deep (>0.5m); slow, shallow (<0.5m); fast (>0.3m/s), deep; fast, shallow habitats all present	Only 3 of the 4 habitat categories present	Only 2 of the 4 habitat categories present	Dominated by 1 velocity/depth category (usually pools)
4. Pool/Glide/Eddy Quality[a] SCORE 4	Complex cover/d/or depth >1.5m; both deep (>0.5m)/shallows (<0.2m) present	Deep (>0.5m) areas present; but only moderate cover	Shallows (<0.2m) prevalent in pool/glide/eddy habitat; little cover	Max depth <0.2m in pool/glide/eddy habitat; or absent completely
5. Riffle/Run Quality[a] SCORE 4	Riffle/run depth generally >10cm, with maximum depth greater than 50 cm (maximum score); substrate stable (e.g. cobble, boulder) & variety of current velocities	Riffle/run depth generally 5-10cm, variety of current velocities	Riffle/run depth generally 1-5cm; primarily a single current velocity	Riffle/run depth <1cm; or riffle/run substrates concreted
6. Bank Stability[a] (facing downstream.) Score each bank LB SCORE 2 RB SCORE 2	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected. 10 9	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion. 8 7 6	Moderately unstable; 30-60% of bank in reach as areas of erosion; high erosion potential during floods. 5 4 3	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars. 2 1 0
7. Embeddedness SCORE 40 %	Percentage that gravel, cobble, and boulder particles are surrounded by fine sediment or flocculent material			
8. Shading SCORE 50 %	Percentage of segment that is shaded (duration is considered in scoring). 0% = fully exposed to sunlight all day in summer, 100% = fully and densely shaded all day in summer			
9. Riparian Buffer Zone Width (m)[a] LB 2 RB 2	Zone width in which human activity is not evident. 50m (164ft) is the maximum recorded value.			
10. Remoteness[a] SCORE 3	Roads greater than 400 meters (0.25 mi) from stream	Roads within 400 meters (0.25 mi) of stream; stream NOT accessible by trail.	Roads within 400 meters (0.25 mi) of stream; stream accessible by trail.	Roads adjacent to stream.
11. Aesthetic (trash) Rating[a] SCORE 8	Little or no human refuse visible from stream channel or riparian zone	Refuse present in minor amounts	Refuse present in moderate amounts	Refuse abundant and unsightly
12. Number of Woody Debris and Rootwads[a] SCORE 7	Count only woody debris and rootwads within the wetted portion of the sampling segment. Count only woody debris >10cm (4in) diameter and >1.5m (5ft) long and rootwads with trunk diameter (at chest height) >15cm (6in) that are functional habitat within the wetted portion of the stream.			

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS

STREAM NAME MP 98A		LOCATION AA County	
STATION # MP	REACH ID# 98A	STREAM CLASS 1	
UTM N	UTM E	RIVER BASIN Middle Patuxent	
STORET #		AGENCY CFI	
INVESTIGATORS JS/JA			
FORM COMPLETED BY JS/JA	DATE 4/15/16 TIME ~2:30 PM	REASON FOR SURVEY BMJ	

Parameters to be evaluated in sampling reach

Habitat Parameter	Condition Category			
	Optimal	Suboptimal	Marginal	Poor
1. Epifaunal Substrate/ Available Cover	Greater than 50% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient).	30-50% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale).	10-30% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 10% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
SCORE 5	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	(5) 4 3 2 1 0
2. Pool Substrate Characterization	Mixture of substrate materials, with gravel and firm sand prevalent; root mats and submerged vegetation common.	Mixture of soft sand, mud, or clay; mud may be dominant; some root mats and submerged vegetation present.	All mud or clay or sand bottom; little or no root mat; no submerged vegetation.	Hard-pan clay or bedrock; no root mat or vegetation.
SCORE 6	20 19 18 17 16	15 14 13 12 11	10 9 8 7 (6)	5 4 3 2 1 0
3. Pool Variability	Even mix of large-shallow, large-deep, small-shallow, small-deep pools present.	Majority of pools large-deep; very few shallow.	Shallow pools much more prevalent than deep pools.	Majority of pools small-shallow or pools absent.
SCORE 4	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 (4) 3 2 1 0
4. Sediment Deposition	Little or no enlargement of islands or point bars and less than <20% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 20-50% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 50-80% of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; more than 80% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
SCORE 4	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 (4) 3 2 1 0
5. Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills >75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
SCORE 6	20 19 18 17 16	15 14 13 12 11	10 9 8 7 (6)	5 4 3 2 1 0

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HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS

Parameters to be evaluated broader than sampling reach

Habitat Parameter	Condition Category: Optimal	Suboptimal	Marginal	Poor
6. Channel Alteration cow crossing major incision SCORE 5	Channelization or dredging absent or minimal; stream with normal pattern. 20 19 18 17 16	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr) may be present, but recent channelization is not present. 15 14 13 12 11	Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted. 10 9 8 7 6	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely. (5) 4 3 2 1 0
7. Channel Sinuosity SCORE 4	The bends in the stream increase the stream length 3 to 4 times longer than if it was in a straight line. (Note - channel braiding is considered normal in coastal plains and other low-lying areas. This parameter is not easily rated in these areas.) 20 19 18 17 16	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line. 15 14 13 12 11	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line. 10 9 8 7 (6)	Channel straight; waterway has been channelized for a long distance. 5 (4) 3 2 1 0
8. Bank Stability (score each bank) SCORE 1 (LB) SCORE 1 (RB)	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected. Left Bank 10 9 Right Bank 10 9	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion. 8 7 6 8 7 6	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods. 5 4 3 5 4 3	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars. 2 (1) 0 2 (1) 0
9. Vegetative Protection (score each bank) Note: determine left or right side by facing downstream. SCORE 3 (LB) SCORE 6 (RB)	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally. Left Bank 10 9 Right Bank 10 9	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining. 8 7 6 8 7 (6)	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining. 5 4 (3) 5 4 3	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height. 2 1 0 2 1 0
10. Riparian Vegetative Zone Width (score each bank riparian zone) SCORE 1 (LB) SCORE 5 (RB)	Width of riparian zone >18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone. Left Bank 10 9 Right Bank 10 9	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally. 8 7 6 8 7 6	Width of riparian zone 6-12 meters; human activities have impacted zone a great deal. 5 4 3 (5) 4 3	Width of riparian zone <6 meters: little or no riparian vegetation due to human activities. 2 (1) 0 2 1 0

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Total Score 51

v. 2009

MBSS SPRING HABITAT DATA SHEET

Page 1 of 7

SITE Watershed Code: MP | Segment: 92A | Type: NT | Year: 2016

Reviewer: First: JS / Second: CR

DATE: Year: 16 | Month: 04 | Day: 14

50 Dist. from Nearest Road to Site (m)

15 Trash Rating 0 - 20 TRAFFIC CONES

LANDUSE (Y/N)

N	Old Field	Y	Residential
Y	Deciduous Forest	N	Commercial/Industrial
N	Coniferous Forest	N	Cropland
Y	Wetland	N	Pasture
N	Surface Mine	N	Orchard/Vineyard/Nursery
N	Landfill	N	Golf Course

ROAD CULVERT

N/A

Present in Segment (Y/N): N

Sampleable? (Y/N): N

Width of Culvert (m):

Length of Culvert (m):

STREAM GRADIENT

	Location (m)	Height (m)
1		
2		
3		

RIPARIAN VEGETATION
(facing upstream)

	LEFT BANK	RIGHT BANK
Width (50m max)	50	50
Adjacent Land Cover	LN	LN
Vegetation Type	MRGY	MRGY
Buffer Breaks (Y/N)	N	N

	LEFT BANK	RIGHT BANK
Storm Drain		
Tile Drain		
Impervious Drainage		
Gully		
Orchard		
Crop		
Pasture		
New Construction		
Dirt Road		
Gravel Road		
Raw Sewage		
Railroad		

Buffer Break Types
(M = minor; S = severe)

CHANNELIZATION

N Evidence of Channel Straightening or Dredging (Y/N)

TYPE	EXTENT (m)		
	LEFT BANK	BOTTOM	RIGHT BANK
Concrete			
Gabion			
Rip-Rap			
Earthen Berm		N/A	
Dredge Spoil Off Channel		N/A	
Pipe Culvert			

Actual Coordinates
(If >30m distance between original coordinates and stream)

Lat:

Lon:

SAME

Stream Block Ht. (m):

Stream Block Type:

Lat:

Lon:

v. 2009

MBSS SPRING INDEX PERIOD DATA SHEET

SITE — Watershed Code: MP | Segment: 92A | Type: IV | Year: 2016

Reviewer: First: JS / Second: CR

DATE — Year: 16 | Month: 04 | Day: 14

CREW: JOSEPH SMITH / CARISSA REH

STREAM: MP92A

TIME 1550 (Military)

LOCALITY: LOTHIAN, AA CO, MD

SAMPLEABILITY

- Y Benthos
- Y Habitat Assessment
- Y Water Quality
- Y Vernal Pool — P (PRESENT/ABSENT)

OTHER (SPECIFY) N/A

SITE ACCESS ROUTE

PARK ALONG OLD SOLOMON ISLANDS RD
WALK THROUGH TREELINE
REACH IS 50 M WEST.

SAMPLE LABELS

Verified by: CR

QC LABEL

Watershed Code: MP | Segment: 92A (Letters only) | Type: IV | Year: 2016

Dup. (D) or Blank (B): ____ Verified by: ____

TEMP. LOGGER N/A

	(Y/N)	(TIME - Military)	#
WATER			
AIR			

LOCATION ____

PHOTODOCUMENTATION

Number	Title	Voucher (Y/N)
	~~US~~ MP - US, DS, FUNGUS	
	DS - US, DS, RB	
	US - US, DS	
	OVERVIEW / MAYAPPLE - LB	

BENTHIC HABITAT SAMPLED

01 Riffle	17 Leaf Pack	00 Undercut Banks
02 Rootwad/Woody Debris	00 Macrophytes	00 Other N/A

SAMPLING CONSID.: (____ NUM. ANODES)

STREAM WIDTH (m): 0 m: 0.4 | 75 m: 0.4

v. 2009

MBSS SPRING FAUNA DATA SHEET

SITE Watershed Code: [ ][ ][M][P] Segment: [9][2][A] Type: [IN] Year: [2][0][1][6]

Reviewer: First JS / Second CR

HERPETOFAUNA

☐ None Observed

Species	Lifestage (Adult, Juv., Larval, Egg)	SEEN (Y/N)	HEARD (Y/N)	NUMBER RETAINED	NUMBER PHOTOS TAKEN
1 ADULT	Adult	☒	☐	0	0
SPRING PEEPER	Adult	☒	☒	0	0
1 ADULT GREEN FROG	Adult	☒	☐	0	0
2 JUVENILE SALAMANDERS	Juv.	☒	☐	0	0
		☐	☐	☐	☐
		☐	☐	☐	☐
		☐	☐	☐	☐

MUSSELS

☒ None Observed

Species	LIVE	DEAD	NUMBER RETAINED	NUMBER PHOTOS TAKEN
	☐	☐	☐☐	☐
	☐	☐	☐☐	☐
	☐	☐	☐☐	☐
	☐	☐	☐☐	☐
	☐	☐	☐☐	☐

Corbicula: LIVE ☐ DEAD ☐ NONE ☒

CRAYFISHES

☒ None Observed

Species	NUMBER RETAINED
	☐☐
	☐☐
	☐☐
	☐☐
	☐☐

Crayfish Burrows [P]
(Absent, Present, Extensive)

COMMENTS

Physical Habitat Assessment and Water Quality Data Sheet

Site ID: MP92A
Subwatershed: LYONS CREEK
Length of Reach: 75m **Date:** 4/14/16
Team Members: JS/CR **Time:** 15:50

Weather
Current: SUNNY 60°F
Past 24hrs: SUNNY 55°F
Past 48hrs: OVERCAST RAIN - 50°F

Stream Character

P Meandering	A Channelized
A Braided	P Straight
P Riffle	P Run/Glide
A Deep Pool >.5m	P Silt/Clay
P Shallow Pool <.5m	E Sand
P Gravel	P Cobble
A Boulder >2m	A Boulder <2m
A Concrete/Gabion	A Bedrock
A Undercut Bank	P Rootwad
E Overhead Cover	A Storm Drain
A Effluent Discharge	P Human Refuse
A Emergent Vegetation	A Beaver Pond
A Floating Vegetation	

A=Absent P=Present E=Extensive

Parameter	Down-stream	Mid-stream	Up-stream
Description			
pH	6.69	6.10	6.2
Temperature (°C)	14.61	14.14	13.93
DO (mg/l)	12.75	12.38	12.21
Conductivity (uS/cm)	145	178	188
TDS (mg/l)	117	146	155
Turbidity (NTU)	32.9	11.2	1.9
Notes: BARO	783.8	767.5	767.5

Bar Formation
☐ None ☑ Minor ☐ Moderate ☐ Extensive

Bank Erosion (see guidance sheet)

	Left Bank	Right Bank	Severity: 0=none 1=min 2=mod 3=severe
Extent (m)	50	50	
Severity	2	2	
Avg. Height	0.6m	0.6m	

Maximum stream depth (cm) 30cm

Benthic Habitat Sampled (20 total)

	Sq. ft.
Riffle	1
Rootwad/Woody Debris	2
Leaf Pack	17
Submerged Vegetation	0
Undercut Banks	0
Other: N/A	0

Rootwads/Woody Debris

# Instream Woody Debris	2
# Dewatered Woody Debris	2
# Instream Rootwads	2
# Dewatered Rootwads	1

Stream Gradient

Location (ft)	Height (ft)	Water Depth (ft)

Photographs/Observations:
- BUFFER = HEALTHY MATURE DECIDUOUS FOREST
- 2 EROSIONAL DRAINAGE FEATURES ALONG R.B.
- WETLANDS PRESENT
- VARIATION OF SUBSTRATE
- TRIBUS OF REACH W/ CULVERT & PRIVATE DRIVE WAY OVER THIS PART OF STREAM

MBSS Physical Habitat Assessment Sheet

Stream Habitat Assessment Guidance Sheet				
Habitat Parameter	Optimal 16-20	Sub-Optimal 11-15	Marginal 6-10	Poor 0-5
1. Instream Habitat[a] SCORE 11	Greater than 50% of a variety of cobble, boulder, submerged logs, undercut banks, snags, rootwads, aquatic plants or other stable habitat	30-50% of stable habitat. Adequate habitat	10-30% mix of stable habitat. Habitat availability less than desireable	Less than 10% stable habitat. Lack of habitat is obvious
2. Epifaunal Substrate[b] SCORE 8	Preferred substrate abundant, stable, and at full colonization potential (riffles well developed and dominated by cobble; and/or woody debris prevalent, not new, and not transient	Abund. of cobble with gravel and/or boulders common; or woody debris, aquatic veg., undercut banks common but not prevalent/suited for full colonization	Large boulders and/or bedrock prevalent; cobble, woody debris, or other preferred surfaces uncommon	Stable substrate lacking; or particles are over 75% surrounded by fine sediment or flocculent material
3. Velocity/Depth Diversity[c] SCORE 16	Slow (<0.3m/s), deep (>0.5m); slow, shallow (<0.5m); fast (>0.3m/s), deep; fast, shallow habitats all present	Only 3 of the 4 habitat categories present	Only 2 of the 4 habitat categories present	Dominated by 1 velocity/depth category (usually pools)
4. Pool/Glide/Eddy Quality[d] SCORE 6	Complex cover/& or depth >1.5m; both deep (>0.5m)/shallows (<0.2m) present	Deep (>0.5m) areas present; but only moderate cover	Shallows (<0.2m) prevalent in pool/glide/eddy habitat; little cover	Max depth <0.2m in pool/glide/eddy habitat; or absent completely
5. Riffle/Run Quality[e] SCORE 5	Riffle/run depth generally >10cm, with maximum depth greater than 50 cm (maximum score); substrate stable (e.g. cobble, boulder) & variety of current velocities	Riffle/run depth generally 5-10cm, variety of current velocities	Riffle/run depth generally 1-5cm; primarily a single current velocity	Riffle/run depth <1cm; or riffle/run substrates concreted
6. Bank Stability[f] (facing downstream.) Score each bank LB SCORE 4 RB SCORE 4	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected. 10 9	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion. 8 7 6	Moderately unstable; 30-60% of bank in reach as areas of erosion; high erosion potential during floods. 5 4 3	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars. 2 1 0
7. Embeddedness SCORE 60 %	Percentage that gravel, cobble, and boulder particles are surrounded by fine sediment or flocculent material			
8. Shading SCORE 80 %	Percentage of segment that is shaded (duration is considered in scoring). 0% = fully exposed to sunlight all day in summer, 100% = fully and densely shaded all day in summer			
9. Riparian Buffer Zone Width (m)[g] LB 50 RB 50	Zone width in which human activity is not evident. 50m (164ft) is the maximum recorded value.			
10. Remoteness[h] SCORE 5	Roads greater than 400 meters (0.25 mi) from stream	Roads within 400 meters (0.25 mi) of stream; stream NOT accessible by trail.	Roads within 400 meters (0.25 mi) of stream; stream accessible by trail.	Roads adjacent to stream.
11. Aesthetic (trash) Rating[i] SCORE 15	Little or no human refuse visible from stream channel or riparian zone	Refuse present in minor amounts	Refuse present in moderate amounts	Refuse abundant and unsightly
12. Number of Woody Debris and Rootwads[j] SCORE 2	Count only woody debris and rootwads within the wetted portion of the sampling segment. Count only woody debris >10cm (4in) diameter and >1.5m (5ft) long and rootwads with trunk diameter (at chest height) >15cm (6in) that are functional habitat within the wetted portion of the stream.			

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS

STREAM NAME MP92A	LOCATION LOTHIAN, AA CO, MD	
STATION # _____ REACH ID# _____	STREAM CLASS III	
UTM N _____ UTM E	RIVER BASIN PATUXENT RIVER	
STORET #	AGENCY CEI	
INVESTIGATORS JS/CR		
FORM COMPLETED BY CR	DATE 4/14/16 TIME 1:50 (PM)	REASON FOR SURVEY PMI SAMPLING

Parameters to be evaluated in sampling reach

Habitat Parameter	Condition Category			
	Optimal	Suboptimal	Marginal	Poor
1. Epifaunal Substrate/ Available Cover	Greater than 50% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient).	30-50% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale).	10-30% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 10% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
SCORE 8	20 19 18 17 16	15 14 13 12 11	10 9 (8) 7 6	5 4 3 2 1 0
2. Pool Substrate Characterization	Mixture of substrate materials, with gravel and firm sand prevalent; root mats and submerged vegetation common.	Mixture of soft sand, mud, or clay; mud may be dominant; some root mats and submerged vegetation present.	All mud or clay or sand bottom; little or no root mat; no submerged vegetation.	Hard-pan clay or bedrock; no root mat or vegetation.
SCORE 6	20 19 18 17 16	15 14 13 12 11	10 9 8 7 (6)	5 4 3 2 1 0
3. Pool Variability	Even mix of large-shallow, large-deep, small-shallow, small-deep pools present.	Majority of pools large-deep; very few shallow.	Shallow pools much more prevalent than deep pools.	Majority of pools small-shallow or pools absent.
SCORE 6	20 19 18 17 16	15 14 13 12 11	10 9 8 7 (6)	5 4 3 2 1 0
4. Sediment Deposition	Little or no enlargement of islands or point bars and less than <20% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 20-50% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 50-80% of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; more than 80% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
SCORE 10	20 19 18 17 16	15 14 13 12 11	(10) 9 8 7 6	5 4 3 2 1 0
5. Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills >75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
SCORE 11	20 19 18 17 16	15 14 13 12 (11)	10 9 8 7 6	5 4 3 2 1 0

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HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS

Parameters to be evaluated broader than sampling reach

Habitat Parameter	Condition Category			
	Optimal	Suboptimal	Marginal	Poor
6. Channel Alteration NO ALTERATION W/IN 75m REACH SCORE 20	Channelization or dredging absent or minimal; stream with normal pattern. **20** 19 18 17 16	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr) may be present, but recent channelization is not present. 15 14 13 12 11	Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted. 10 9 8 7 6	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely. 5 4 3 2 1 0
7. Channel Sinuosity SCORE 16	The bends in the stream increase the stream length 3 to 4 times longer than if it was in a straight line. (Note - channel braiding is considered normal in coastal plains and other low-lying areas. This parameter is not easily rated in these areas.) 20 19 18 17 **16**	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line. 15 14 13 12 11	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line. 10 9 8 7 6	Channel straight; waterway has been channelized for a long distance. 5 4 3 2 1 0
8. Bank Stability (score each bank) SCORE 5 (LB) SCORE 5 (RB)	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected. **Left Bank** 10 9 **Right Bank** 10 9	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion. 8 7 6 8 7 6	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods. **5** 4 3 **5** 4 3	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars. 2 1 0 2 1 0
9. Vegetative Protection (score each bank) Note: determine left or right side by facing downstream. SCORE 5 (LB) SCORE 5 (RB)	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally. **Left Bank** 10 9 **Right Bank** 10 9	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining. 8 7 6 8 7 6	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining. **5** 4 3 **5** 4 3	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height. 2 1 0 2 1 0
10. Riparian Vegetative Zone Width (score each bank riparian zone) SCORE 9 (LB) SCORE 9 (RB)	Width of riparian zone >18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone. **Left Bank** 10 **9** **Right Bank** 10 **9**	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally. 8 7 6 8 7 6	Width of riparian zone 6-12 meters; human activities have impacted zone a great deal. 5 4 3 5 4 3	Width of riparian zone <6 meters: little or no riparian vegetation due to human activities. 2 1 0 2 1 0

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Total Score 115

v. 2014

MBSS SPRING INDEX PERIOD DATA SHEET

SITE: Watershed Code MP103A; Segment; Type; Year 2016

Reviewer: First JR / Second JP

DATE: Year 16; Month 04; Day 25

CREW: Jeff Reagan, Justin Park

STREAM NAME:

LOCALITY:

TIME: 0930 (Military)

SAMPLEABILITY

- [X] Benthos
- [ ] Facies Mapping
- [X] Habitat Assessment
- [X] Water Quality
- [ ] Vernal Pool
- [N] Present (Y/N)

Other:

SITE ACCESS ROUTE: 5752 Wrighton Rd.
Permission granted to park

SAMPLE LABELS

Verified by:

QC LABELS

Watershed Code | Segment (Letters Only) | Type | Year

Dup. (D) or Blank (B): Verified by:

TEMP. LOGGERS

	(Y/N)	(TIME - Military)	#
WATER			
AIR			

LOCATION:

PHOTODOCUMENTATION

Number		Voucher (Y/N)

BENTHIC HABITAT SAMPLED

- 16 Riffle
- 02 Rootwad/Woody Debris
- 02 Leaf Pack
- Macrophytes
- Undercut Banks
- Other:

SAMPLING CONSIDERATIONS: (01 NUM. ANODES)

STREAM WIDTH (m): 1.0 (0 m); .08 (75 m)

6.

v. 2014

MBSS SPRING FAUNAL DATA SHEET

SITE | Watershed Code: MP10 3A | Segment: | Type: | Year: 2016 | Reviewer: First JR / Second JP

HERPETOFAUNA

[X] None Observed

Species	Lifestage: Adult	Larval	Egg	SEEN (Y/N)	HEARD (Y/N)	Number Retained	Number Photos Taken

MUSSELS

[X] None Observed

Species	LIVE	DEAD	Number Retained	Num. Photos Taken

Corbicula: LIVE [ ] DEAD [ ] NONE [X]

CRAYFISH

[X] None Observed

Species	Number Retained

Crayfish Burrows (A,P,E): [A]

COMMENTS: Holes in bank, unknown origin

v. 2014

MBSS SPRING HABITAT DATA SHEET

SITE — Watershed Code: MP10 3A — Segment: — Type: — Year: 2016 — Reviewer: First: JR / Second: JP

DATE — Year: 16 — Month: 04 — Day: 25

50 Dist. from Nearest Road to Site (m)

08 Trash Rating 0 - 20

LANDUSE (Y/N)

N	Old Field	Y	Residential
Y	Deciduous Forest	N	Commercial/Industrial
N	Coniferous Forest	N	Cropland
N	Wetland	N	Pasture
N	Surface Mine	N	Orchard/Vineyard/Nursery
N	Landfill	N	Golf Course

RIPARIAN VEGETATION
(facing upstream)

	LEFT BANK	RIGHT BANK
Width (50m max)	06	30
Adj. Land Cover	FR	FR
Veg Type	YRMG	YRMG
Buffer Breaks (Y/N)	N	N

ROAD CULVERT

Present in Segment? (Y/N)	N
Sampleable? (Y/N)	
Width of Culvert (m)	
Length of Culvert (m)	

STREAM GRADIENT

	Location (m)	Height (m)
1		
2		
3		

BUFFER BREAKS

	LEFT BANK	RIGHT BANK
Storm Drain		
Tile Drain		
Imperv. Drainage		
New Construction		
Orchard		
Crop		
Pasture		
Gully		
Dirt Road		
Gravel Road		
Raw Sewage		
Railroad		

Buffer Break Types (M = Minor; S = Severe)

CHANNELIZATION

N Evidence of Channel Straightening or Dredging (Y/N)

TYPE	EXTENT (m) LEFT BANK	BOTTOM	RIGHT BANK
Concrete			
Gabion			
Rip-Rap			
Earthen Berm			
Dredge Spoil Off Channel			
Pipe Culvert			

Actual Site Midpoint Coordinates
(Taken at Time of Sampling)

Lat

Long

Stream Blockages

Stream Block Ht. (m)

Stream Block Type

Lat

Long

Physical Habitat Assessment and Water Quality Data Sheet

Site ID: MP103A
Subwatershed: _____
Length of Reach: 75m Date: 4/25/16
Team Members: JP, JR Time: 9:30

Weather
Current: 78° Clear
Past 24hrs: 73° Clear
Past 48hrs: 75° Rain

Parameter	Down-stream	Mid-stream	Up-stream
Description			
pH	6.08	5.96	5.94
Temperature (°C)	12.5	12.0	11.9
DO (mg/l)	5.91	8.02	8.90
Conductivity (uS/cm)	166	160	168
TDS (mg/l) ppm	80	80	82
Turbidity (NTU)	2.52	2.25	2.83

Notes: _____

Stream Character

[E] Meandering	[A] Channelized
[A] Braided	[A] Straight
[P] Riffle	[P] Run/Glide
[P] Deep Pool >.5m	[E] Silt/Clay
[P] Shallow Pool <.5m	[E] Sand
[E] Gravel	[A] Cobble
[A] Boulder >2m	[A] Boulder <2m
[A] Concrete/Gabion	[A] Bedrock
[E] Undercut Bank	[P] Rootwad
[E] Overhead Cover	[A] Storm Drain
[A] Effluent Discharge	[E] Human Refuse
[A] Emergent Vegetation	[A] Beaver Pond
[A] Floating Vegetation	

A=Absent P=Present E=Extensive

Bar Formation
☐ None ☒ Moderate
☐ Minor ☐ Extensive

Bank Erosion (see guidance sheet)

	Left Bank	Right Bank
Extent (m)	75	75
Severity	3	3
Avg. Height	3.5ft	3.5ft

Severity: 1=low, 2=mod, 3=severe

Maximum stream depth (cm): 50

Benthic Habitat Sampled (20 total)

	Sq. ft.
Riffle	16
Rootwad/Woody Debris	2
Leaf Pack	2
Submerged Vegetation	
Undercut Banks	
Other:	

Rootwads/Woody Debris

# Instream Woody Debris	4
# Dewatered Woody Debris	3
# Instream Rootwads	1
# Dewatered Rootwads	4

Stream Gradient

Location (ft)	Height (ft)	Water Depth (ft)

Photographs/Observations:

MBSS Physical Habitat Assessment Sheet

Stream Habitat Assessment Guidance Sheet				
Habitat Parameter	Optima 16-20	Sub-Optima 11-15	Marginal 6-10	Poor 0-5
1. Instream Habitat[1] SCORE 14	Greater than 50% of a variety of cobble, boulder, submerged logs, undercut banks, snags, rootwads, aquatic plants or other stable habitat	30-50% of stable habitat. Adequate habitat	10-30% mix of stable habitat. Habitat availability less than desireable	Less than 10% stable habitat. Lack of habitat is obvious
2. Epifaunal Substrate[2] SCORE 14	Preferred substrate abundant, stable, and at full colonization potential (riffles well developed and dominated by cobble; and/or woody debris prevalent; not new, and not transient	Abund. of cobble with gravel and/or boulders common; or woody debris, aquatic veg., undercut banks common but not prevalent/suited for full colonization	Large boulders and/or bedrock prevalent; cobble, woody debris, or other preferred surfaces uncommon	Stable substrate lacking; or particles are over 75% surrounded by fine sediment or flocculent material
3. Velocity/Depth Diversity[3] SCORE 8	Slow (<0.3m/s), deep (>0.5m); slow, shallow (<0.5m); fast (>0.3m/s), deep; fast, shallow habitats all present	Only 3 of the 4 habitat categories present	Only 2 of the 4 habitat categories present	Dominated by 1 velocity/depth category (usually pools)
4. Pool/Glide/Eddy Quality[4] SCORE 13	Complex cover & /or depth >1.5m; both deep (>0.5m) shallows (<0.2m) present	Deep (>0.5m) areas present; but only moderate cover	Shallows (<0.2m) prevalent in pool/glide/eddy habitat; little cover	Max depth <0.2m in pool/glide/eddy habitat; or absent completely
5. Riffle Run Quality[5] SCORE 8	Riffle/run depth generally >10cm, with maximum depth greater than 50 cm (maximum score), substrate stable (e.g. cobble, boulder) & variety of current velocities	Riffle run depth generally 5-10cm, variety of current velocities	Riffle-run depth generally 1-5cm, primarily a single current velocity	Riffle run depth <1cm, or riffle run substrates concreted
6. Bank Stability[6] (facing downstream) Score each bank LB SCORE 1 RB SCORE 1	Banks stable; evidence of erosion or bank failure absent or minimal, little potential for future problems. <5% of bank affected. 10 9	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion 8 7 6	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods. 5 4 3	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing. 60-100% of bank has erosional scars. 2 1 0
7. Embeddedness SCORE 80 %	Percentage that gravel, cobble, and boulder particles are surrounded by fine sediment or flocculent material: sand/silt			
8. Shading SCORE 85 %	Percentage of segment that is shaded (duration is considered in scoring). 0% = fully exposed to sunlight all day in summer, 100% = fully and densely shaded all day in summer			
9. Riparian Buffer Zone Width (m)[7] LB 6m RB 18m	Zone width in which human activity is not evident; 50m (164ft) is the maximum recorded value			
10. Remoteness SCORE 6	Roads greater than 400 meters (0.25 mi) from stream	Roads within 400 meters (0.25 mi) of stream; stream NOT accessible by trail	Roads within 400 meters (0.25 mi) of stream; stream accessible by trail	Roads adjacent to stream
11. Aesthetics (trash) Rating[8] SCORE 4	Little or no human refuse visible from stream channel or riparian zone	Refuse present in minor amounts	Refuse present in moderate amounts	Refuse abundant and unsightly 4
12. Number of Woody Debris and Rootwads[9] SCORE 7	Count only woody debris and rootwads within the wetted portion of the sampling segment. Count only woody debris >10cm (4in) diameter and >1.5m (5ft) long and rootwads with trunk diameter (at chest height) >15cm (6in) that are functional habitat within the wetted portion of the stream.			

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS (FRONT)

STREAM NAME MP103A	LOCATION
STATION # _____ RIVERMILE _____	STREAM CLASS
LAT _____ LONG _____	RIVER BASIN
STORET #	AGENCY
INVESTIGATORS JR/JP	
FORM COMPLETED BY JP	DATE 4/25/16 TIME 930 (AM) PM
REASON FOR SURVEY Bug Sampling	

Parameters to be evaluated in sampling reach

Habitat Parameter	Condition Category			
	Optimal	Suboptimal	Marginal	Poor
1. Epifaunal Substrate/ Available Cover	Greater than 50% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient).	30-50% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale).	10-30% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 10% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
SCORE (14)	20 19 18 17 16	15 (14) 13 12 11	10 9 8 7 6	5 4 3 2 1 0
2. Pool Substrate Characterization	Mixture of substrate materials, with gravel and firm sand prevalent; root mats and submerged vegetation common.	Mixture of soft sand, mud, or clay; mud may be dominant; some root mats and submerged vegetation present.	All mud or clay or sand bottom; little or no root mat; no submerged vegetation.	Hard-pan clay or bedrock; no root mat or vegetation.
SCORE (8)	20 19 18 17 16	15 14 13 12 11	10 9 (8) 7 6	5 4 3 2 1 0
3. Pool Variability	Even mix of large-shallow, large-deep, small-shallow, small-deep pools present.	Majority of pools large-deep; very few shallow.	Shallow pools much more prevalent than deep pools.	Majority of pools small-shallow or pools absent.
SCORE (7)	20 19 18 17 16	15 14 13 12 11	10 9 8 (7) 6	5 4 3 2 1 0
4. Sediment Deposition	Little or no enlargement of islands or point bars and less than <20% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 20-50% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 50-80% of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; more than 80% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
SCORE (6)	20 19 18 17 16	15 14 13 12 11	10 9 8 7 (6)	5 4 3 2 1 0
5. Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills >75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
SCORE (8)	20 19 18 17 16	15 14 13 12 11	10 9 (8) 7 6	5 4 3 2 1 0

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS (BACK)

Parameters to be evaluated broader than sampling reach

Habitat Parameter	Condition Category: Optimal	Suboptimal	Marginal	Poor
6. Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr) may be present, but recent channelization is not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.
SCORE 15	20 19 18 17 16	(15) 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
7. Channel Sinuosity	The bends in the stream increase the stream length 3 to 4 times longer than if it was in a straight line. (Note - channel braiding is considered normal in coastal plains and other low-lying areas. This parameter is not easily rated in these areas.)	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	Channel straight; waterway has been channelized for a long distance.
SCORE 6	20 19 18 17 16	15 14 13 12 11	10 9 8 7 (6)	5 4 3 2 1 0
8. Bank Stability (score each bank)	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.
SCORE 1 (LB)	Left Bank 10 9	8 7 6	5 4 3	2 (1) 0
SCORE 1 (RB)	Right Bank 10 9	8 7 6	5 4 3	2 (1) 0
9. Vegetative Protection (score each bank) Note: determine left or right side by facing downstream.	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
SCORE 3 (LB)	Left Bank 10 9	8 7 6	5 4 (3)	2 1 0
SCORE 3 (RB)	Right Bank 10 9	8 7 6	5 4 (3)	2 1 0
10. Riparian Vegetative Zone Width (score each bank riparian zone)	Width of riparian zone >18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone.	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6-12 meters; human activities have impacted zone a great deal.	Width of riparian zone <6 meters: little or no riparian vegetation due to human activities.
SCORE 8 (LB)	Left Bank 10 9	(8) 7 6	5 4 3	2 1 0
SCORE 3 (RB)	Right Bank 10 9	8 7 6	5 4 (3)	2 1 0

Total Score (83)

v. 2014

MBSS SPRING INDEX PERIOD DATA SHEET

SITE — Watershed Code: MP12 | Segment: | Type: | Year: 2016

Reviewer: First: MT / Second: JP

DATE — Year: 16 | Month: 09 | Day: 21

CREW: Mike Thompson / Justin Park

STREAM NAME:

LOCALITY:

TIME: 0915 (Military)

SAMPLEABILITY

- [X] Benthos
- [ ] Facies Mapping
- [X] Habitat Assessment
- [X] Water Quality
- [ ] Vernal Pool
- [N] Present (Y/N)

Other:

SITE ACCESS ROUTE:

SAMPLE LABELS

Verified by:

QC LABELS

Watershed Code | Segment (Letters Only) | Type | Year

Dup. (D) or Blank (B): Verified by:

TEMP. LOGGERS

	(Y/N)	(TIME - Military)	
WATER			#
AIR			#

LOCATION:

PHOTODOCUMENTATION

Number		Voucher (Y/N)

BENTHIC HABITAT SAMPLED

- [16] Riffle
- [02] Rootwad/Woody Debris
- [02] Leaf Pack
- [ ] Macrophytes
- [ ] Undercut Banks
- [ ] Other:

SAMPLING CONSIDERATIONS: (01 NUM. ANODES)

STREAM WIDTH (m): 1.6 (0 m) | 1.0 (75 m)

6.

v. 2014

MBSS SPRING FAUNAL DATA SHEET

SITE — Watershed Code: MP12 9A | Segment: | Type: | Year: 2016 | Reviewer: First: MT / Second: JP

HERPETOFAUNA

☐ None Observed

Species	Lifestage: Adult	Larval	Egg	SEEN (Y/N)	HEARD (Y/N)	Number Retained	Number Photos Taken
Pickerel Frog	X			Y	N		

MUSSELS

☒ None Observed

Species	LIVE	DEAD	Number Retained	Num. Photos Taken

Corbicula — LIVE ☐ DEAD ☐ NONE ☒

CRAYFISH

☒ None Observed

Species	Number Retained

Crayfish Burrows (A,P,E): P

COMMENTS:

v. 2014

MBSS SPRING HABITAT DATA SHEET

SITE — Watershed Code: MP129A | Segment: | Type: | Year: 2016

Reviewer: First: MT / Second: JP

DATE — Year: 16 | Month: 04 | Day: 21

0075 Dist. from Nearest Road to Site (m)

17 Trash Rating 0 - 20

LANDUSE (Y/N)

N	Old Field	Y	Residential
Y	Deciduous Forest	N	Commercial/Industrial
N	Coniferous Forest	N	Cropland
N	Wetland	N	Pasture
N	Surface Mine	N	Orchard/Vineyard/Nursery
N	Landfill	N	Golf Course

RIPARIAN VEGETATION
(facing upstream)

	LEFT BANK	RIGHT BANK
Width (50m max)	40	40
Adj. Land Cover	FR	FR
Veg Type	YMRG	YMRG
Buffer Breaks (Y/N)	N	N

ROAD CULVERT

Present in Segment? (Y/N)	N
Sampleable? (Y/N)	
Width of Culvert (m)	
Length of Culvert (m)	

STREAM GRADIENT

	Location (m)	Height (m)
1		
2		
3		

BUFFER BREAKS

	LEFT BANK	RIGHT BANK
Storm Drain		
Tile Drain		
Imperv. Drainage		
New Construction		
Orchard		
Crop		
Pasture		
Gully		
Dirt Road		
Gravel Road		
Raw Sewage		
Railroad		

Buffer Break Types (M = Minor; S = Severe)

CHANNELIZATION

N — Evidence of Channel Straightening or Dredging (Y/N)

TYPE	EXTENT (m) LEFT BANK	BOTTOM	RIGHT BANK
Concrete			
Gabion			
Rip-Rap			
Earthen Berm			
Dredge Spoil Off Channel			
Pipe Culvert			

Actual Site Midpoint Coordinates
(Taken at Time of Sampling)

Lat:
Long:

Stream Blockages

Stream Block Ht. (m):
Stream Block Type:
Lat:
Long:

Physical Habitat Assessment and Water Quality Data Sheet

Site ID: MP 129A
Subwatershed: _____
Length of Reach: 75 Date: 9/21/16
Team Members: MT/JP Time: 9:15

Weather
Current: Cloudy H 73°
Past 24hrs: clear H 73°
Past 48hrs: clear H 75°

Parameter	Down-stream	Mid-stream	Up-stream
Description			
pH	5.69	6.26	6.30
Temperature (°C)	10.7	10.8	10.8
DO (mg/l)	11.44	11.55	11.39
Conductivity (uS/cm)	139	134	134
TDS (mg/l)	68	67	67
Turbidity (NTU)	7.99	8.90	10.00

Notes: Leaf + log obstruction to flow directly below mid stream sample location

Stream Character

E Meandering	A Channelized
A Braided	A Straight
P Riffle	P Run/Glide
A Deep Pool >.5m	P Silt/Clay
P Shallow Pool <.5m	E Sand
P Gravel	A Cobble
A Boulder >2m	A Boulder <2m
A Concrete/Gabion	A Bedrock
P Undercut Bank	P Rootwad
E Overhead Cover	A Storm Drain
A Effluent Discharge	P Human Refuse
A Emergent Vegetation	A Beaver Pond
A Floating Vegetation	

A=Absent P=Present E=Extensive

Bar Formation
☐ None ☒ Moderate
☐ Minor ☐ Extensive

Bank Erosion (see guidance sheet)

	(DS) Left Bank	(DS) Right Bank	
Extent (m)	25	15	Severity
Severity	2	2	0=None
Avg. Height	1.25m	1.25m	1=Low
			2=Moderate
			3=Severe

Maximum stream depth (cm) .25

Benthic Habitat Sampled (20 total)	Sq. ft.
Riffle	16
Rootwad/Woody Debris	2
Leaf Pack	2
Submerged Vegetation	
Undercut Banks	
Other:	

Rootwads/Woody Debris

# Instream Woody Debris	11
# Dewatered Woody Debris	9
# Instream Rootwads	0
# Dewatered Rootwads	2

Stream Gradient

Location (ft)	Height (ft)	Water Depth (ft)

Photographs/Observations:

MBSS Physical Habitat Assessment Sheet

Stream Habitat Assessment Guidance Sheet				
Habitat Parameter	Optima 16-20	Sub-Optima 11-15	Marginal 6-10	Poor 0-5
1. In-stream Habitat[1] SCORE 8	Greater than 50% of a variety of cobble, boulder, submerged logs, undercut banks, snags, rootwads, aquatic plants or other stable habitat	30-50% of stable habitat. Adequate habitat	10-30% mix of stable habitat. Habitat availability less than desireable	Less than 10% stable habitat. Lack of habitat is obvious
2. Epifaunal Substrate[2] SCORE 5	Preferred substrate abundant, stable, and at full colonization potential (riffles well developed and dominated by cobble; and/or woody debris prevalent, not new, and not transient	Abund. of cobble with gravel and/or boulders common; or woody debris, aquatic veg., undercut banks common but not prevalent/suited for full colonization	Large boulders and/or bedrock prevalent; cobble, woody debris, or other preferred surfaces uncommon	Stable substrate lacking; or particles are over 75% surrounded by fine sediment or flocculent material
3. Velocity/Depth Diversity[3] SCORE 7	Slow (<0.3m/s), deep (>0.5m); slow, shallow (<0.5m); fast (>0.3m/s), deep; fast, shallow habitats all present	Only 3 of the 4 habitat categories present	Only 2 of the 4 habitat categories present	Dominated by 1 velocity/depth category (usually pools)
4. Pool/Glide/Eddy Quality[4] SCORE 5	Complex cover &/or depth >1.5m; both deep (>0.5m) shallows (<0.2m) present	Deep (>0.5m) areas present; but only moderate cover	Shallows (<0.2m) prevalent in pool/glide/eddy habitat; little cover	Max depth <0.2m in pool/glide/eddy habitat; or absent completely
5. Riffle/Run Quality[5] SCORE 10	Riffle/run depth generally >10cm, with maximum depth greater than 50 cm (maximum score); substrate stable (e.g. cobble, boulder) & variety of current velocities	Riffle/run depth generally 5-10cm, variety of current velocities	Riffle/run depth generally 1-5cm, primarily a single current velocity	Riffle/run depth <1cm, or riffle/run substrates concreted
6. Bank Stability[6] (facing downstream) Score each bank LB SCORE 7 RB SCORE 7	Banks stable; evidence of erosion or bank failure absent or minimal. Little potential for future problems. <5% of bank affected. 10 9	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion 8 7 6	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods. 5 4 3	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars. 2 1 0
7. Embeddedness SCORE 25 %	Percentage that gravel, cobble, and boulder particles are surrounded by fine sediment or flocculent material. Sand bedded stream			
8. Shading SCORE 80 %	Percentage of segment that is shaded (during or is considered in scoring). 0% = fully exposed to sunlight all day in summer. 100% = fully and densely shaded all day in summer			
9. Riparian Buffer Zone Width (m)[7] LB 40 RB 40	Zone width in which human activity is not evident. 50m (164ft) is the maximum recorded value			
10. Remoteness SCORE 12	Roads greater than 400 meters (0.25 mi) from stream	Roads within 400 meters (0.25 mi) of stream; stream NOT accessible by trail	Roads within 400 meters (0.25 mi) of stream; stream accessible by trail	Roads adjacent to stream
11. Aesthetics (trash) Rating[8] SCORE 17	Little or no human refuse visible from stream channel or riparian zone	Refuse present in minor amounts	Refuse present in moderate amounts	Refuse abundant and unsightly
12. Number of Woody Debris and Rootwads[9] SCORE 22	Count only woody debris and rootwads within the wetted portion of the sampling segment. Count only woody debris >10cm (4in) diameter and >1.5m (5ft) long and rootwads with trunk diameter (at chest height) >15cm (6in) that are functional habitat within the wetted portion of the stream.			

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS (FRONT)

STREAM NAME	LOCATION MP129A
STATION # _____ RIVERMILE _____	STREAM CLASS
LAT _____ LONG _____	RIVER BASIN
STORET #	AGENCY
INVESTIGATORS MT/JP	
FORM COMPLETED BY JP	DATE 4/21/16 TIME 915 (AM) PM
REASON FOR SURVEY Bug Sampling	

Parameters to be evaluated in sampling reach

Habitat Parameter	Condition Category			
	Optimal	Suboptimal	Marginal	Poor
1. Epifaunal Substrate/ Available Cover	Greater than 50% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient).	30-50% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale).	10-30% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 10% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
SCORE (8)	20 19 18 17 16	15 14 13 12 11	10 9 (8) 7 6	5 4 3 2 1 0
2. Pool Substrate Characterization	Mixture of substrate materials, with gravel and firm sand prevalent; root mats and submerged vegetation common.	Mixture of soft sand, mud, or clay; mud may be dominant; some root mats and submerged vegetation present.	All mud or clay or sand bottom; little or no root mat; no submerged vegetation.	Hard-pan clay or bedrock; no root mat or vegetation.
SCORE (6)	20 19 18 17 16	15 14 13 12 11	10 9 8 7 (6)	5 4 3 2 1 0
3. Pool Variability	Even mix of large-shallow, large-deep, small-shallow, small-deep pools present.	Majority of pools large-deep; very few shallow.	Shallow pools much more prevalent than deep pools.	Majority of pools small-shallow or pools absent.
SCORE (5)	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	(5) 4 3 2 1 0
4. Sediment Deposition	Little or no enlargement of islands or point bars and less than <20% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 20-50% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 50-80% of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; more than 80% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
SCORE (5)	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	(5) 4 3 2 1 0
5. Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills >75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
SCORE (13)	20 19 18 17 16	15 14 (13) 12 11	10 9 8 7 6	5 4 3 2 1 0

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS (BACK)

Parameters to be evaluated broader than sampling reach

Habitat Parameter	Condition Category			
	Optimal	Suboptimal	Marginal	Poor
6. Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr) may be present, but recent channelization is not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.
SCORE (19)	20 (19) 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
7. Channel Sinuosity	The bends in the stream increase the stream length 3 to 4 times longer than if it was in a straight line. (Note - channel braiding is considered normal in coastal plains and other low-lying areas. This parameter is not easily rated in these areas.)	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	Channel straight; waterway has been channelized for a long distance.
SCORE (12)	20 19 18 17 16	15 14 13 (12) 11	10 9 8 7 6	5 4 3 2 1 0
8. Bank Stability (score each bank)	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.
SCORE 7 (LB)	Left Bank 10 9	8 (7) 6	5 4 3	2 1 0
SCORE 7 (RB)	Right Bank 10 9	8 (7) 6	5 4 3	2 1 0
9. Vegetative Protection (score each bank) Note: determine left or right side by facing downstream.	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
SCORE 1 (LB)	Left Bank 10 9	8 7 6	5 4 3	2 (1) 0
SCORE 1 (RB)	Right Bank 10 9	8 7 6	5 4 3	2 (1) 0
10. Riparian Vegetative Zone Width (score each bank riparian zone)	Width of riparian zone >18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone.	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6-12 meters; human activities have impacted zone a great deal.	Width of riparian zone <6 meters: little or no riparian vegetation due to human activities.
SCORE 9 (LB)	Left Bank 10 (9)	8 7 6	5 4 3	2 1 0
SCORE 9 (RB)	Right Bank 10 (9)	8 7 6	5 4 3	2 1 0

Total Score 102

v. 2014

MBSS SPRING INDEX PERIOD DATA SHEET

SITE — Watershed Code: MP132A — Segment: — Type: — Year: 2016

Reviewer: First: MT / Second: JP

DATE — Year: 16 — Month: 04 — Day: 21

CREW: Mike Thompson Justin Park

STREAM NAME:

LOCALITY:

TIME: 1100 (Military)

SAMPLEABILITY

- [Y] Benthos
- [N] Facies Mapping
- [Y] Habitat Assessment
- [Y] Water Quality
- [N] Vernal Pool — [N] Present (Y/N)

Other:

SITE ACCESS ROUTE:

SAMPLE LABELS

Verified by:

QC LABELS

Watershed Code | Segment (Letters Only) | Type | Year

Dup. (D) or Blank (B): Verified by:

TEMP. LOGGERS

	(Y/N)	(TIME - Military)	
WATER			#
AIR			#

LOCATION:

PHOTODOCUMENTATION

Number		Voucher (Y/N)

BENTHIC HABITAT SAMPLED

- [02] Riffle
- [16] Rootwad/Woody Debris
- [02] Leaf Pack
- [ ] Macrophytes
- [ ] Undercut Banks
- Other:

SAMPLING CONSIDERATIONS: ([02] NUM. ANODES)

STREAM WIDTH (m): [4.5] 0 m — [4.0] 75 m

6.

v. 2014

MBSS SPRING FAUNAL DATA SHEET

SITE | Watershed Code: MP132A | Segment: | Type: | Year: 2016 | Reviewer: First: MT / Second: JP

HERPETOFAUNA

☐ None Observed

Species	Lifestage: Adult	Larval	Egg	SEEN (Y/N)	HEARD (Y/N)	Number Retained	Number Photos Taken
Pickerel Frog	X			Y	N		

MUSSELS

☒ None Observed

Species	LIVE	DEAD	Number Retained	Num. Photos Taken

Corbicula: LIVE ☐ DEAD ☐ NONE ☒

CRAYFISH

☒ None Observed

Species	Number Retained

Crayfish Burrows (A,P,E): A

COMMENTS:

v. 2014

MBSS SPRING HABITAT DATA SHEET

SITE — Watershed Code: M P 13 2A | Segment: | Type: | Year: 2016

Reviewer: First: MT / Second: JP

DATE — Year: 16 | Month: 04 | Day: 21

0085 Dist. from Nearest Road to Site (m)

14 Trash Rating 0 - 20

LANDUSE (Y/N)

N	Old Field	N	Residential
Y	Deciduous Forest	N	Commercial/Industrial
N	Coniferous Forest	N	Cropland
Y	Wetland	N	Pasture
N	Surface Mine	N	Orchard/Vineyard/Nursery
N	Landfill	N	Golf Course

RIPARIAN VEGETATION

(facing upstream)

	LEFT BANK (DS)	RIGHT BANK (DS)
Width (50m max)	50	50
Adj. Land Cover	FR	FR
Veg Type	R Y M G	R Y M G
Buffer Breaks (Y/N)	N	N

ROAD CULVERT

Present in Segment? (Y/N)	N
Sampleable? (Y/N)	
Width of Culvert (m)	
Length of Culvert (m)	

STREAM GRADIENT

	Location (m)	Height (m)
1		
2		
3		

BUFFER BREAKS

	LEFT BANK	RIGHT BANK
Storm Drain		
Tile Drain		
Imperv. Drainage		
New Construction		
Orchard		
Crop		
Pasture		
Gully		
Dirt Road		
Gravel Road		
Raw Sewage		
Railroad		

Buffer Break Types (M = Minor; S = Severe)

CHANNELIZATION

N — Evidence of Channel Straightening or Dredging (Y/N)

TYPE	EXTENT (m) LEFT BANK	BOTTOM	RIGHT BANK
Concrete			
Gabion			
Rip-Rap			
Earthen Berm			
Dredge Spoil Off Channel			
Pipe Culvert			

Actual Site Midpoint Coordinates

(Taken at Time of Sampling)

Lat

Long

Stream Blockages

Stream Block Ht. (m)

Stream Block Type

Lat

Long

Physical Habitat Assessment and Water Quality Data Sheet

Site ID: MP 132A
Subwatershed: _____
Length of Reach: 75 m Date: 4/21/16
Team Members: MT/JP Time: 11:00

Stream Character

A	Meandering	A	Channelized
A	Braided	E	Straight
P	Riffle	E	Run/Glide
P	Deep Pool >.5m	P	Silt/Clay
P	Shallow Pool <.5m	E	Sand
P	Gravel	A	Cobble
A	Boulder >2m	A	Boulder <2m
A	Concrete/Gabion	A	Bedrock
P	Undercut Bank	P	Rootwad
P	Overhead Cover	A	Storm Drain
A	Effluent Discharge	P	Human Refuse
A	Emergent Vegetation	A	Beaver Pond
A	Floating Vegetation		

(very poor)
sig. lacking (very minor)

A=Absent P=Present E=Extensive

Bar Formation

☐	None	☐	Moderate
☒	Minor	☐	Extensive

Bank Erosion (see guidance sheet)

	(DS) Left Bank	(DS) Right Bank	Severity
Extent (m)	6	20	
Severity	2	1	0=None
Avg. Height	1	1.75	1=Minor
			2=Moderate
			3=Extensive

Maximum stream depth (cm) _____

Benthic Habitat Sampled (20 total)	Sq. ft.
Riffle	2
Rootwad/Woody Debris	16
Leaf Pack	2
Submerged Vegetation	
Undercut Banks	
Other:	

Rootwads/Woody Debris		
# Instream Woody Debris	10	HHTHT
# Dewatered Woody Debris	4	IIII
# Instream Rootwads	1	I
# Dewatered Rootwads	1	I

Stream Gradient

Location (ft)	Height (ft)	Water Depth (ft)

Weather
Current: Cloudy 73°
Past 24hrs: clear 73°
Past 48hrs: clear 75°

Parameter	Down-stream	Mid-stream	Up-stream
Description			
pH	6.66	6.79	6.89
Temperature (°C)	12.5°	12.5°	12.5°
DO (mg/l)	11.66	11.57	11.65
Conductivity (uS/cm)	197	197	189
TDS (mg/l)	97	99	95
Turbidity (NTU)	8.75	8.74	8.35

Notes: Stream enters channel at about downstream sample location

Photographs/Observations:

MBSS Physical Habitat Assessment Sheet

Stream Habitat Assessment Guidance Sheet				
Habitat Parameter	Optima 16-20	Sub-Optima 11-15	Marginal 6-10	Poor 0-5
1. In-stream Habitat[1] SCORE 1	Greater than 50% of a variety of cobble, boulder, submerged logs, undercut banks, snags, rootwads, aquatic plants or other stable habitat	30-50% of stable habitat. Adequate habitat	10-30% mix of stable habitat. Habitat availability less than desireable	Less than 10% stable habitat. Lack of habitat is obvious
2. Epifaunal Substrate[2] SCORE 1	Preferred substrate abundant, stable, and at full colonization potential (riffles well developed and dominated by cobble; and/or woody debris prevalent; not new, and not transient	Abund. of cobble with gravel and/or boulders common; or woody debris, aquatic veg., undercut banks common but not prevalent/suited for full colonization	Large boulders and/or bedrock prevalent; cobble, woody debris, or other preferred surfaces uncommon	Stable substrate lacking; or particles are over 75% surrounded by fine sediment or flocculent material
3. Velocity/Depth Diversity[3] SCORE 11	Slow (<0.3m/s), deep (>0.5m); slow, shallow (<0.5m); fast (>0.3m/s), deep; fast, shallow habitats all present	Only 3 of the 4 habitat categories present 11	Only 2 of the 4 habitat categories present	Dominated by 1 velocity/depth category (usually pools)
4. Pool/Glide/Eddy Quality[4] SCORE 11	Complex cover & or depth >1.5m; both deep (>0.5m) shallows (<0.2m) present	Deep (>0.5m) areas present; but only moderate cover	Shallows (<0.2m) prevalent in pool/glide/eddy habitat; little cover	Max depth <0.2m in pool/glide/eddy habitat; or absent completely
5. Riffle/Run Quality[5] SCORE 7	Riffle/run depth generally >10cm, with maximum depth greater than 50 cm (maximum score); substrate stable (e.g. cobble, boulder) & variety of current velocities	Riffle/run depth generally 5-10cm; variety of current velocities	Riffle/run depth generally 1-5cm; primarily a single current velocity	Riffle/run depth <1cm, or riffle/run substrates concreted
6. Bank Stability[6] (facing downstream) Score each bank LB SCORE 8 RB SCORE 8	Banks stable; evidence of erosion or bank failure absent or minimal. little potential for future problems. <5% of bank affected. 10 9	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion 8 7 6	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods. 5 4 3	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing. 60-100% of bank has erosional scars. 2 1 0
7. Embeddedness SCORE 100 %	Percentage that gravel, cobble, and boulder particles are surrounded by fine sediment or flocculent material sand embedded stream			
8. Shading SCORE 90 %	Percentage of segment that is shaded (duration is considered in scoring). 0% = fully exposed to sunlight all day in summer. 100% = fully and densely shaded all day in summer			
9. Riparian Buffer Zone Width (m)[7] LB 50 RB 50	Zone width in which human activity is not evident. 60m (196ft) is the maximum recorded value			
10. Remoteness SCORE 5	Roads greater than 400 meters (0.25 mi) from stream	Roads within 400 meters (0.25 mi) of stream; stream NOT accessible by trail	Roads within 400 meters (0.25 mi) of stream; stream accessible by trail	Roads adjacent to stream
11. Aesthetic (trash) Rating[8] SCORE 17	Little or no human refuse visible from stream channel or riparian zone	Refuse present in minor amounts	Refuse present in moderate amounts	Refuse abundant and unsightly
12. Number of Woody Debris and Rootwads[9] SCORE 16	Count only woody debris and rootwads within the wetted portion of the sampling segment. Count only woody debris >10cm (4in) diameter and >1.5m (5ft) long and rootwads with trunk diameter (at chest height) >15cm (6in) that are functional habitat within the wetted portion of the stream.			

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS (FRONT)

STREAM NAME MP132A	LOCATION
STATION # _____ RIVERMILE _____	STREAM CLASS
LAT _____ LONG _____	RIVER BASIN
STORET #	AGENCY
INVESTIGATORS MT / JP	
FORM COMPLETED BY JP	DATE 4/21/16 TIME ~~11:00~~ (AM) PM
REASON FOR SURVEY Bug Sampling	

Parameters to be evaluated in sampling reach

Habitat Parameter	Condition Category			
	Optimal	Suboptimal	Marginal	Poor
1. Epifaunal Substrate/ Available Cover	Greater than 50% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient).	30-50% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale).	10-30% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 10% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
SCORE (1)	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 (1) 0
2. Pool Substrate Characterization	Mixture of substrate materials, with gravel and firm sand prevalent; root mats and submerged vegetation common.	Mixture of soft sand, mud, or clay; mud may be dominant; some root mats and submerged vegetation present.	All mud or clay or sand bottom; little or no root mat; no submerged vegetation.	Hard-pan clay or bedrock; no root mat or vegetation.
SCORE (6)	20 19 18 17 16	15 14 13 12 11	10 9 8 7 (6)	5 4 3 2 1 0
3. Pool Variability	Even mix of large-shallow, large-deep, small-shallow, small-deep pools present.	Majority of pools large-deep; very few shallow.	Shallow pools much more prevalent than deep pools.	Majority of pools small-shallow or pools absent.
SCORE (7)	20 19 18 17 16	15 14 13 12 11	10 9 8 (7) 6	5 4 3 2 1 0
4. Sediment Deposition	Little or no enlargement of islands or point bars and less than <20% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 20-50% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 50-80% of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; more than 80% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
SCORE (4)	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 (4) 3 2 1 0
5. Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills >75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
SCORE (17)	20 19 18 (17) 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS (BACK)

Parameters to be evaluated broader than sampling reach

Habitat Parameter	Condition Category			
	Optimal	Suboptimal	Marginal	Poor
6. Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr) may be present, but recent channelization is not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.
SCORE (18)	20 19 (18) 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
7. Channel Sinuosity	The bends in the stream increase the stream length 3 to 4 times longer than if it was in a straight line. (Note - channel braiding is considered normal in coastal plains and other low-lying areas. This parameter is not easily rated in these areas.)	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	Channel straight; waterway has been channelized for a long distance.
SCORE (1)	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 (1) 0
8. Bank Stability (score each bank)	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.
SCORE 8 (LB)	Left Bank 10 9	(8) 7 6	5 4 3	2 1 0
SCORE 8 (RB)	Right Bank 10 9	(8) 7 6	5 4 3	2 1 0
9. Vegetative Protection (score each bank) Note: determine left or right side by facing downstream.	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
SCORE 2 (LB)	Left Bank 10 9	8 7 6	5 4 3	(2) 1 0
SCORE 3 (RB)	Right Bank 10 9	8 7 6	5 4 (3)	2 1 0
10. Riparian Vegetative Zone Width (score each bank riparian zone)	Width of riparian zone >18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone.	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6-12 meters; human activities have impacted zone a great deal.	Width of riparian zone <6 meters: little or no riparian vegetation due to human activities.
SCORE 10 (LB)	Left Bank (10) 9	8 7 6	5 4 3	2 1 0
SCORE 10 (RB)	Right Bank (10) 9	8 7 6	5 4 3	2 1 0

Total Score 95

v. 2014

MBSS SPRING INDEX PERIOD DATA SHEET

SITE — Watershed Code: MP134 | Segment: — | Type: P | Year: 2016

Reviewer: First: GZ | Second: JR

DATE — Year: 16 | Month: 04 | Day: 14

CREW: GZ/JCR

STREAM NAME:

LOCALITY:

TIME: 1530 (Military)

SAMPLEABILITY

- Y Benthos
- Y Habitat Assessment
- Y Water Quality
- N Vernal Pool
- ✓ Facies Mapping
- ✓ Present (Y/N)

Other:

SITE ACCESS ROUTE: side of Southern MD Rd

SAMPLE LABELS

Verified by:

MP134A QC LABELS

Watershed Code | Segment (Letters Only) | Type | Year

Dup. (D) or Blank (B): Verified by:

TEMP. LOGGERS

	(Y/N)	(TIME - Military)	
WATER			#
AIR			#

LOCATION:

PHOTODOCUMENTATION

Number		Voucher (Y/N)

BENTHIC HABITAT SAMPLED

16	Riffle	02	Leaf Pack	00	Undercut Banks
02	Rootwad/Woody Debris	00	Macrophytes	00	Other:

SAMPLING CONSIDERATIONS: (NUM. ANODES)

STREAM WIDTH (m): 0.8 (0 m) | 0.7 (75 m)

6.

v. 2014

MBSS SPRING FAUNAL DATA SHEET

SITE	Watershed Code	Segment	Type	Year	Reviewer: First	Second
	MP134A	—	P	2016	GZ	/ JR

HERPETOFAUNA

☐ None Observed

Species	Adult	Larval	Egg	SEEN (Y/N)	HEARD (Y/N)	Number Retained	Number Photos Taken
Green frog	X			Y	N	0	2

MUSSELS

☒ None Observed

Species	LIVE	DEAD	Number Retained	Num. Photos Taken

Corbicula: LIVE ☐ DEAD ☐ NONE ☑

CRAYFISH

☒ None Observed

Species	Number Retained

Crayfish Burrows (A,P,E) A

COMMENTS: High iron flocc content

v. 2014

MBSS SPRING HABITAT DATA SHEET

SITE — Watershed Code: MP134 — Segment: - — Type: P — Year: 2016 — Reviewer: First: GZ / Second: JR

DATE — Year: 16 — Month: 04 — Day: 14

20 Dist. from Nearest Road to Site (m)

13 Trash Rating 0 - 20

LANDUSE (Y/N)

N	Old Field	N	Residential
Y	Deciduous Forest	N	Commercial/Industrial
N	Coniferous Forest	N	Cropland
N	Wetland	N	Pasture
N	Surface Mine	N	Orchard/Vineyard/Nursery
N	Landfill	N	Golf Course

RIPARIAN VEGETATION
(facing upstream)

	LEFT BANK	RIGHT BANK
Width (50m max)	50	20
Adj. Land Cover	FR	RD
Veg Type	YMRG	MRYG
Buffer Breaks (Y/N)	N	N

ROAD CULVERT

Present in Segment? (Y/N)	N
Sampleable? (Y/N)	
Width of Culvert (m)	
Length of Culvert (m)	

STREAM GRADIENT

	Location (m)	Height (m)
1		
2		
3		

BUFFER BREAKS

	LEFT BANK	RIGHT BANK
Storm Drain		
Tile Drain		
Imperv. Drainage		
New Construction		
Orchard		
Crop		
Pasture		
Gully		
Dirt Road		
Gravel Road		
Raw Sewage		
Railroad		

NR

Buffer Break Types (M = Minor; S = Severe)

CHANNELIZATION

N — Evidence of Channel Straightening or Dredging (Y/N)

TYPE	EXTENT (m) LEFT BANK	BOTTOM	RIGHT BANK
Concrete			
Gabion			
Rip-Rap			
Earthen Berm			
Dredge Spoil Off Channel			
Pipe Culvert			

Actual Site Midpoint Coordinates
(Taken at Time of Sampling)

Lat

Long

Stream Blockages

Stream Block Ht. (m)

Stream Block Type

Lat

Long

Physical Habitat Assessment and Water Quality Data Sheet

Site ID: MP 134A
Subwatershed: _____
Length of Reach: 75M Date: 4/14/16
Team Members: GZ/SCR Time: 3:30 PM

Weather
Current: Sunny 62°
Past 24hrs: No Rain
Past 48hrs: No Rain

Stream Character

P	Meandering	A	Channelized
A	Braided	P	Straight
P	Riffle	P	Run/Glide
A	Deep Pool >.5m	P	Silt/Clay
P	Shallow Pool <.5m	P	Sand
P	Gravel	A	Cobble
A	Boulder >2m	A	Boulder <2m
A	Concrete/Gabion	A	Bedrock
A	Undercut Bank	P	Rootwad
P	Overhead Cover	A	Storm Drain
A	Effluent Discharge	P	Human Refuse
A	Emergent Vegetation	A	Beaver Pond
A	Floating Vegetation		

A=Absent P=Present E=Extensive

Parameter	Down-stream	Mid-stream	Up-stream
Description			
pH	6.21	6.16	6.02
Temperature (°C)	16.5	16.4	16.1
DO (mg/l)	2.84	2.45	1.80
Conductivity (uS/cm)	929	938	926
TDS (mg/l)	469	469	463
Turbidity (NTU)	6.29	3.04	3.00

Notes: High Iron floc content

Bar Formation
☐ None ☐ Minor ☒ Moderate ☐ Extensive

Bank Erosion (see guidance sheet)

DS

	Left Bank	Right Bank
Extent (m)	40	30
Severity	2	1
Avg. Height	3.5	2

Severity: 0=none 1=mild 2=mod 3=severe

Maximum stream depth (cm): 45

Benthic Habitat Sampled (20 total)

	Sq. ft.
Riffle	16
Rootwad/Woody Debris	2
Leaf Pack	2
Submerged Vegetation	
Undercut Banks	
Other:	

Rootwads/Woody Debris

# Instream Woody Debris	5
# Dewatered Woody Debris	7
# Instream Rootwads	2
# Dewatered Rootwads	5

IIII IIII II IIII

Stream Gradient

Location (ft)	Height (ft)	Water Depth (ft)

Photographs/Observations:

MBSS Physical Habitat Assessment Sheet

Stream Habitat Assessment Guidance Sheet				
Habitat Parameter	Optima 16-20	Sub-Optima 11-15	Marginal 6-10	Poor 0-5
1. In-stream Habitat[1] score 11	Greater than 50% of a variety of cobble, boulder, submerged logs, undercut banks, snags, rootwads, aquatic plants or other stable habitat	30-50% of stable habitat. Adequate habitat	10-30% mix of stable habitat. Habitat availability less than desireable	Less than 10% stable habitat. Lack of habitat is obvious
2. Epifaunal Substrate[2] score 10	Preferred substrate abundant, stable, and at full colonization potential (riffles well developed and dominated by cobble, and/or woody debris prevalent; not new, and not transient	Abund. of cobble with gravel and/or boulders common; or woody debris, aquatic veg., undercut banks common but not prevalent/suited for full colonization	Large boulders and/or bedrock prevalent; cobble, woody debris, or other preferred surfaces uncommon	Stable substrate lacking; or particles are over 75% surrounded by fine sediment or flocculent material
3. Velocity/Depth Diversity[3] score 11	Slow (<0.3m/s), deep (>0.5m); slow, shallow (<0.5m); fast (>0.3m/s), deep; fast, shallow habitats all present	Only 3 of the 4 habitat categories present	Only 2 of the 4 habitat categories present	Dominated by 1 velocity/depth category (usually pools)
4. Pool/Glide/Eddy Quality[4] score 10	Complex cover & or depth >1.5m; both deep (>0.5m) shallows (<0.2m) present	Deep (>0.5m) areas present; but only moderate cover	Shallows (<0.2m) prevalent in pool/glide/eddy habitat; little cover	Max depth <0.2m in pool/glide/eddy habitat; or absent completely
5. Riffle Run Quality[5] score 9	Riffle/run depth generally >10cm, with maximum depth greater than 50 cm (maximum scores substrate stable (e.g. cobble, boulder) & variety of current velocities	Riffle/run depth generally 5-10cm, variety of current velocities	Riffle/run depth generally 1-5cm, primarily a single current velocity	Riffle/run depth <1cm, or riffle/run substrates concreted
6. Bank Stability[6] (facing downstream) Score each bank LB score 5 RB score 6	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected. 10 9	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion 8 7 6	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods. 5 4 3	Unstable; many eroded areas, "raw" areas frequent along straight sections and bends; obvious bank sloughing. 60-100% of bank has erosional scars. 2 1 0
7. Embeddedness score 50 %	Percentage that gravel, cobble, and boulder particles are surrounded by fine sediment or flocculent material			
8. Shading score 70 %	Percentage of segment that is shaded (duration is considered in scoring). 0% = fully exposed to sunlight all day in summer. 100% = fully and densely shaded all day in summer			
9. Riparian Buffer Zone Width (m)[7] LB 20 RB 50	Zone width in which human activity is not evident. 50m (164ft) is the maximum recorded value			
10. Remoteness score 20	Roads greater than 400 meters (0.25 mi) from stream	Roads within 400 meters (0.25 mi) of stream; stream NOT accessible by trail	Road's within 400 meters (0.25 mi) of stream; stream accessible by trail	Roads adjacent to stream
11. Aesthetic (trash) Rating[8] score 13	Little or no human refuse visible from stream channel or riparian zone	Refuse present in minor amounts	Refuse present in moderate amounts	Refuse abundant and unsightly
12. Number of Woody Debris and Rootwads[9] score 12	Count only woody debris and rootwads within the wetted portion of the sampling segment. Count only woody debris >10cm (4in) diameter and >1.5m (5ft) long and rootwads with trunk diameter (at chest height) >15cm (6in) that are "functional" habitat within the wetted portion of the stream.			

09

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS (FRONT)

STREAM NAME MP134A	LOCATION MP134A
STATION #_____ RIVERMILE_____	STREAM CLASS
LAT _____ LONG _____	RIVER BASIN
STORET #	AGENCY
INVESTIGATORS GZ / JCR	
FORM COMPLETED BY Biohabitats	DATE 4/14/16 TIME 3:30 AM (PM)
REASON FOR SURVEY Bug Sampling.	

Parameters to be evaluated in sampling reach

Habitat Parameter	Condition Category			
	Optimal	Suboptimal	Marginal	Poor
1. Epifaunal Substrate/ Available Cover	Greater than 50% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient).	30-50% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale).	10-30% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 10% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
SCORE 11	20 19 18 17 16	15 14 13 12 (11)	10 9 8 7 6	5 4 3 2 1 0
2. Pool Substrate Characterization	Mixture of substrate materials, with gravel and firm sand prevalent; root mats and submerged vegetation common.	Mixture of soft sand, mud, or clay; mud may be dominant; some root mats and submerged vegetation present.	All mud or clay or sand bottom; little or no root mat; no submerged vegetation.	Hard-pan clay or bedrock; no root mat or vegetation.
SCORE 7	20 19 18 17 16	15 14 13 12 11	10 9 8 (7) 6	5 4 3 2 1 0
3. Pool Variability	Even mix of large-shallow, large-deep, small-shallow, small-deep pools present.	Majority of pools large-deep; very few shallow.	Shallow pools much more prevalent than deep pools.	Majority of pools small-shallow or pools absent.
SCORE 6	20 19 18 17 16	15 14 13 12 11	10 9 8 7 (6)	5 4 3 2 1 0
4. Sediment Deposition	Little or no enlargement of islands or point bars and less than <20% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 20-50% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 50-80% of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; more than 80% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
SCORE 9	20 19 18 17 16	15 14 13 12 11	10 (9) 8 7 6	5 4 3 2 1 0
5. Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills >75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
SCORE 9	20 19 18 17 16	15 14 13 12 11	10 (9) 8 7 6	5 4 3 2 1 0

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS (BACK)

Parameters to be evaluated broader than sampling reach

Habitat Parameter	Condition Category: Optimal	Suboptimal	Marginal	Poor
6. Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr) may be present, but recent channelization is not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.
SCORE 15	20 19 18 17 16	(15) 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
7. Channel Sinuosity	The bends in the stream increase the stream length 3 to 4 times longer than if it was in a straight line. (Note - channel braiding is considered normal in coastal plains and other low-lying areas. This parameter is not easily rated in these areas.)	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	Channel straight; waterway has been channelized for a long distance.
SCORE 14	20 19 18 17 16	15 (14) 13 12 11	10 9 8 7 6	5 4 3 2 1 0
8. Bank Stability (score each bank) 05	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.
SCORE 5 (LB)	Left Bank 10 9	8 7 6	(5) 4 3	2 1 0
SCORE 6 (RB)	Right Bank 10 9	8 7 (6)	5 4 3	2 1 0
9. Vegetative Protection (score each bank) Note: determine left or right side by facing downstream.	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
SCORE 5 (LB)	Left Bank 10 9	8 7 6	(5) 4 3	2 1 0
SCORE 7 (RB)	Right Bank 10 9	8 (7) 6	5 4 3	2 1 0
10. Riparian Vegetative Zone Width (score each bank riparian zone) 09	Width of riparian zone >18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone.	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6-12 meters; human activities have impacted zone a great deal.	Width of riparian zone <6 meters: little or no riparian vegetation due to human activities.
SCORE 5 (LB)	Left Bank 10 9	8 7 6	(5) 4 3	2 1 0
SCORE 9 (RB)	Right Bank 10 (9)	8 7 6	5 4 3	2 1 0

Total Score 109

v. 2014

MBSS SPRING INDEX PERIOD DATA SHEET

SITE MP139R — Watershed Code | Segment | Type: P | Year: 2016

Reviewer: First: MKT / Second: MWT

DATE: Year: 16 | Month: 04 | Day: 13

CREW: MKT/MWT

STREAM NAME:

LOCALITY:

TIME: 0935 (Military)

SAMPLEABILITY

- Y Benthos
- N Facies Mapping
- Y Habitat Assessment
- Y Water Quality
- N Vernal Pool
- N Present (Y/N)

Other:

SITE ACCESS ROUTE:

SAMPLE LABELS

Verified by:

N/A QC LABELS

Watershed Code | Segment (Letters Only) | Type | Year

Dup. (D) or Blank (B): Verified by:

TEMP. LOGGERS

	(Y/N)	(TIME - Military)	#
WATER		N/A	
AIR			#

LOCATION:

PHOTODOCUMENTATION

Number | Voucher (Y/N)

BENTHIC HABITAT SAMPLED

- 14 Riffle
- 5 Rootwad/Woody Debris
- 1 Leaf Pack
- 0 Macrophytes
- 0 Undercut Banks
- 0 Other:

SAMPLING CONSIDERATIONS: (2 NUM. ANODES)

probably one anode during summer

STREAM WIDTH (m): 25.5 (0 m) | 20.0 (75 m)

6.

v. 2014

MBSS SPRING FAUNAL DATA SHEET

SITE MP139A | Watershed Code | Segment | Type: P | Year: 2016 | Reviewer: First: MKT / Second: MWT

HERPETOFAUNA

☐ None Observed

Species	Lifestage: Adult	Lifestage: Larval	Lifestage: Egg	SEEN (Y/N)	HEARD (Y/N)	Number Retained	Number Photos Taken
DUSKY Salamander		X		Y	N	0	0
Green Frog		X		Y	N	0	0
Cricket Frog		X		Y	N	0	0

MUSSELS

☐ None Observed

Species	LIVE	DEAD	Number Retained	Num. Photos Taken

Corbicula: LIVE ☐ DEAD ☐ NONE ☐

CRAYFISH

☐ None Observed

Species	Number Retained

Crayfish Burrows (A,P,E): A

COMMENTS: _____

v. 2014

MBSS SPRING HABITAT DATA SHEET

SITE MP139A — Watershed Code | Segment | Type: P | Year: 2016

Reviewer: First: MKT / Second: MWT

DATE — Year: 16 | Month: 04 | Day: 13

100 Dist. from Nearest Road to Site (m)

19 Trash Rating 0 - 20

LANDUSE (Y/N)

N	Old Field	N	Residential
Y	Deciduous Forest	N	Commercial/Industrial
N	Coniferous Forest	N	Cropland
N	Wetland	N	Pasture
N	Surface Mine	N	Orchard/Vineyard/Nursery
N	Landfill	N	Golf Course

RIPARIAN VEGETATION
(facing upstream)

	LEFT BANK	RIGHT BANK
Width (50m max)	50	50
Adj. Land Cover	FR	FR
Veg Type	MYRG	MYRG
Buffer Breaks (Y/N)	N	N

BUFFER BREAKS

	LEFT BANK	RIGHT BANK
Storm Drain		
Tile Drain		
Imperv. Drainage		
New Construction		
Orchard		
Crop		
Pasture		
Gully		
Dirt Road		
Gravel Road		
Raw Sewage		
Railroad		

Buffer Break Types (M = Minor; S = Severe)

ROAD CULVERT

Present in Segment? (Y/N)	N
Sampleable? (Y/N)	
Width of Culvert (m)	
Length of Culvert (m)	

STREAM GRADIENT

	Location (m)	Height (m)
1		
2		
3		

CHANNELIZATION

N Evidence of Channel Straightening or Dredging (Y/N)

TYPE	EXTENT (m)		
	LEFT BANK	BOTTOM	RIGHT BANK
Concrete			
Gabion			
Rip-Rap			
Earthen Berm			
Dredge Spoil Off Channel			
Pipe Culvert			

Actual Site Midpoint Coordinates
(Taken at Time of Sampling)

Lat

Long

Stream Blockages

Stream Block Ht. (m)

Stream Block Type

Lat

Long

Physical Habitat Assessment and Water Quality Data Sheet

Site ID: MP139A
Subwatershed: _____
Length of Reach: 75m Date: 4/13/16
Team Members: MKT/MWT Time: 9:35Am

Stream Character

- [P] Meandering
- [A] Braided
- [P] Riffle
- [P] Deep Pool >.5m
- [P] Shallow Pool <.5m
- [P] Gravel
- [A] Boulder >2m
- [A] Concrete/Gabion
- [A] Undercut Bank
- [P] Overhead Cover
- [A] Effluent Discharge
- [A] Emergent Vegetation
- [A] Floating Vegetation
- [A] Channelized
- [A] Straight
- [P] Run/Glide
- [E] Silt/Clay
- [E] Sand
- [A] Cobble
- [A] Boulder <2m
- [A] Bedrock
- [P] Rootwad
- [A] Storm Drain
- [A] Human Refuse
- [A] Beaver Pond

A=Absent P=Present E=Extensive

Bar Formation

- [ ] None
- [ ] Minor
- [X] Moderate
- [ ] Extensive

Bank Erosion (see guidance sheet)

	Left Bank	Right Bank	Severity
Extent (m)	10	10	
Severity	1	1	0=none
Avg. Height	2m (6ft)	2m (6ft)	1=min 2=mod 3=severe

Maximum stream depth (cm): 70

Benthic Habitat Sampled (20 total)	Sq. ft.
Riffle	14
Rootwad/Woody Debris	5
Leaf Pack	1
Submerged Vegetation	
Undercut Banks	
Other:	

Rootwads/Woody Debris

# Instream Woody Debris	11
# Dewatered Woody Debris	5
# Instream Rootwads	2
# Dewatered Rootwads	0

Stream Gradient

Location (ft)	Height (ft)	Water Depth (ft)
	NA	

Weather

Current: Clear
Past 24hrs: Cloudy/Rain
Past 48hrs: Cloudy/Rain

Parameter	Down-stream	Mid-stream	Up-stream
Description	Glide	RUN	POOL
pH	6.66	6.72	6.81
Temperature (°C)	9.5	9.5	9.8
DO (mg/l)	11.61	11.52	10.88
Conductivity (uS/cm)	190	195	190
TDS (mg/l)	95	97	96
Turbidity (NTU)	2.93	2.52	2.69

Notes: _____

Photographs/Observations:

→ few fallen trees
→ Mark (property owner) was present during sampling

MBSS Physical Habitat Assessment Sheet

Stream Habitat Assessment Guidance Sheet				
Habitat Parameter	Optima 16-20	Sub-Optima 11-15	Marginal 6-10	Poor 0-5
1. In-stream Habitat[1] SCORE 9	Greater than 50% of a variety of cobble, boulder, submerged logs, undercut banks, snags, rootwads, aquatic plants or other stable habitat	30-50% of stable habitat. Adequate habitat	10-30% mix of stable habitat. Habitat availability less than desireable	Less than 10% stable habitat. Lack of habitat is obvious
2. Epifaunal Substrate[2] SCORE 3	Preferred substrate abundant, stable, and at full colonization potential (riffles well developed and dominated by cobble; and/or woody debris prevalent, not new, and not transient	Abund. of cobble with gravel and/or boulders common; or woody debris, aquatic veg., undercut banks common but not prevalent/suited for full colonization	Large boulders and/or bedrock prevalent; cobble, woody debris, or other preferred surfaces uncommon	Stable substrate lacking; or particles are over 75% surrounded by fine sediment or flocculent material
3. Velocity/Depth Diversity[3] SCORE 13	Slow (<0.3m/s), deep (>0.5m); slow, shallow (<0.5m); fast (>0.3m/s), deep; fast, shallow habitats all present	Only 3 of the 4 habitat categories present	Only 2 of the 4 habitat categories present	Dominated by 1 velocity/depth category (usually pools)
4. Pool/Glide/Eddy Quality[4] SCORE 15	Complex cover &/or depth >1.5m; both deep (>0.5m) shallows (<0.2m) present	Deep (>0.3m) areas present; but only moderate cover	Shallows (<0.2m) prevalent in pool/glide/eddy habitat; little cover	Max depth <0.2m in pool/glide/eddy habitat; or absent completely
5. Riffle/Run Quality[5] SCORE 11	Riffle/run depth generally >10cm, with maximum depth greater than 50 cm (maximum score); substrate stable (e.g. cobble, boulder) & variety of current velocities	Riffle/run depth generally 5-10cm, variety of current velocities	Riffle/run depth generally 1-5cm, primarily a single current velocity	Riffle/run depth <1cm, or riffle/run substrates concreted
6. Bank Stability[6] (facing downstream) Score each bank LB SCORE 8 RB SCORE 5	Banks stable; evidence of erosion or bank failure absent or minima. little potential for future problems. <5% of bank affected. 10 9	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion 8 7 6	Moderately unstable; 30-50% of bank in reach as areas of erosion; high erosion potential during floods. 5 4 3	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars. 2 1 0
7. Embeddedness SCORE 100 %	Percentage that gravel, cobble, and boulder particles are surrounded by fine sediment or flocculent material			
8. Shading SCORE 75 %	Percentage of segment that is shaded (duration is considered in scoring). 0% = fully exposed to sunlight all day in summer. 100% = fully and densely shaded all day in summer			
9. Riparian Buffer Zone Width (m)[7] LB 50 RB 50	Zone width in which human activity is not evident. 50m (164ft) is the maximum recorded value			
10. Remoteness SCORE 10	Roads greater than 400 meters (0.25 mi) from stream	Roads within 400 meters (0.25 mi) of stream; stream NOT accessible by trail	Roads within 400 meters (0.25 mi) of stream; stream accessible by trail	Roads adjacent to stream
11. Aesthetic (trash) Rating[8] SCORE 19	Little or no human refuse visible from stream channel or riparian zone	Refuse present in minor amounts	Refuse present in moderate amounts	Refuse abundant and unsightly
12. Number of Woody Debris and Rootwads[9] SCORE 16	Count only woody debris and rootwads within the wetted portion of the sampling segment. Count only woody debris >10cm (4in) diameter and >1.5m (5ft) long and rootwads with trunk diameter (at chest height) >15cm (6in) that are "functional habitat within the wetted portion of the stream.			

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS (FRONT)

STREAM NAME MP139A	LOCATION	
STATION # _____ RIVERMILE _____	STREAM CLASS	
LAT _____ LONG _____	RIVER BASIN	
STORET #	AGENCY Biohabitats	
INVESTIGATORS MKT / MWT		
FORM COMPLETED BY MKT	DATE April 13, 2016 TIME 835 (AM) PM	REASON FOR SURVEY Bug Sampling

Parameters to be evaluated in sampling reach

Habitat Parameter	Condition Category			
	Optimal	Suboptimal	Marginal	Poor
1. Epifaunal Substrate/ Available Cover	Greater than 50% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient).	30-50% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale).	10-30% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 10% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
SCORE 9	20 19 18 17 16	15 14 13 12 11	10 (9) 8 7 6	5 4 3 2 1 0
2. Pool Substrate Characterization	Mixture of substrate materials, with gravel and firm sand prevalent; root mats and submerged vegetation common.	Mixture of soft sand, mud, or clay; mud may be dominant; some root mats and submerged vegetation present.	All mud or clay or sand bottom; little or no root mat; no submerged vegetation.	Hard-pan clay or bedrock; no root mat or vegetation.
SCORE 8	20 19 18 17 16	15 14 13 12 11	10 9 (8) 7 6	5 4 3 2 1 0
3. Pool Variability	Even mix of large-shallow, large-deep, small-shallow, small-deep pools present.	Majority of pools large-deep; very few shallow.	Shallow pools much more prevalent than deep pools.	Majority of pools small-shallow or pools absent.
SCORE 11	20 19 18 17 16	15 14 13 12 (11)	10 9 8 7 6	5 4 3 2 1 0
4. Sediment Deposition	Little or no enlargement of islands or point bars and less than <20% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 20-50% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 50-80% of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; more than 80% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
SCORE 8	20 19 18 17 16	15 14 13 12 11	10 9 (8) 7 6	5 4 3 2 1 0
5. Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills >75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
SCORE 13	20 19 18 17 16	15 14 (13) 12 11	10 9 8 7 6	5 4 3 2 1 0

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS (BACK)

Parameters to be evaluated broader than sampling reach

Habitat Parameter	Condition Category			
	Optimal	Suboptimal	Marginal	Poor
6. Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr) may be present, but recent channelization is not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.
SCORE 18	20 19 **(18)** 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
7. Channel Sinuosity	The bends in the stream increase the stream length 3 to 4 times longer than if it was in a straight line. (Note - channel braiding is considered normal in coastal plains and other low-lying areas. This parameter is not easily rated in these areas.)	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	Channel straight; waterway has been channelized for a long distance.
SCORE 9	20 19 18 17 16	15 14 13 12 11	10 **(9)** 8 7 6	5 4 3 2 1 0
8. Bank Stability (score each bank)	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.
SCORE 8 (LB)	Left Bank 10 9	**(8)** 7 6	5 4 3	2 1 0
SCORE 5 (RB)	Right Bank 10 9	8 7 6	**(5)** 4 3	2 1 0
9. Vegetative Protection (score each bank) Note: determine left or right side by facing downstream.	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
SCORE 7 (LB)	Left Bank 10 9	8 **(7)** 6	5 4 3	2 1 0
SCORE 6 (RB)	Right Bank 10 9	8 7 **(6)**	5 4 3	2 1 0
10. Riparian Vegetative Zone Width (score each bank riparian zone)	Width of riparian zone >18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone.	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6-12 meters; human activities have impacted zone a great deal.	Width of riparian zone <6 meters: little or no riparian vegetation due to human activities.
SCORE 10 (LB)	Left Bank **(10)** 9	8 7 6	5 4 3	2 1 0
SCORE 10 (RB)	Right Bank **(10)** 9	8 7 6	5 4 3	2 1 0

Total Score 122

v. 2009

MBSS SPRING INDEX PERIOD DATA SHEET

Page 1 of 4

SITE Watershed Code | Segment | Type | Year: MP139A Rep | P | 2015

Reviewer: First MWT / Second MKT

DATE Year | Month | Day: 16 | 04 | 13

CREW: MWT/MKT

STREAM:

TIME 0835 (Military)

LOCALITY:

SAMPLEABILITY

- [Y] Benthos
- [Y] Habitat Assessment
- [Y] Water Quality
- [N] Vernal Pool [A] PRESENT/ABSENT

OTHER (SPECIFY)

SITE ACCESS ROUTE

SAMPLE LABELS

Verified by:

QC LABEL

Watershed Code | Segment (Letters only) | Type | Year

Dup. (D) or Blank (B): Verified by:

TEMP. LOGGER

	(Y/N)	(TIME - Military)	#
WATER			#
AIR			#

LOCATION

PHOTODOCUMENTATION

Number	Title	Voucher (Y/N)

BENTHIC HABITAT SAMPLED

- [14] Riffle
- [1] Leaf Pack
- [0] Undercut Banks
- [5] Rootwad/Woody Debris
- [0] Macrophytes
- [0] Other

SAMPLING CONSID.: ([2] NUM. ANODES) probably one anode during summer low flows

STREAM WIDTH (m): 25 (0 m) | 20 (75 m)

v. 2009

MBSS SPRING FAUNA DATA SHEET

SITE Watershed Code: MP139 A Rep | Segment: | Type: P | Year: 2016

Reviewer: First: MWT / Second: MKT

HERPETOFAUNA

☐ None Observed

Species	Lifestage (Adult / Juv. / Larval / Egg)	SEEN (Y/N)	HEARD (Y/N)	NUMBER RETAINED	NUMBER PHOTOS TAKEN
Dusky Salamander	Larval	Y	N	0	0
Green Frog	Larval	Y	N	0	0
Cricket Frog	Larval	Y	N	0	0

MUSSELS

☒ None Observed

Species	LIVE	DEAD	NUMBER RETAINED	NUMBER PHOTOS TAKEN

Corbicula: LIVE ☐ DEAD ☐ NONE ☒

CRAYFISHES

☒ None Observed

Species	NUMBER RETAINED

Crayfish Burrows: A

(Absent, Present, Extensive)

COMMENTS

v. 2009

RepP **MBSS SPRING HABITAT DATA SHEET**

SITE Watershed Code: MP139 Segment: [ ] Type: P Year: 2016

Reviewer: First: MWT / Second: MKT

DATE Year: 06 Month: 04 Day: 13

100 Dist. from Nearest Road to Site (m)

19 Trash Rating 0 - 20

LANDUSE (Y/N)

N	Old Field	N	Residential
Y	Deciduous Forest	N	Commercial/Industrial
N	Coniferous Forest	N	Cropland
N	Wetland	N	Pasture
N	Surface Mine	N	Orchard/Vineyard/Nursery
N	Landfill	N	Golf Course

ROAD CULVERT

Present in Segment (Y/N): N

Sampleable? (Y/N): [ ]

Width of Culvert (m): [ ]

Length of Culvert (m): [ ]

STREAM GRADIENT

	Location (m)	Height (m)
1		
2		
3		

RIPARIAN VEGETATION

(facing upstream)

	LEFT BANK	RIGHT BANK
Width (50m max)	50	50
Adjacent Land Cover	FR	FR
Vegetation Type	MYRG	MYRG
Buffer Breaks (Y/N)	N	N

	LEFT BANK	RIGHT BANK
Storm Drain		
Tile Drain		
Impervious Drainage		
Gully		
Orchard		
Crop		
Pasture		
New Construction		
Dirt Road		
Gravel Road		
Raw Sewage		
Railroad		

Buffer Break Types
(M = minor; S = severe)

CHANNELIZATION

N Evidence of Channel Straightening or Dredging (Y/N)

TYPE	EXTENT (m)		
	LEFT BANK	BOTTOM	RIGHT BANK
Concrete			
Gabion			
Rip-Rap			
Earthen Berm		N/A	
Dredge Spoil Off Channel		N/A	
Pipe Culvert			

Actual Coordinates
(If >30m distance between original coordinates and stream)

Lat

Lon

Stream Block Ht. (m)

Stream Block Type

Lat

Lon

Physical Habitat Assessment and Water Quality Data Sheet

Site ID: MPB9A Rep
Subwatershed: _____
Length of Reach: 75m Date: 4/13/16
Team Members: MWT/MRT Time: 08:35am

Stream Character

[P] Meandering	[A] Channelized
[A] Braided	[A] Straight
[P] Riffle	[P] Run/Glide
[P] Deep Pool >.5m	[E] Silt/Clay
[P] Shallow Pool <.5m	[P] Sand
[P] Gravel	[A] Cobble
[A] Boulder >2m	[A] Boulder <2m
[A] Concrete/Gabion	[A] Bedrock
[A] Undercut Bank	[P] Rootwad
[P] Overhead Cover	[A] Storm Drain
[A] Effluent Discharge	[A] Human Refuse
[A] Emergent Vegetation	[A] Beaver Pond
[A] Floating Vegetation	

A=Absent P=Present E=Extensive

Bar Formation

[ ] None	[X] Moderate
[ ] Minor	[ ] Extensive

Bank Erosion (see guidance sheet)

	Left Bank	Right Bank	Severity
Extent (m)	10	10	
Severity	1	1	0=none
Avg. Height	2m	2m	1=min
			2=mod
Maximum stream depth (cm)	70		3=severe

Benthic Habitat Sampled (20 total)	Sq. ft.
Riffle	14
Rootwad/Woody Debris	5
Leaf Pack	1
Submerged Vegetation	0
Undercut Banks	0
Other:_____	0

Rootwads/Woody Debris

# Instream Woody Debris	11	[X]
# Dewatered Woody Debris	5	[ ]
# Instream Rootwads	2	[ ]
# Dewatered Rootwads	0	

Stream Gradient

Location (ft)	Height (ft)	Water Depth (ft)

Weather
Current: Clear
Past 24hrs: Cloudy/Rain
Past 48hrs: Cloudy/Rain

Parameter	Down-stream	Mid-stream	Up-stream
Description	Glide	Run	Pool
pH	6.66	6.72	6.81
Temperature (°C)	9.5	9.5	7.8
DO (mg/l)	11.61	11.52	10.88
Conductivity (uS/cm)	190	195	190
TDS (mg/l)	95	97	96
Turbidity (NTU)	2.93	2.52	2.69

Notes: _____

Photographs/Observations:
- few fallen trees
- property owner was present for sampling effort

MP 139A Rep

MBSS Physical Habitat Assessment Sheet

Stream Habitat Assessment Guidance Sheet				
Habitat Parameter	Optimal 16-20	Sub-Optimal 11-15	Marginal 6-10	Poor 0-5
1. Instream Habitat[1] SCORE 9	Greater than 50% of a variety of cobble, boulder, submerged logs, undercut banks, snags, rootwads, aquatic plants or other stable habitat	30-50% of stable habitat. Adequate habitat	10-30% mix of stable habitat. Habitat availability less than desireable	Less than 10% stable habitat. Lack of habitat is obvious
2. Epifaunal Substrate[2] SCORE 3	Preferred substrate abundant, stable, and at full colonization potential (riffles well developed and dominated by cobble; and/or woody debris prevalent, not new, and not transient	Abund. of cobble with gravel and/or boulders common; or woody debris, aquatic veg., undercut banks common but not prevalent/suited for full colonization	Large boulders and/or bedrock prevalent; cobble, woody debris, or other preferred surfaces uncommon	Stable substrate lacking; or particles are over 75% surrounded by fine sediment or flocculent material
3. Velocity/Depth Diversity[3] SCORE 13	Slow (<0.3m/s), deep (>0.5m); slow, shallow (<0.5m); fast (>0.3m/s), deep; fast, shallow habitats all present	Only 3 of the 4 habitat categories present	Only 2 of the 4 habitat categories present	Dominated by 1 velocity/depth category (usually pools)
4. Pool/Glide/Eddy Quality[4] SCORE 15	Complex cover/&/or depth >1.5m; both deep (>0.5m)/shallows (<0.2m) present	Deep (>0.5m) areas present; but only moderate cover	Shallows (<0.2m) prevalent in pool/glide/eddy habitat; little cover	Max depth <0.2m in pool/glide/eddy habitat; or absent completely
5. Riffle/Run Quality[5] SCORE 11	Riffle/run depth generally >10cm, with maximum depth greater than 50 cm (maximum score); substrate stable (e.g. cobble, boulder) & variety of current velocities	Riffle/run depth generally 5-10cm, variety of current velocities	Riffle/run depth generally 1-5cm; primarily a single current velocity	Riffle/run depth <1cm; or riffle/run substrates concreted
6. Bank Stability[6] (facing downstream) Score each bank LB SCORE 8 RB SCORE 5	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected. 10 9	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion. 8 7 6	Moderately unstable; 30-60% of bank in reach as areas of erosion; high erosion potential during floods. 5 4 3	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars. 2 1 0
7. Embeddedness SCORE 100 %	Percentage that gravel, cobble, and boulder particles are surrounded by fine sediment or flocculent material			
8. Shading SCORE 75 %	Percentage of segment that is shaded (duration is considered in scoring). 0% = fully exposed to sunlight all day in summer, 100% = fully and densely shaded all day in summer			
9. Riparian Buffer Zone Width (m)[7] LB 50 RB 50	Zone width in which human activity is not evident. 50m (164ft) is the maximum recorded value.			
10. Remoteness[8] SCORE 10	Roads greater than 400 meters (0.25 mi) from stream	Roads within 400 meters (0.25 mi) of stream; stream NOT accessible by trail.	Roads within 400 meters (0.25 mi) of stream; stream accessible by trail.	Roads adjacent to stream.
11. Aesthetic (trash) Rating[9] SCORE 18	Little or no human refuse visible from stream channel or riparian zone	Refuse present in minor amounts	Refuse present in moderate amounts	Refuse abundant and unsightly
12. Number of Woody Debris and Rootwads[10] SCORE 18	Count only woody debris and rootwads within the wetted portion of the sampling segment. Count only woody debris >10cm (4in) diameter and >1.5m (5ft) long and rootwads with trunk diameter (at chest height) >15cm (6in) that are functional habitat within the wetted portion of the stream.			

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS (FRONT)

STREAM NAME MP139A Rep	LOCATION	
STATION #_____ RIVERMILE_____	STREAM CLASS	
LAT_____ LONG_____	RIVER BASIN	
STORET #	AGENCY Biohabitats	
INVESTIGATORS MKT/MWT		
FORM COMPLETED BY MWT	DATE 4/13/16 TIME 8:35 (AM) PM	REASON FOR SURVEY Bug sampling

Parameters to be evaluated in sampling reach

Habitat Parameter	Condition Category			
	Optimal	**Suboptimal**	**Marginal**	**Poor**
1. Epifaunal Substrate/ Available Cover	Greater than 50% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient).	30-50% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale).	10-30% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 10% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
SCORE 9	20 19 18 17 16	15 14 13 12 11	10 (9) 8 7 6	5 4 3 2 1 0
2. Pool Substrate Characterization	Mixture of substrate materials, with gravel and firm sand prevalent; root mats and submerged vegetation common.	Mixture of soft sand, mud, or clay; mud may be dominant; some root mats and submerged vegetation present.	All mud or clay or sand bottom; little or no root mat; no submerged vegetation.	Hard-pan clay or bedrock; no root mat or vegetation.
SCORE 8	20 19 18 17 16	15 14 13 12 11	10 9 (8) 7 6	5 4 3 2 1 0
3. Pool Variability	Even mix of large-shallow, large-deep, small-shallow, small-deep pools present.	Majority of pools large-deep; very few shallow.	Shallow pools much more prevalent than deep pools.	Majority of pools small-shallow or pools absent.
SCORE 11	20 19 18 17 16	15 14 13 12 (11)	10 9 8 7 6	5 4 3 2 1 0
4. Sediment Deposition	Little or no enlargement of islands or point bars and less than <20% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 20-50% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 50-80% of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; more than 80% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
SCORE 8	20 19 18 17 16	15 14 13 12 11	10 9 (8) 7 6	5 4 3 2 1 0
5. Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills >75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
SCORE 13	20 19 18 17 16	15 14 (13) 12 11	10 9 8 7 6	5 4 3 2 1 0

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS (BACK)

Parameters to be evaluated broader than sampling reach

Habitat Parameter	Condition Category			
	Optimal	Suboptimal	Marginal	Poor
6. Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr) may be present, but recent channelization is not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.
SCORE 18	20 19 (18) 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
7. Channel Sinuosity	The bends in the stream increase the stream length 3 to 4 times longer than if it was in a straight line. (Note - channel braiding is considered normal in coastal plains and other low-lying areas. This parameter is not easily rated in these areas.)	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	Channel straight; waterway has been channelized for a long distance.
SCORE 9	20 19 18 17 16	15 14 13 12 11	10 (9) 8 7 6	5 4 3 2 1 0
8. Bank Stability (score each bank)	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.
SCORE 8 (LB)	Left Bank 10 9	(8) 7 6	5 4 3	2 1 0
SCORE 5 (RB)	Right Bank 10 9	8 7 6	(5) 4 3	2 1 0
9. Vegetative Protection (score each bank) Note: determine left or right side by facing downstream.	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
SCORE 7 (LB)	Left Bank 10 9	8 (7) 6	5 4 3	2 1 0
SCORE 6 (RB)	Right Bank 10 9	8 7 (6)	5 4 3	2 1 0
10. Riparian Vegetative Zone Width (score each bank riparian zone)	Width of riparian zone >18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone.	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6-12 meters; human activities have impacted zone a great deal.	Width of riparian zone <6 meters: little or no riparian vegetation due to human activities.
SCORE 10 (LB)	Left Bank (10) 9	8 7 6	5 4 3	2 1 0
SCORE 10 (RB)	Right Bank (10) 9	8 7 6	5 4 3	2 1 0

Total Score _____

v. 2014

MBSS SPRING FAUNAL DATA SHEET

SITE | Watershed Code: MP19 | Segment: | Type: P | Year: 2016 | Reviewer: First: KT / Second: MWT

HERPETOFAUNA

☐ None Observed

Species	Lifestage: Adult	Lifestage: Larval	Lifestage: Egg	SEEN (Y/N)	HEARD (Y/N)	Number Retained	Number Photos Taken
NORTHERN WATER SNAKE	X			Y	N	0	0

MUSSELS

☐ None Observed

Species	LIVE	DEAD	Number Retained	Num. Photos Taken

Corbicula: LIVE ☐ DEAD ☐ NONE ☐

CRAYFISH

☐ None Observed

Species	Number Retained
UNKNOWN SPECIES (SEEN; NONE CAPTURED)	0

Crayfish Burrows (A,P,E): P

COMMENTS:

MBSS VERNAL POOL DATA SHEET

SITE — Watershed Code: MP19 | Segment: | Type: P | Year: 2016

Reviewer: First: KT / Second: MWT

Within Transect? (Y/N): N

Lat ____ Long ____

Vernal Pool ID: VP

Dimensions: ___ m X ___ m

Max Depth: ___ cm

Landscape Setting: ___ Upland or Floodplain

Fish Observed? (Y/N):

Anostraca Observed? (Y/N):

Predominant Surrounding Landuse:

Distance From Pool

HERPETOFAUNA

None Observed

Species	Lifestage Adult	Lifestage Larva	Lifestage Egg	Seen (Y/N)	Heard (Y/N)	# Ret.	# Photos Taken

PHOTODOCUMENTATION

Number		Voucher (Y/N)

COMMENTS:

Within Transect? (Y/N): N

Lat ____ Long ____

Vernal Pool ID: VP

Dimensions: ___ m X ___ m

Max Depth: ___ cm

Landscape Setting: ___ Upland or Floodplain

Fish Observed? (Y/N):

Anostraca Observed? (Y/N):

Predominant Surrounding Landuse:

Distance From Pool

HERPETOFAUNA

None Observed

Species	Lifestage Adult	Lifestage Larva	Lifestage Egg	Seen (Y/N)	Heard (Y/N)	# Ret.	# Photos Taken

PHOTODOCUMENTATION

Number		Voucher (Y/N)

COMMENTS:

v. 2014

MBSS SPRING HABITAT DATA SHEET

SITE — Watershed Code: MPI9 | Segment: | Type: P | Year: 2016 | Reviewer: First: KT / Second:

DATE — Year: 16 | Month: 04 | Day: 13

100 Dist. from Nearest Road to Site (m)

3 Trash Rating 0 - 20

LANDUSE (Y/N)

N	Old Field	N	Residential
Y	Deciduous Forest	N	Commercial/Industrial
N	Coniferous Forest	N	Cropland
N	Wetland	N	Pasture
N	Surface Mine	N	Orchard/Vineyard/Nursery
N	Landfill	N	Golf Course

RIPARIAN VEGETATION
(facing upstream)

	LEFT BANK	RIGHT BANK
Width (50m max)	50	50
Adj. Land Cover	FR	FR
Veg Type	YRMG	YRMG
Buffer Breaks (Y/N)	N	N

ROAD CULVERT

Present in Segment? (Y/N)	N
Sampleable? (Y/N)	
Width of Culvert (m)	
Length of Culvert (m)	

STREAM GRADIENT

	Location (m)	Height (m)
1		
2		
3		

BUFFER BREAKS

	LEFT BANK	RIGHT BANK
Storm Drain		
Tile Drain		
Imperv. Drainage		
New Construction		
Orchard		
Crop		
Pasture		
Gully		
Dirt Road		
Gravel Road		
Raw Sewage		
Railroad		

Buffer Break Types (M = Minor; S = Severe)

CHANNELIZATION

N Evidence of Channel Straightening or Dredging (Y/N)

TYPE	EXTENT (m)		
	LEFT BANK	BOTTOM	RIGHT BANK
Concrete			
Gabion			
Rip-Rap			
Earthen Berm			
Dredge Spoil Off Channel			
Pipe Culvert			

Actual Site Midpoint Coordinates
(Taken at Time of Sampling)

Lat
Long

Stream Blockages

Stream Block Ht. (m)
Stream Block Type
Lat
Long

Physical Habitat Assessment and Water Quality Data Sheet

Site ID: MP19
Subwatershed: _____
Length of Reach: 75m Date: 4/18/16
Team Members: KT/MWT Time: 1449 PM

Stream Character

P	Meandering	A	Channelized
A	Braided	A	Straight
P	Riffle	P	Run/Glide
P	Deep Pool >.6m	P	Silt/Clay
P	Shallow Pool <.6m	P	Sand
P	Gravel	A	Cobble
A	Boulder >2m	A	Boulder <2m
A	Concrete/Gabion	A	Bedrock
A	Undercut Bank	P	Rootwad
P	Overhead Cover	A	Storm Drain
A	Effluent Discharge	E	Human Refuse
A	Emergent Vegetation	A	Beaver Pond
A	Floating Vegetation		

A=Absent P=Present E=Extensive

Bar Formation

☐	None	☑	Moderate
☐	Minor	☐	Extensive

Bank Erosion (see guidance sheet)

	Left Bank	Right Bank	
Extent (m)	0	3	Severity
Severity	0	1	0=none
Avg. Height	0	1m (3ft)	1=mild
			2=mod
			3=severe

Maximum stream depth (cm): 50

Benthic Habitat Sampled (20 total)	Sq. ft.
Riffle	12
Rootwad/Woody Debris	4
Leaf Pack	4
Submerged Vegetation	0
Undercut Banks	0
Other: _____	0

Rootwads/Woody Debris

# Instream Woody Debris	5
# Dewatered Woody Debris	3
# Instream Rootwads	4
# Dewatered Rootwads	2

Stream Gradient

Location (ft)	Height (ft)	Water Depth (ft)
NA		

Weather
Current: CLEAR
Past 24hrs: CLOUDY/RAIN
Past 48hrs: CLOUDY/RAIN

Parameter	Down-stream	Mid-stream	Up-stream
Description	RIFFLE	POOL	RUN
pH	6.74	6.86	6.92
Temperature (°C)	15.6	15.7	15.8
DO (mg/l)	5.84	4.67	6.100
Conductivity (uS/cm)	342	345	345
TDS (mg/l)	170	172	172
Turbidity (NTU)	2.04	11.28	1.92

Notes: _____

Photographs/Observations:
→ LOTS OF TRASH IN-STREAM & IN FLOODPLAIN (TIRES, APPLIANCES, ETC.)

MBSS Physical Habitat Assessment Sheet

Stream Habitat Assessment Guidance Sheet				
Habitat Parameter	Optima 16-20	Sub-Optima 11-15	Marginal 6-10	Poor 0-5
1. In-Stream Habitat[1] SCORE 11	Greater than 50% of a variety of cobble, boulder, submerged logs, undercut banks, snags, rootwads, aquatic plants or other stable habitat	30-50% of stable habitat. Adequate habitat	10-30% mix of stable habitat. Habitat availability less than desireable	Less than 10% stable habitat. Lack of habitat is obvious
2. Epifaunal Substrate[2] SCORE 3	Preferred substrate abundant, stable, and at full colonization potential (riffles well developed and dominated by cobble; and/or woody debris prevalent; not new, and not transient	Abund. of cobble with gravel and/or boulders common; or woody debris, aquatic veg., undercut banks common but not prevalent/suited for full colonization	Large boulders and/or bedrock prevalent; cobble, woody debris, or other preferred surfaces uncommon	Stable substrate lacking; or particles are over 75% surrounded by fine sediment or flocculent material
3. Velocity/Depth Diversity[3] SCORE 11	Slow (<0.3m/s), deep (>0.5m); slow, shallow (<0.5m); fast (>0.3m/s), deep; fast, shallow habitats all present	Only 3 of the 4 habitat categories present	Only 2 of the 4 habitat categories present	Dominated by 1 velocity/depth category (usually pools)
4. Pool/Glide/Eddy Quality[4] SCORE 4	Complex cover & /or depth >1.5m; both deep (>0.5m) shallows (<0.2m) present	Deep (>0.5m) areas present; but only moderate cover	Shallows (<0.2m) prevalent in pool/glide/eddy habitat; little cover	Max depth <0.2m in pool/glide/eddy habitat; or absent completely
5. Riffle/Run Quality[5] SCORE 6	Riffle/run depth generally >10cm, with maximum depth greater than 50 cm (maximum score); substrate stable (e.g. cobble, boulder) & variety of current velocities	Riffle/run depth generally 5-10cm, variety of current velocities	Riffle/run depth generally 1-5cm; primarily a single current velocity	Riffle/run depth <1cm, or riffle/run substrates concreted
6. Bank Stability[6] (Facing downstream) Score each bank LB SCORE 8 RB SCORE 7	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected. 10 9	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion 8 7 6	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods. 5 4 3	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars. 2 1 0
7. Embeddedness SCORE 90 %	Percentage that gravel, cobble, and boulder particles are surrounded by fine sediment or flocculent material			
8. Shading SCORE 90 %	Percentage of segment that is shaded (duration is considered in scoring). 0% = fully exposed to sunlight all day in summer. 100% = fully and densely shaded all day in summer			
9. Riparian Buffer Zone Width (m)[7] LB 50 RB 50	Zone width in which human activity is not evident. 50m (164ft) is the maximum recorded value			
10. Remoteness SCORE 6	Roads greater than 400 meters (0.25 mi) from stream	Roads within 400 meters (0.25 mi) of stream; stream NOT accessible by trail	Roads within 400 meters (0.25 mi) of stream; stream accessible by trail	Roads adjacent to stream
11. Aesthetic (Trash) Rating[8] SCORE 3	Little or no human refuse visible from stream channel or riparian zone	Refuse present in minor amounts	Refuse present in moderate amounts	Refuse abundant and unsightly
12. Number of Woody Debris and Rootwads[9] SCORE 14	Count only woody debris and rootwads within the wetted portion of the sampling segment. Count only woody debris >10cm (4in) diameter and >1.5m (5ft) long and rootwads with trunk diameter (at chest height) >15cm (6in) that are functional habitat within the wetted portion of the stream.			

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS (FRONT)

STREAM NAME MP19	LOCATION
STATION #_____ RIVERMILE_____	STREAM CLASS
LAT _____ LONG _____	RIVER BASIN
STORET #	AGENCY BIOHABITATS
INVESTIGATORS KT/MWT	
FORM COMPLETED BY KT	DATE 4/13/16 TIME 1449 AM (PM) — REASON FOR SURVEY BUG Sampling

Parameters to be evaluated in sampling reach

Habitat Parameter	Condition Category			
	Optimal	Suboptimal	Marginal	Poor
1. Epifaunal Substrate/ Available Cover	Greater than 50% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient).	30-50% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale).	10-30% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 10% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
SCORE 11	20 19 18 17 16	15 14 13 12 (11)	10 9 8 7 6	5 4 3 2 1 0
2. Pool Substrate Characterization	Mixture of substrate materials, with gravel and firm sand prevalent; root mats and submerged vegetation common.	Mixture of soft sand, mud, or clay; mud may be dominant; some root mats and submerged vegetation present.	All mud or clay or sand bottom; little or no root mat; no submerged vegetation.	Hard-pan clay or bedrock; no root mat or vegetation.
SCORE 9	20 19 18 17 16	15 14 13 12 11	10 (9) 8 7 6	5 4 3 2 1 0
3. Pool Variability	Even mix of large-shallow, large-deep, small-shallow, small-deep pools present.	Majority of pools large-deep; very few shallow.	Shallow pools much more prevalent than deep pools.	Majority of pools small-shallow or pools absent.
SCORE 4	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 (4) 3 2 1 0
4. Sediment Deposition	Little or no enlargement of islands or point bars and less than <20% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 20-50% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 50-80% of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; more than 80% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
SCORE 3	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 (3) 2 1 0
5. Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills >75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
SCORE 9	20 19 18 17 16	15 14 13 12 11	10 (9) 8 7 6	5 4 3 2 1 0

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS (BACK)

Parameters to be evaluated broader than sampling reach

Habitat Parameter	Condition Category: Optimal	Suboptimal	Marginal	Poor
6. Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr) may be present, but recent channelization is not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.
SCORE 18	20 19 (18) 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
7. Channel Sinuosity	The bends in the stream increase the stream length 3 to 4 times longer than if it was in a straight line. (Note - channel braiding is considered normal in coastal plains and other low-lying areas. This parameter is not easily rated in these areas.)	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	Channel straight; waterway has been channelized for a long distance.
SCORE 6	20 19 18 17 16	15 14 13 12 11	10 9 8 7 (6)	5 4 3 2 1 0
8. Bank Stability (score each bank)	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.
SCORE 8 (LB)	Left Bank 10 9	(8) 7 6	5 4 3	2 1 0
SCORE 7 (RB)	Right Bank 10 9	8 (7) 6	5 4 3	2 1 0
9. Vegetative Protection (score each bank) Note: determine left or right side by facing downstream.	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
SCORE 6 (LB)	Left Bank 10 9	8 7 (6)	5 4 3	2 1 0
SCORE 6 (RB)	Right Bank 10 9	8 7 (6)	5 4 3	2 1 0
10. Riparian Vegetative Zone Width (score each bank riparian zone)	Width of riparian zone >18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone.	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6-12 meters; human activities have impacted zone a great deal.	Width of riparian zone <6 meters: little or no riparian vegetation due to human activities.
SCORE 10 (LB)	Left Bank (10) 9	8 7 6	5 4 3	2 1 0
SCORE 10 (RB)	Right Bank (10) 9	8 7 6	5 4 3	2 1 0

Total Score 107

v. 2014

MBSS SPRING INDEX PERIOD DATA SHEET

SITE — Watershed Code: MP22 | Segment: — | Type: P | Year: 2016

Reviewer: First: GZ | Second: JR

DATE — Year: 16 | Month: 04 | Day: 14

CREW: GZ / JLR

STREAM NAME:

LOCALITY:

TIME: 0700 (Military)

SAMPLEABILITY

- [Y] Benthos
- [N] Facies Mapping
- [Y] Habitat Assessment
- [Y] Water Quality
- [N] Vernal Pool
- [ ] Present (Y/N)

Other:

SITE ACCESS ROUTE: 979 Mt Zion Rd

SAMPLE LABELS

Verified by:

QC LABELS

Watershed Code | Segment (Letters Only) | Type | Year

Dup. (D) or Blank (B): Verified by:

TEMP. LOGGERS

	(Y/N)	(TIME - Military)	
WATER			#
AIR			#

LOCATION:

PHOTODOCUMENTATION

Number | Voucher (Y/N)

BENTHIC HABITAT SAMPLED

- 17 Riffle
- 02 Rootwad/Woody Debris
- 01 Leaf Pack
- 00 Macrophytes
- 00 Undercut Banks
- 00 Other:

SAMPLING CONSIDERATIONS: (NUM. ANODES)

STREAM WIDTH (m): 0 m: 0.9 (04) | 75 m: 1.2 (05)

v. 2014

MBSS SPRING FAUNAL DATA SHEET

SITE — Watershed Code: M P 2 2 — Segment: — — Type: P — Year: 2 0 1 6 — Reviewer: First: GZ / Second: JV

HERPETOFAUNA

☐ None Observed

Species	Lifestage: Adult	Larval	Egg	SEEN (Y/N)	HEARD (Y/N)	Number Retained	Number Photos Taken
Northern Rusty		X		Y	N	0	0

MUSSELS

☒ None Observed

Species	LIVE	DEAD	Number Retained	Num. Photos Taken

Corbicula — LIVE ☐ DEAD ☐ NONE ☐

CRAYFISH

☒ None Observed

Species	Number Retained

Crayfish Burrows (A,P,E): P

COMMENTS:

v. 2014

MBSS SPRING HABITAT DATA SHEET

SITE — Watershed Code: M P 2 2 — Segment: — 1 — Type: P — Year: 2 0 1 6 — Reviewer: First: G 2 / Second: [signature]

DATE — Year: 1 6 — Month: 0 4 — Day: 1 4

2 0 0 Dist. from Nearest Road to Site (m)

1 7 Trash Rating 0 - 20

LANDUSE (Y/N)

N	Old Field	N	Residential
Y	Deciduous Forest	N	Commercial/Industrial
N	Coniferous Forest	N	Cropland
N	Wetland	N	Pasture
N	Surface Mine	N	Orchard/Vineyard/Nursery
N	Landfill	N	Golf Course

RIPARIAN VEGETATION
(facing upstream)

	LEFT BANK	RIGHT BANK
Width (50m max)	4 0	5 0
Adj. Land Cover	F R	F R
Veg Type	Y R M G	Y M R G
Buffer Breaks (Y/N)	N	N

ROAD CULVERT

Present in Segment? (Y/N)	N
Sampleable? (Y/N)	
Width of Culvert (m)	
Length of Culvert (m)	

STREAM GRADIENT

	Location (m)	Height (m)
1		
2		
3		

BUFFER BREAKS

	LEFT BANK	RIGHT BANK
Storm Drain		
Tile Drain		
Imperv. Drainage		
New Construction		
Orchard		
Crop		
Pasture	NA	
Gully		
Dirt Road		
Gravel Road		
Raw Sewage		
Railroad		

Buffer Break Types (M = Minor; S = Severe)

CHANNELIZATION

N Evidence of Channel Straightening or Dredging (Y/N)

TYPE	EXTENT (m)		
	LEFT BANK	BOTTOM	RIGHT BANK
Concrete			
Gabion			
Rip-Rap			
Earthen Berm		NA	
Dredge Spoil Off Channel			
Pipe Culvert			

Actual Site Midpoint Coordinates
(Taken at Time of Sampling)

Lat

Long

Stream Blockages

Stream Block Ht. (m)

Stream Block Type

Lat

Long

Physical Habitat Assessment and Water Quality Data Sheet

Site ID: MP22
Subwatershed: _____
Length of Reach: 75m Date: 4/14/16
Team Members: GZ/JCR Time: 1:00 PM

Weather
Current: Clear
Past 24hrs: Clear
Past 48hrs: Clear

Parameter	Down-stream	Mid-stream	Up-stream
Description			
pH	6.75	7.03	6.85
Temperature (°C)	16.2	16.0	16.0
DO (mg/l)	3.72	3.05	3.02
Conductivity (uS/cm)	138	136	138
TDS (mg/l)	68	68	68
Turbidity (NTU)	7.40	9.49	10.02

Notes: _____

Stream Character

[E] Meandering	[A] Channelized
[A] Braided	[P] Straight
[E] Riffle	[P] Run/Glide
[A] Deep Pool >.5m	[P] Silt/Clay
[P] Shallow Pool <.5m	[P] Sand
[E] Gravel	[A] Cobble
[A] Boulder >2m	[A] Boulder <2m
[A] Concrete/Gabion	[A] Bedrock
[A] Undercut Bank	[P] Rootwad
[P] Overhead Cover	[A] Storm Drain
[A] Effluent Discharge	[A] Human Refuse
[A] Emergent Vegetation	[A] Beaver Pond
[A] Floating Vegetation	

A=Absent P=Present E=Extensive

Bar Formation
DS
☐ None ☒ Moderate
☐ Minor ☐ Extensive

Bank Erosion (see guidance sheet)

	Left Bank	Right Bank	Severity
Extent (m)	20	50	
Severity	1	2	0=None
Avg. Height	2	6	1=Low
			2=Med
Maximum stream depth (cm)	20		3=Severe

Benthic Habitat Sampled (20 total)

	Sq. ft.
Riffle	17
Rootwad/Woody Debris	2
Leaf Pack	1
Submerged Vegetation	
Undercut Banks	
Other:	

Rootwads/Woody Debris

# Instream Woody Debris	4
# Dewatered Woody Debris	4
# Instream Rootwads	0
# Dewatered Rootwads	1

Stream Gradient

Location (ft)	Height (ft)	Water Depth (ft)

Photographs/Observations:

MBSS Physical Habitat Assessment Sheet

Stream Habitat Assessment Guidance Sheet				
Habitat Parameter	Optima 16-20	Sub-Optima 11-15	Marginal 6-10	Poor 0-5
1. In-stream Habitat[1] SCORE 14	Greater than 50% of a variety of cobble, boulder, submerged logs, undercut banks, snags, rootwads, aquatic plants or other stable habitat	30-50% of stable habitat. Adequate habitat	10-30% mix of stable habitat. Habitat availability less than desireable	Less than 10% stable habitat. Lack of habitat is obvious
2. Epifaunal Substrate[2] SCORE 12	Preferred substrate abundant, stable, and at full colonization potential (riffles well developed and dominated by cobble; and/or woody debris prevalent, not new, and not transient	Abund. of cobble with gravel and/or boulders common; or woody debris, aquatic veg., undercut banks common but not prevalent/suited for full colonization	Large boulders and/or bedrock prevalent; cobble, woody debris, or other preferred surfaces uncommon	Stable substrate lacking; or particles are over 75% surrounded by fine sediment or flocculent material
3. Velocity/Depth Diversity[3] SCORE 12	Slow (<0.3m/s), deep (>0.5m); slow, shallow (<0.5m); fast (>0.3m/s), deep; fast, shallow habitats all present	Only 3 of the 4 habitat categories present	Only 2 of the 4 habitat categories present	Dominated by 1 velocity/depth category (usually pools)
4. Pool/Glide/Eddy Quality[4] SCORE 9	Complex cover & /or depth >1.5m; both deep (>0.5m) shallows (<0.2m) present	Deep (>0.5m) areas present; but only moderate cover	Shallows (<0.2m) prevalent in pool/glide/eddy habitat; little cover	Max depth <0.2m in pool/glide/eddy habitat; or absent completely
5. Riffle/Run Quality[5] SCORE 10	Riffle/run depth generally >10cm, with maximum depth greater than 50 cm (maximum score); substrate stable (e.g. cobble, boulder) & variety of current velocities	Riffle/run depth generally 5-10cm, variety of current velocities	Riffle/run depth generally 1-5cm, primarily a single current velocity	Riffle/run depth <1cm, or riffle/run substrates not created
6. Bank Stability[6] (facing downstream) Score each bank LB SCORE 7 RB SCORE 3	Banks stable; evidence of erosion or bank failure absent or minimal, little potential for future problems. <5% of bank affected. 10 9	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion 8 7 6	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods. 5 4 3	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars. 2 1 0
7. Embeddedness SCORE 25%	Percentage that gravel, cobble, and boulder particles are surrounded by fine sediment or flocculent material			
8. Shading SCORE 80 %	Percentage of segment that is shaded (duration is considered in scoring). 0% = fully exposed to sunlight all day in summer, 100% = fully and densely shaded all day in summer			
9. Riparian Buffer Zone Width (m)[7] LB 50 RB 40	Zone width in which human activity is not evident; 50m (164ft) is the maximum recorded value			
10. Remoteness SCORE 200	Roads greater than 400 meters (0.25 mi) from stream	Roads within 400 meters (0.25 mi) of stream; stream NOT accessible by trail	Roads within 400 meters (0.25 mi) of stream; stream accessible by trail	Roads adjacent to stream
11. Aesthetic (trash) Rating[8] SCORE 17	Little or no human refuse visible from stream channel or riparian zone	Refuse present in minor amounts	Refuse present in moderate amounts	Refuse abundant and unsightly
12. Number of Woody Debris and Rootwads[9] SCORE 8	Count only woody debris and rootwads within the wetted portion of the sampling segment. Count only woody debris >10cm (4in) diameter and >1.5m (5ft) long and rootwads with trunk diameter (at chest height) >15cm (6in) that are functional habitat within the wetted portion of the stream.			

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS (FRONT)

STREAM NAME MP22	LOCATION MP22
STATION #_____ RIVERMILE_____	STREAM CLASS
LAT _____ LONG _____	RIVER BASIN
STORET #	AGENCY Biohabitats
INVESTIGATORS GZ JCR	
FORM COMPLETED BY Biohabitats	DATE 4/14/16 TIME 1:00 AM (PM)
REASON FOR SURVEY Bug Sampling	

Parameters to be evaluated in sampling reach

Habitat Parameter	Condition Category			
	Optimal	Suboptimal	Marginal	Poor
1. Epifaunal Substrate/ Available Cover	Greater than 50% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient).	30-50% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale).	10-30% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 10% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
SCORE 13	20 19 18 17 16	15 14 (13) 12 11	10 9 8 7 6	5 4 3 2 1 0
2. Pool Substrate Characterization	Mixture of substrate materials, with gravel and firm sand prevalent; root mats and submerged vegetation common.	Mixture of soft sand, mud, or clay; mud may be dominant; some root mats and submerged vegetation present.	All mud or clay or sand bottom; little or no root mat; no submerged vegetation.	Hard-pan clay or bedrock; no root mat or vegetation.
SCORE 8	20 19 18 17 16	15 14 13 12 11	10 9 (8) 7 6	5 4 3 2 1 0
3. Pool Variability	Even mix of large-shallow, large-deep, small-shallow, small-deep pools present.	Majority of pools large-deep; very few shallow.	Shallow pools much more prevalent than deep pools.	Majority of pools small-shallow or pools absent.
SCORE 5	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	(5) 4 3 2 1 0
4. Sediment Deposition	Little or no enlargement of islands or point bars and less than <20% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 20-50% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 50-80% of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; more than 80% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
SCORE 12	20 19 18 17 16	15 14 13 (12) 11	10 9 8 7 6	5 4 3 2 1 0
5. Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills >75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
SCORE 13	20 19 18 17 16	15 14 (13) 12 11	10 9 8 7 6	5 4 3 2 1 0

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS (BACK)

Parameters to be evaluated broader than sampling reach

Habitat Parameter	Condition Category: Optimal	Suboptimal	Marginal	Poor
6. Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr) may be present, but recent channelization is not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.
SCORE 15	20 19 18 17 16	(15) 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
7. Channel Sinuosity	The bends in the stream increase the stream length 3 to 4 times longer than if it was in a straight line. (Note - channel braiding is considered normal in coastal plains and other low-lying areas. This parameter is not easily rated in these areas.)	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	Channel straight; waterway has been channelized for a long distance.
SCORE 14	20 19 18 17 16	15 (14) 13 12 11	10 9 8 7 6	5 4 3 2 1 0
8. Bank Stability (score each bank)	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.
SCORE 7 (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE 3 (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0
9. Vegetative Protection (score each bank) Note: determine left or right side by facing downstream.	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
SCORE 6 (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE 4 (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0
10. Riparian Vegetative Zone Width (score each bank riparian zone)	Width of riparian zone >18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone.	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6-12 meters; human activities have impacted zone a great deal.	Width of riparian zone <6 meters: little or no riparian vegetation due to human activities.
SCORE 9 (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE 8 (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0

Total Score 117

v. 2014

MBSS SPRING INDEX PERIOD DATA SHEET

SITE — Watershed Code: MP33 | Segment: | Type: P | Year: 2016

Reviewer: First: KT / Second: MWT

DATE — Year: 16 | Month: 03 | Day: 25

CREW: MKT/MWT

STREAM NAME:

LOCALITY:

TIME: 0923 (Military)

SAMPLEABILITY

- [Y] Benthos
- [N] Facies Mapping
- [Y] Habitat Assessment
- [Y] Water Quality
- [N] Vernal Pool
- [N] Present (Y/N)

Other:

SITE ACCESS ROUTE:

SAMPLE LABELS

Verified by:

QC LABELS

Watershed Code | Segment (Letters Only) | Type | Year

Dup. (D) or Blank (B): Verified by:

TEMP. LOGGERS

	(Y/N)	(TIME - Military)	
WATER			#
AIR			#

LOCATION:

PHOTODOCUMENTATION

Number		Voucher (Y/N)

BENTHIC HABITAT SAMPLED

- 16 Riffle
- 12 Rootwad/Woody Debris
- 20 Leaf Pack
- Macrophytes
- 00 Undercut Banks
- Other:

SAMPLING CONSIDERATIONS: (11 NUM. ANODES)

STREAM WIDTH (m): 25 (0 m) | 20 (75 m)

6.

v. 2014

MBSS SPRING FAUNAL DATA SHEET

SITE | Watershed Code: MP33 | Segment: | Type: P | Year: 2016 | Reviewer: First: KT / Second: MD

HERPETOFAUNA

☐ None Observed

Species	Lifestage: Adult	Larval	Egg	SEEN (Y/N)	HEARD (Y/N)	Number Retained	Number Photos Taken
NORTHERN TWO LINE	X			Y		0	4

MUSSELS

☐ None Observed

Species	LIVE	DEAD	Number Retained	Num. Photos Taken

Corbicula: LIVE ☒ DEAD ☒ NONE ☐

CRAYFISH

☒ None Observed

Species	Number Retained

Crayfish Burrows (A,P,E): A

COMMENTS:

v. 2014

MBSS SPRING HABITAT DATA SHEET

SITE — Watershed Code: MP33 — Segment: — Type: P — Year: 2016 — Reviewer: First: KT / Second: MWT

DATE — Year: 16 — Month: 03 — Day: 25

15 Dist. from Nearest Road to Site (m)

15 Trash Rating 0 - 20

LANDUSE (Y/N)

N	Old Field	N	Residential
Y	Deciduous Forest	N	Commercial/Industrial
N	Coniferous Forest	N	Cropland
N	Wetland	N	Pasture
N	Surface Mine	N	Orchard/Vineyard/Nursery
N	Landfill	N	Golf Course

RIPARIAN VEGETATION
(facing upstream)

	LEFT BANK	RIGHT BANK
Width (50m max)	25	50
Adj. Land Cover	PV	FR
Veg Type	YRMG	YMRG
Buffer Breaks (Y/N)	Y	N

BUFFER BREAKS

	LEFT BANK	RIGHT BANK
Storm Drain	M	
Tile Drain		
Imperv. Drainage	S	
New Construction		
Orchard		
Crop		
Pasture		
Gully		
Dirt Road		
Gravel Road		
Raw Sewage		
Railroad		

Buffer Break Types (M = Minor; S = Severe)

ROAD CULVERT

Present in Segment? (Y/N)	N
Sampleable? (Y/N)	N
Width of Culvert (m)	
Length of Culvert (m)	

STREAM GRADIENT

	Location (m)	Height (m)
1		
2		
3		

CHANNELIZATION

N Evidence of Channel Straightening or Dredging (Y/N)

TYPE	EXTENT (m) LEFT BANK	BOTTOM	RIGHT BANK
Concrete			
Gabion			
Rip-Rap			
Earthen Berm			
Dredge Spoil Off Channel			
Pipe Culvert			

Actual Site Midpoint Coordinates
(Taken at Time of Sampling)

Lat

Long

Stream Blockages

Stream Block Ht. (m)

Stream Block Type

Lat

Long

Physical Habitat Assessment and Water Quality Data Sheet

Site ID: MP33
Subwatershed: _____
Length of Reach: 75m Date: 3/25/16
Team Members: MKT/MWT Time: 923AM

Weather
Current: Clear
Past 24hrs: Clear
Past 48hrs: Clear

Stream Character

P	Meandering	A	Channelized
A	Braided	P	Straight
P	Riffle	P	Run/Glide
P	Deep Pool >.5m	E	Silt/Clay
P	Shallow Pool <.5m	P	Sand
P	Gravel	A	Cobble
A	Boulder >2m	A	Boulder <2m
A	Concrete/Gabion	A	Bedrock
A	Undercut Bank	P	Rootwad
P	Overhead Cover	A	Storm Drain
A	Effluent Discharge	P	Human Refuse
A	Emergent Vegetation	A	Beaver Pond
A	Floating Vegetation		

A=Absent P=Present E=Extensive

Parameter	Down-stream	Mid-stream	Up-stream
Description	POOL/RUN	POOL	RUN
pH	6.18	6.54	6.75
Temperature (°C)	15.1	15.1	15.1
DO (mg/l)	8.57	1.30	9.99
Conductivity (uS/cm)	338	360	336
TDS (mg/l)	170	177	173
Turbidity (NTU)	8.49	7.35	8.05

Notes: _____

Bar Formation
☐ None ☐ Moderate
☒ Minor ☐ Extensive

Photographs/Observations:
→ good floodplain; could have better floodplain connection
→ no frogs - strange

Bank Erosion (see guidance sheet)

	Left Bank	Right Bank
Extent (m)	70	70
Severity	1	1
Avg. Height	1m	1m

Severity: 0=none 1=min 2=mod 3=severe

Maximum stream depth (cm): 70

Benthic Habitat Sampled (20 total)	Sq. ft.
Riffle	6
Rootwad/Woody Debris	12
Leaf Pack	2
Submerged Vegetation	0
Undercut Banks	0
Other: _____	0

Rootwads/Woody Debris

# Instream Woody Debris	2
# Dewatered Woody Debris	3
# Instream Rootwads	7
# Dewatered Rootwads	0

Stream Gradient

Location (ft)	Height (ft)	Water Depth (ft)

MBSS Physical Habitat Assessment Sheet

Stream Habitat Assessment Guidance Sheet				
Habitat Parameter	Optima 16-20	Sub-Optima 11-15	Marginal 6-10	Poor 0-5
1. In-stream Habitat[1] score 8	Greater than 50% of a variety of cobble, boulder, submerged logs, undercut banks, snags, rootwads, aquatic plants or other stable habitat	30-50% of stable habitat. Adequate habitat	10-30% mix of stable habitat. Habitat availability less than desireable	Less than 10% stable habitat. Lack of habitat is obvious
2. Epifaunal Substrate[2] score 11	Preferred substrate abundant, stable, and at full colonization potential (riffles well developed and dominated by cobble; and/or woody debris prevalent, not new, and not transient	Abund. of cobble with gravel and/or boulders common; or woody debris, aquatic veg., undercut banks common but not prevalent/suited for full colonization	Large boulders and/or bedrock prevalent; cobble, woody debris, or other preferred surfaces uncommon	Stable substrate lacking; or particles are over 75% surrounded by fine sediment or flocculent material
3. Velocity/Depth Diversity[3] score 11	Slow (<0.3m/s), deep (>0.5m); slow, shallow (<0.5m); fast (>0.3m/s), deep; fast, shallow habitats all present	Only 3 of the 4 habitat categories present	Only 2 of the 4 habitat categories present	Dominated by 1 velocity/depth category (usually pools)
4. Pool/Glide/Eddy Quality[4] score 8	Complex cover & or depth >1.5m; both deep (>0.5m) shallows (<0.2m) present	Deep (>0.5m) areas present; but only moderate cover	Shallows (<0.2m) prevalent in pool/glide/eddy habitat; little cover	Max depth <0.2m in pool/glide/eddy habitat; or absent completely
5. Riffle/Run Quality[5] score 11	Riffle/run depth generally >10cm, with maximum depth greater than 50 cm (maximum score), substrate stable (e.g. cobble, boulder) & variety of current velocities	Riffle/run depth generally 5-10cm, variety of current velocities	Riffle/run depth generally 1-5cm, primarily a single current velocity	Riffle/run depth <1cm, or riffle/run substrates cemented
6. Bank Stability[6] (Trading downstream) Score each bank LB score 6 RB score 6	Banks stable; evidence of erosion or bank failure absent or minima, little potential for future problems. <5% of bank affected. 10 9	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion 8 7 6	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods. 5 4 3	Unstable; many eroded areas, "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars. 2 1 0
7. Embeddedness score 100 %	Percentage that gravel, cobble, and boulder particles are surrounded by fine sediment or flocculent material			
8. Shading score 100 %	Percentage of segment that is shaded (duration is considered in scoring). 0% = fully exposed to sunlight all day in summer, 100% = fully and densely shaded all day in summer			
9. Riparian Buffer Zone Width (m)[7] LB 50 RB 15	Zone width in which human activity is not evident. 50m (164ft) is the maximum recorded value			
10. Remoteness score 2	Roads greater than 400 meters (0.25 mi) from stream	Roads within 400 meters (0.25 mi) of stream; stream NOT accessible by trail	Roads within 400 meters (0.25 mi) of stream; stream accessible by trail	Roads adjacent to stream
11. Aesthetics (trash) Rating[8] score 11	Little or no human refuse visible from stream channel or riparian zone	Refuse present in minor amounts	Refuse present in moderate amounts	Refuse abundant and unsightly
12. Number of Woody Debris and Rootwads[9] score 12	Count only woody debris and rootwads within the wetted portion of the sampling segment. Count only woody debris >10cm (4in) diameter and >1.5m (5ft) long and rootwads with trunk diameter (at chest height) >15cm (6in) that are functional habitat within the wetted portion of the stream.			

woody
ROOTWADS

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS (FRONT)

STREAM NAME MP33	LOCATION	
STATION # _____ RIVERMILE _____	STREAM CLASS	
LAT _____ LONG _____	RIVER BASIN	
STORET #	AGENCY Biohabitats	
INVESTIGATORS MKT/MWT		
FORM COMPLETED BY MKT	DATE 3/25/16 TIME 1923 (AM) PM	REASON FOR SURVEY BUGS

Parameters to be evaluated in sampling reach

Habitat Parameter	Condition Category			
	Optimal	Suboptimal	Marginal	Poor
1. Epifaunal Substrate/ Available Cover	Greater than 50% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient).	30-50% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale).	10-30% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 10% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
SCORE 8	20 19 18 17 16	15 14 13 12 11	10 9 (8) 7 6	5 4 3 2 1 0
2. Pool Substrate Characterization	Mixture of substrate materials, with gravel and firm sand prevalent; root mats and submerged vegetation common.	Mixture of soft sand, mud, or clay; mud may be dominant; some root mats and submerged vegetation present.	All mud or clay or sand bottom; little or no root mat; no submerged vegetation.	Hard-pan clay or bedrock; no root mat or vegetation.
SCORE 12	20 19 18 17 16	15 14 13 (12) 11	10 9 8 7 6	5 4 3 2 1 0
3. Pool Variability	Even mix of large-shallow, large-deep, small-shallow, small-deep pools present.	Majority of pools large-deep; very few shallow.	Shallow pools much more prevalent than deep pools.	Majority of pools small-shallow or pools absent.
SCORE 7	20 19 18 17 16	15 14 13 12 11	10 9 8 (7) 6	5 4 3 2 1 0
4. Sediment Deposition	Little or no enlargement of islands or point bars and less than <20% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 20-50% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 50-80% of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; more than 80% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
SCORE 7	20 19 18 17 16	15 14 13 12 11	10 9 8 (7) 6	5 4 3 2 1 0
5. Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills >75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
SCORE 16	20 19 18 17 (16)	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS (BACK)

Parameters to be evaluated broader than sampling reach

Habitat Parameter	Condition Category			
	Optimal	Suboptimal	Marginal	Poor
6. Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr) may be present, but recent channelization is not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.
SCORE 18	20 19 **(18)** 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
7. Channel Sinuosity	The bends in the stream increase the stream length 3 to 4 times longer than if it was in a straight line. (Note - channel braiding is considered normal in coastal plains and other low-lying areas. This parameter is not easily rated in these areas.)	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	Channel straight; waterway has been channelized for a long distance.
SCORE 8	20 19 18 17 16	15 14 13 12 11	10 9 **(8)** 7 6	5 4 3 2 1 0
8. Bank Stability (score each bank)	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.
SCORE 6 (LB)	Left Bank 10 9	8 7 **(6)**	5 4 3	2 1 0
SCORE 6 (RB)	Right Bank 10 9	8 7 **(6)**	5 4 3	2 1 0
9. Vegetative Protection (score each bank) Note: determine left or right side by facing downstream.	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
SCORE 8 (LB)	Left Bank 10 9	**(8)** 7 6	5 4 3	2 1 0
SCORE 8 (RB)	Right Bank 10 9	**(8)** 7 6	5 4 3	2 1 0
10. Riparian Vegetative Zone Width (score each bank riparian zone)	Width of riparian zone >18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone.	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6-12 meters; human activities have impacted zone a great deal.	Width of riparian zone <6 meters: little or no riparian vegetation due to human activities.
SCORE 10 (LB)	Left Bank **(10)** 9	8 7 6	5 4 3	2 1 0
SCORE 8 (RB)	Right Bank 10 9	**(8)** 7 6	5 4 3	2 1 0

Total Score 122

v. 2014

MBSS SPRING INDEX PERIOD DATA SHEET

Page 1 of 4

SITE — Watershed Code: MP34 | Segment: — | Type: P | Year: 2016

Reviewer: First: JP / Second: GZ

DATE — Year: 16 | Month: 03 | Day: 31

CREW:

STREAM NAME:

LOCALITY:

TIME: 1515 (Military)

SAMPLEABILITY

- [✓] Benthos
- [X] Facies Mapping
- [✓] Habitat Assessment
- [✓] Water Quality
- [X] Vernal Pool
- [ ] Present (Y/N)

Other:

SITE ACCESS ROUTE: Parked at Mary Lou Dr., walked into woods.

SAMPLE LABELS

Verified by: GZ

QC LABELS

Watershed Code: MP34 | Segment: — (Letters Only) | Type: P | Year: 2016

Dup. (D) or Blank (B): [ ] Verified by: JP

TEMP. LOGGERS

	(Y/N)	(TIME - Military)	#
WATER			
AIR			

LOCATION:

PHOTODOCUMENTATION

Number		Voucher (Y/N)

BENTHIC HABITAT SAMPLED

- 17 Riffle
- 01 Rootwad/Woody Debris
- 02 Leaf Pack
- 00 Macrophytes
- 00 Undercut Banks
- Other:

SAMPLING CONSIDERATIONS: (01 NUM. ANODES)

STREAM WIDTH (m): 1.0 (0 m) | 1.0 (75 m)

6.

v. 2014

MBSS SPRING FAUNAL DATA SHEET

SITE | Watershed Code: MP34 | Segment: ___ | Type: P | Year: 2016 | Reviewer: First: JP / Second: GZ

HERPETOFAUNA

☐ None Observed

Species	Lifestage: Adult	Larval	Egg	SEEN (Y/N)	HEARD (Y/N)	Number Retained	Number Photos Taken
Green Frogs	X			Y	N	N	N

MUSSELS

☒ None Observed

Species	LIVE	DEAD	Number Retained	Num. Photos Taken

Corbicula: LIVE ☐ DEAD ☐ NONE ☐

CRAYFISH

☒ None Observed

Species	Number Retained

Crayfish Burrows (A,P,E): P

COMMENTS: _____

v. 2014

MBSS SPRING HABITAT DATA SHEET

SITE — Watershed Code: MP34 | Segment: — | Type: P | Year: 2016 | Reviewer: First: JP / Second: GZ

DATE — Year: 16 | Month: 03 | Day: 31

300 Dist. from Nearest Road to Site (m)

00 Trash Rating 0 - 20

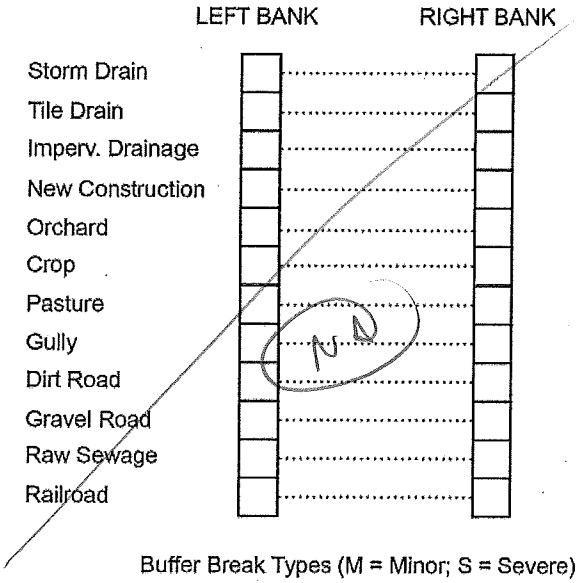
LANDUSE (Y/N)

N	Old Field	N	Residential
Y	Deciduous Forest	N	Commercial/Industrial
N	Coniferous Forest	N	Cropland
N	Wetland	N	Pasture
N	Surface Mine	N	Orchard/Vineyard/Nursery
N	Landfill	N	Golf Course

RIPARIAN VEGETATION
(facing upstream)

	LEFT BANK	RIGHT BANK
Width (50m max)	50	50
Adj. Land Cover	FR	FR
Veg Type	YRMG	YRMG
Buffer Breaks (Y/N)	N	N

BUFFER BREAKS



Buffer Break Types (M = Minor; S = Severe)

ROAD CULVERT

Present in Segment? (Y/N): N

Sampleable? (Y/N):

Width of Culvert (m):

Length of Culvert (m):

STREAM GRADIENT

	Location (m)	Height (m)
1		
2		
3		

CHANNELIZATION

N — Evidence of Channel Straightening or Dredging (Y/N)

TYPE	EXTENT (m)		
	LEFT BANK	BOTTOM	RIGHT BANK
Concrete			
Gabion			
Rip-Rap			
Earthen Berm			
Dredge Spoil Off Channel			
Pipe Culvert			

Actual Site Midpoint Coordinates
(Taken at Time of Sampling)

Lat

Long

Stream Blockages

Stream Block Ht. (m)

Stream Block Type

Lat

Long

Physical Habitat Assessment and Water Quality Data Sheet

Site ID: MP34
Subwatershed: _____
Length of Reach: 75M Date: 3/3/16
Team Members: JP/GZ Time: 3:15

Weather
Current: Partly cloudy
Past 24hrs: clear
Past 48hrs: clear

Parameter	Down-stream	Mid-stream	Up-stream
Description			
pH	6.71	6.56	6.45
Temperature (°C)	15.2	15.2	15.4
DO (mg/l)	12.57	10.03	9.44
Conductivity (uS/cm)	80	80	81
TDS (mg/l)	40	40	40
Turbidity (NTU)	7.67	7.81	10.29

Notes: _____

Stream Character

P Meandering	A Channelized
A Braided	P Straight
E Riffle	P Run/Glide
A Deep Pool >.5m	P Silt/Clay
P Shallow Pool <.5m	E Sand
E Gravel	A Cobble
A Boulder >2m	A Boulder <2m
A Concrete/Gabion	A Bedrock
A Undercut Bank	A Rootwad
P Overhead Cover	A Storm Drain
A Effluent Discharge	A Human Refuse
P Emergent Vegetation	A Beaver Pond
A Floating Vegetation	

A=Absent P=Present E=Extensive

Bar Formation
☒ None ☐ Moderate
☐ Minor ☐ Extensive

Bank Erosion (see guidance sheet)

	Left Bank	Right Bank
Extent (m)	25	25
Severity	2	2
Avg. Height	4.5'	4.5'

Severity: 0=none, 1=mild, 2=moderate, 3=severe

Maximum stream depth (cm): 25

Benthic Habitat Sampled (20 total)

	Sq. ft.
Riffle	17
Rootwad/Woody Debris	1
Leaf Pack	2
Submerged Vegetation	0
Undercut Banks	0
Other: _____	

Rootwads/Woody Debris

# Instream Woody Debris	3
# Dewatered Woody Debris	2
# Instream Rootwads	0
# Dewatered Rootwads	1

Stream Gradient

Location (ft)	Height (ft)	Water Depth (ft)

Photographs/Observations:

MBSS Physical Habitat Assessment Sheet

Stream Habitat Assessment Guidance Sheet				
Habitat Parameter	Optima 16-20	Sub-Optima 11-15	Marginal 6-10	Poor 0-5
1. Instream Habitat[a] SCORE 7	Greater than 50% of a variety of cobble, boulder, submerged logs, undercut banks, snags, rootwads, aquatic plants or other stable habitat	30-50% of stable habitat. Adequate habitat	10-30% mix of stable habitat. Habitat availability less than desirable	Less than 10% stable habitat. Lack of habitat is obvious
2. Epifaunal Substrate[a] SCORE 8	Preferred substrate abundant, stable, and at full colonization potential (riffles well developed and dominated by cobble; and/or woody debris prevalent, not new, and not transient)	Abund. of cobble with gravel and/or boulders common; or woody debris, aquatic veg., undercut banks common but not prevalent/suited for full colonization	Large boulders and/or bedrock prevalent; cobble, woody debris, or other preferred surfaces uncommon	Stable substrate lacking; or particles are over 75% surrounded by fine sediment or flocculent material
3. Velocity/Depth Diversity[a] SCORE 8	Slow (<0.3m/s), deep (>0.5m); slow, shallow (<0.5m); fast (>0.3m/s), deep; fast, shallow habitats all present	Only 3 of the 4 habitat categories present	Only 2 of the 4 habitat categories present	Dominated by 1 velocity/depth category (usually pools)
4. Pool/Glide/Eddy Quality[a] SCORE 6	Complex cover &/or depth >1.5m; both deep (>0.5m) shallows (<0.2m) present	Deep (>0.3m) areas present; but only moderate cover	Shallows (<0.2m) prevalent in pool/glide/eddy habitat; little cover	Max depth <0.2m in pool/glide/eddy habitat; or absent completely
5. Riffle/Run Quality[a] SCORE 9	Riffle/run depth generally >10cm, with maximum depth greater than 50 cm (maximum score); substrate stable (e.g. cobble, boulder) & variety of current velocities	Riffle/run depth generally 5-10cm; variety of current velocities	Riffle/run depth generally 1-5cm; primarily a single current velocity	Riffle/run depth <1cm; or riffle/run substrates concreted
6. Bank Stability[a] (facing downstream) Score each bank LB SCORE 7 RB SCORE 7	Banks stable; evidence of erosion or bank failure absent or minima; little potential for future problems. <5% of bank affected. 10 9	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion 8 7 6	Moderately unstable; 30-60% of bank in reach as areas of erosion; high erosion potential during floods. 5 4 3	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars. 2 1 0
7. Embeddedness SCORE 30 %	Percentage that gravel, cobble, and boulder particles are surrounded by fine sediment or flocculent material			
8. Shading SCORE 70 %	Percentage of segment that is shaded (duration is considered in scoring). 0% = fully exposed to sunlight all day in summer, 100% = fully and densely shaded all day in summer			
9. Riparian Buffer Zone Width (m)[a] LB 50 RB 50	Zone width in which human activity is not evident. 50m (164ft) is the maximum recorded value			
10. Remoteness SCORE 15	Roads greater than 400 meters (0.25 mi) from stream	Roads within 400 meters (0.25 mi) of stream; stream NOT accessible by trail	Roads within 400 meters (0.25 mi) of stream; stream accessible by trail	Roads adjacent to stream
11. Aesthetic (trash) Rating[a] SCORE 0	Little or no human refuse visible from stream channel or riparian zone	Refuse present in minor amounts	Refuse present in moderate amounts	Refuse abundant and unsightly
12. Number of Woody Debris and Rootwads[a] SCORE 3	Count only woody debris and rootwads within the wetted portion of the sampling segment. Count only woody debris >10cm (4in) diameter and >1.5m (5ft) long and rootwads with trunk diameter (at chest height) >15cm (6in) that are "functional habitat within the wetted portion of the stream.			

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS (FRONT)

STREAM NAME MP 34	LOCATION MP34	
STATION #_____ RIVERMILE_____	STREAM CLASS	
LAT _____ LONG _____	RIVER BASIN	
STORET #	AGENCY	
INVESTIGATORS JP / GE		
FORM COMPLETED BY Biohabitats	DATE 3/31/16 TIME 315 AM (PM)	REASON FOR SURVEY Benthic Sampling

Parameters to be evaluated in sampling reach

Habitat Parameter	Condition Category			
	Optimal	Suboptimal	Marginal	Poor
1. Epifaunal Substrate/ Available Cover	Greater than 50% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient).	30-50% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale).	10-30% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 10% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
SCORE 8	20 19 18 17 16	15 14 13 12 11	10 9 (8) 7 6	5 4 3 2 1 0
2. Pool Substrate Characterization	Mixture of substrate materials, with gravel and firm sand prevalent; root mats and submerged vegetation common.	Mixture of soft sand, mud, or clay; mud may be dominant; some root mats and submerged vegetation present.	All mud or clay or sand bottom; little or no root mat; no submerged vegetation.	Hard-pan clay or bedrock; no root mat or vegetation.
SCORE 10	20 19 18 17 16	15 14 13 12 11	(10) 9 8 7 6	5 4 3 2 1 0
3. Pool Variability	Even mix of large-shallow, large-deep, small-shallow, small-deep pools present.	Majority of pools large-deep; very few shallow.	Shallow pools much more prevalent than deep pools.	Majority of pools small-shallow or pools absent.
SCORE 3	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 (3) 2 1 0
4. Sediment Deposition	Little or no enlargement of islands or point bars and less than <20% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 20-50% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 50-80% of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; more than 80% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
SCORE 7	20 19 18 17 16	15 14 13 12 11	10 9 8 (7) 6	5 4 3 2 1 0
5. Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills >75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
SCORE 16	20 19 18 17 (16)	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS (BACK)

Parameters to be evaluated broader than sampling reach

Habitat Parameter	Condition Category			
	Optimal	Suboptimal	Marginal	Poor
6. Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr) may be present, but recent channelization is not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.
SCORE 16	20 19 18 17 (16)	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
7. Channel Sinuosity	The bends in the stream increase the stream length 3 to 4 times longer than if it was in a straight line. (Note - channel braiding is considered normal in coastal plains and other low-lying areas. This parameter is not easily rated in these areas.)	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	Channel straight; waterway has been channelized for a long distance.
SCORE 7	20 19 18 17 16	15 14 13 12 11	10 9 8 (7) 6	5 4 3 2 1 0
8. Bank Stability (score each bank)	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.
SCORE 4 (LB)	Left Bank 10 9	8 7 6	5 (4) 3	2 1 0
SCORE 4 (RB)	Right Bank 10 9	8 7 6	5 (4) 3	2 1 0
9. Vegetative Protection (score each bank) Note: determine left or right side by facing downstream.	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
SCORE 2 (LB)	Left Bank 10 9	8 7 6	5 4 3	(2) 1 0
SCORE 2 (RB)	Right Bank 10 9	8 7 6	5 4 3	(2) 1 0
10. Riparian Vegetative Zone Width (score each bank riparian zone)	Width of riparian zone >18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone.	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6-12 meters; human activities have impacted zone a great deal.	Width of riparian zone <6 meters: little or no riparian vegetation due to human activities.
SCORE 10 (LB)	Left Bank (10) 9	8 7 6	5 4 3	2 1 0
SCORE 10 (RB)	Right Bank (10) 9	8 7 6	5 4 3	2 1 0

Total Score 99

v. 2014

MBSS SPRING INDEX PERIOD DATA SHEET

SITE — Watershed Code: MP35 | Segment: — | Type: P | Year: 2016

Reviewer: First: JP / Second: GZ

DATE — Year: 16 | Month: 03 | Day: 31

CREW: GZ / JP

STREAM NAME:

LOCALITY:

TIME: 1055 (Military)

SAMPLEABILITY

- [x] Benthos
- [ ] Facies Mapping
- [x] Habitat Assessment
- [x] Water Quality
- [ ] Vernal Pool
- [ ] Present (Y/N)

Other:

SITE ACCESS ROUTE: walking trail to stream

SAMPLE LABELS

Verified by: GZ

QC LABELS

Watershed Code	Segment	Type	Year
MP35	—	P	2016

(Letters Only)

Dup. (D) or Blank (B): ☐ Verified by: JP

TEMP. LOGGERS

	(Y/N)	(TIME - Military)	
WATER			#
AIR			#

LOCATION:

PHOTODOCUMENTATION

Number		Voucher (Y/N)

BENTHIC HABITAT SAMPLED

12	Riffle
01	Rootwad/Woody Debris
06	Leaf Pack
00	Macrophytes
00	Undercut Banks
	Other:

SAMPLING CONSIDERATIONS: (01 NUM. ANODES)

STREAM WIDTH (m): 1.0 (0 m) 1.0 (75 m)

6.

v. 2014

MBSS SPRING FAUNAL DATA SHEET

SITE — Watershed Code: M P 3 5 — Segment: — — — — Type: P — Year: 2 0 1 6 — Reviewer: First: JP / Second: GZ

HERPETOFAUNA

☐ None Observed

Species	Lifestage: Adult	Lifestage: Larval	Lifestage: Egg	SEEN (Y/N)	HEARD (Y/N)	Number Retained	Number Photos Taken
Desmognathus fuscus – Northern Dusky		X		Y	N	0	1
Green Frog	X			X	N	0	0

MUSSELS

☒ None Observed

Species	LIVE	DEAD	Number Retained	Num. Photos Taken

Corbicula: LIVE ☐ DEAD ☐ NONE ☐

CRAYFISH

☒ None Observed

Species	Number Retained

Crayfish Burrows (A,P,E): ☑ P

COMMENTS:

v. 2014

MBSS SPRING HABITAT DATA SHEET

Page 4 of 4

SITE — Watershed Code: MP35 — Segment: — — Type: P — Year: 2016 — Reviewer: First: JP / Second: GZ

DATE — Year: 16 — Month: 03 — Day: 31

200 Dist. from Nearest Road to Site (m)

10 00 Trash Rating 0 - 20 concentrated

LANDUSE (Y/N)

N	Old Field	N	Residential
Y	Deciduous Forest	N	Commercial/Industrial
N	Coniferous Forest	N	Cropland
N	Wetland	N	Pasture
N	Surface Mine	N	Orchard/Vineyard/Nursery
N	Landfill	N	Golf Course

RIPARIAN VEGETATION
(facing upstream)

	LEFT BANK	RIGHT BANK
Width (50m max)	50	50
Adj. Land Cover	FR	FR
Veg Type	TMRG	TMRG
Buffer Breaks (Y/N)	N	N

ROAD CULVERT

Present in Segment? (Y/N): N

Sampleable? (Y/N):

Width of Culvert (m):

Length of Culvert (m):

STREAM GRADIENT

	Location (m)	Height (m)
1		
2		
3		

BUFFER BREAKS

	LEFT BANK	RIGHT BANK
Storm Drain		
Tile Drain		
Imperv. Drainage		
New Construction		
Orchard		
Crop		
Pasture		
Gully		
Dirt Road		
Gravel Road		
Raw Sewage		
Railroad		

Buffer Break Types (M = Minor; S = Severe)

CHANNELIZATION

N Evidence of Channel Straightening or Dredging (Y/N)

TYPE	EXTENT (m)		
	LEFT BANK	BOTTOM	RIGHT BANK
Concrete			
Gabion			
Rip-Rap			
Earthen Berm			
Dredge Spoil Off Channel			
Pipe Culvert			

Actual Site Midpoint Coordinates
(Taken at Time of Sampling)

Lat

Long

Stream Blockages

Stream Block Ht. (m)

Stream Block Type

Lat

Long

Physical Habitat Assessment and Water Quality Data Sheet

Site ID: MP35
Subwatershed: _____
Length of Reach: 75m Date: 3/31/16
Team Members: GZ/JP Time: 9:15

Weather
Current: clear
Past 24hrs: clear
Past 48hrs: clear

Parameter	Down-stream	Mid-stream	Up-stream
Description			
pH	6.32	6.46	6.17
Temperature (°C)	11.6°C	11.2	11.9
DO (mg/l)	10.24	11.71	9.11
Conductivity (uS/cm)	89	83	64
TDS (mg/l)	44	41?	32
Turbidity (NTU)	10.33	3.89	5.21

Notes: _____

Stream Character

E Meandering	E Channelized
A Braided	A Straight
P Riffle	E Run/Glide
A Deep Pool >.5m	E Silt/Clay
A Shallow Pool <.5m	P Sand
P Gravel	A Cobble
A Boulder >2m	A Boulder <2m
A Concrete/Gabion	A Bedrock
A Undercut Bank	A Rootwad
P Overhead Cover	A Storm Drain
A Effluent Discharge	P Human Refuse
P Emergent Vegetation	A Beaver Pond
A Floating Vegetation	

A=Absent P=Present E=Extensive

Bar Formation
☒ None ☐ Moderate
☐ Minor ☐ Extensive

Bank Erosion (see guidance sheet)

	Left Bank	Right Bank
Extent (m)	60	55
Severity	3	2
Avg. Height	4	4

Severity: 0=none, 1=mild, 2=moderate, 3=severe

Maximum stream depth (cm): 10

Benthic Habitat Sampled (20 total)

	Sq. ft.
Riffle	12
Rootwad/Woody Debris	1
Leaf Pack	6
Submerged Vegetation	/
Undercut Banks	/
Other: _____	/

Rootwads/Woody Debris

||||| ||||| # Instream Woody Debris	10
||||| # Dewatered Woody Debris	6
# Instream Rootwads	9
||||| ||||| # Dewatered Rootwads	

Stream Gradient

Location (ft)	Height (ft)	Water Depth (ft)

Photographs/Observations:

R HHT IIII
W II
L HHT I

MBSS Physical Habitat Assessment Sheet

Stream Habitat Assessment Guidance Sheet

Habitat Parameter	Optima 16-20	Sub-Optima 11-15	Marginal 6-10	Poor 0-5
1. In-stream Habitat[1] SCORE 11	Greater than 50% of a variety of cobble, boulder, submerged logs, undercut banks, snags, rootwads, aquatic plants or other stable habitat	30-50% of stable habitat. Adequate habitat	10-30% mix of stable habitat. Habitat availability less than desireable	Less than 10% stable habitat. Lack of habitat is obvious
2. Epifaunal Substrate[2] SCORE 10	Preferred substrate abundant, stable, and at full colonization potential (riffles well developed and dominated by cobble; and/or woody debris prevalent; not new, and not transient	Abund. of cobble with gravel and/or boulders common; or woody debris, aquatic veg., undercut banks common but not prevalent/suited for full colonization	Large boulders and/or bedrock prevalent; cobble, woody debris, or other preferred surfaces uncommon	Stable substrate lacking; or particles are over 75% surrounded by fine sediment or flocculent material
3. Velocity/Depth Diversity[3] SCORE 12	Slow (<0.3m/s), deep (>0.5m); slow, shallow (<0.3m); fast (>0.3m/s), deep; fast, shallow habitats all present	Only 3 of the 4 habitat categories present	Only 2 of the 4 habitat categories present	Dominated by 1 velocity/depth category (usually pools)
4. Pool/Glide/Eddy Quality[4] SCORE 11	Complex cover & /or depth >1.5m; both deep (>0.5m) shallows (<0.2m) present	Deep (>0.5m) areas present; but only moderate cover	Shallows (<0.2m) prevalent in pool/glide/eddy habitat; little cover	Max depth <0.2m in pool/glide/eddy habitat; or absent completely
5. Riffle/Run Quality[5] SCORE 7	Riffle/run depth generally >10cm, with maximum depth greater than 50 cm (maximum score); substrate stable (e.g. cobble, boulder) & variety of current velocities	Riffle/run depth generally 5-10cm, variety of current velocities	Riffle/run depth generally 1-5cm, primarily a single current velocity	Riffle/run depth <1cm, or riffle/run substrates concreted
6. Bank Stability[6] (facing downstream) Score each bank LB SCORE 4 RB SCORE 4	Banks stable; evidence of erosion or bank failure absent or minimal. little potential for future problems. <5% of bank affected. 10 9	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion 8 7 6	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods. 5 4 3	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars. 2 1 0
7. Embeddedness SCORE 50 %	Percentage that gravel, cobble, and boulder particles are surrounded by fine sediment or flocculent material			
8. Shading SCORE 80 %	Percentage of segment that is shaded (duration is considered in scoring). 0% = fully exposed to sunlight all day in summer. 100% = fully and densely shaded all day in summer			
9. Riparian Buffer Zone Width (m)[7] LB 50 RB 50	Zone width in which human activity is not evident. 60m (164ft) is the maximum recorded value			
10. Remoteness SCORE 10	Roads greater than 400 meters (0.25 mi) from stream	Roads within 400 meters (0.25 mi) of stream; stream NOT accessible by trail	Roads within 400 meters (0.25 mi) of stream; stream accessible by trail	Roads adjacent to stream
11. Aesthetic (trash) Rating[8] SCORE 10	Little or no human refuse visible from stream channel or riparian zone	Refuse present in minor amounts	Refuse present in moderate amounts	Refuse abundant and unsightly
12. Number of Woody Debris and Rootwads[9] SCORE 10	Count only woody debris and rootwads within the wetted portion of the sampling segment. Count only woody debris >10cm (4in) diameter and >1.5m (5ft) long and rootwads with trunk diameter (at chest height) >15cm (6in) that are functional habitat within the wetted portion of the stream.			

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS (FRONT)

STREAM NAME	LOCATION	
STATION # MP35 RIVERMILE	STREAM CLASS	
LAT LONG	RIVER BASIN	
STORET #	AGENCY	
INVESTIGATORS JP | GZ		
FORM COMPLETED BY Biohabitats	DATE 3/31/16 TIME 9:15 (AM) PM	REASON FOR SURVEY

Parameters to be evaluated in sampling reach

Habitat Parameter	Condition Category			
	Optimal	Suboptimal	Marginal	Poor
1. Epifaunal Substrate/ Available Cover	Greater than 50% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient).	30-50% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale).	10-30% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 10% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
SCORE (10)	20 19 18 17 16	15 14 13 12 11	(10) 9 8 7 6	5 4 3 2 1 0
2. Pool Substrate Characterization	Mixture of substrate materials, with gravel and firm sand prevalent; root mats and submerged vegetation common.	Mixture of soft sand, mud, or clay; mud may be dominant; some root mats and submerged vegetation present.	All mud or clay or sand bottom; little or no root mat; no submerged vegetation.	Hard-pan clay or bedrock; no root mat or vegetation.
SCORE 9	20 19 18 17 16	15 14 13 12 11	10 (9) 8 7 6	5 4 3 2 1 0
3. Pool Variability	Even mix of large-shallow, large-deep, small-shallow, small-deep pools present.	Majority of pools large-deep; very few shallow.	Shallow pools much more prevalent than deep pools.	Majority of pools small-shallow or pools absent.
SCORE 3	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 (3) 2 1 0
4. Sediment Deposition	Little or no enlargement of islands or point bars and less than <20% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 20-50% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 50-80% of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; more than 80% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
SCORE 7	20 19 18 17 16	15 14 13 12 11	10 9 8 (7) 6	5 4 3 2 1 0
5. Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills >75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
SCORE 12	20 19 18 17 16	15 14 13 (12) 11	10 9 8 7 6	5 4 3 2 1 0

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS (BACK)

Parameters to be evaluated broader than sampling reach

Habitat Parameter	Condition Category: Optimal	Suboptimal	Marginal	Poor
6. Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr) may be present, but recent channelization is not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.
SCORE 18	20 19 **(18)** 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
7. Channel Sinuosity	The bends in the stream increase the stream length 3 to 4 times longer than if it was in a straight line. (Note - channel braiding is considered normal in coastal plains and other low-lying areas. This parameter is not easily rated in these areas.)	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	Channel straight; waterway has been channelized for a long distance.
SCORE 12	20 19 18 17 16	15 14 13 **(12)** 11	10 9 8 7 6	5 4 3 2 1 0
8. Bank Stability (score each bank) (Downstream)	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.
SCORE 3 (LB)	Left Bank 10 9	8 7 6	5 4 **(3)**	2 1 0
SCORE 7 (RB)	Right Bank 10 9	8 **(7)** 6	5 4 3	2 1 0
9. Vegetative Protection (score each bank) Note: determine left or right side by facing downstream.	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
SCORE 1 (LB)	Left Bank 10 9	8 7 6	5 4 3	2 **(1)** 0
SCORE 4 (RB)	Right Bank 10 9	8 7 6	5 **(4)** 3	2 1 0
10. Riparian Vegetative Zone Width (score each bank riparian zone)	Width of riparian zone >18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone.	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6-12 meters; human activities have impacted zone a great deal.	Width of riparian zone <6 meters: little or no riparian vegetation due to human activities.
SCORE 10 (LB)	Left Bank **(10)** 9	8 7 6	5 4 3	2 1 0
SCORE 10 (RB)	Right Bank **(10)** 9	8 7 6	5 4 3	2 1 0

Total Score 106

3.89 - M
5.21 - U

11.9
32 rpm
6.17 pH
64 µs

v. 2014

MBSS SPRING INDEX PERIOD DATA SHEET

SITE — Watershed Code: MP36 | Segment: — | Type: P | Year: 2016

Reviewer: First: JP / Second: GZ

DATE — Year: 03 | Month: 31 | Day: 16

CREW: JP + GZ

STREAM NAME:

LOCALITY:

TIME: 1230 (Military)

SAMPLEABILITY

- [✓] Benthos
- [✓] Habitat Assessment
- [✓] Water Quality
- [X] Vernal Pool
- [X] Facies Mapping
- [ ] Present (Y/N)

Other:

SITE ACCESS ROUTE: Address 1330 WRIGHTON RD
- walk along ridge through woods

SAMPLE LABELS

Verified by: GZ

QC LABELS

Watershed Code	Segment	Type	Year
MP36	—	P	2016

(Letters Only)

Dup. (D) or Blank (B): [ ] Verified by: JP

TEMP. LOGGERS

	(Y/N)	(TIME - Military)	#
WATER			#
AIR			

LOCATION:

PHOTODOCUMENTATION

Number	Voucher (Y/N)

BENTHIC HABITAT SAMPLED

17	Riffle
01	Rootwad/Woody Debris
05	Leaf Pack
00	Macrophytes
60	Undercut Banks
	Other:

SAMPLING CONSIDERATIONS: (01 NUM. ANODES)

STREAM WIDTH (m): 0.5 (0 m); 0.5 (75 m)

6.

v. 2014

MBSS SPRING FAUNAL DATA SHEET

SITE — Watershed Code: MP36 | Segment: — | Type: P | Year: 2016

Reviewer: First: JP / Second: GZ

HERPETOFAUNA

☐ None Observed

Species	Lifestage: Adult	Lifestage: Larval	Lifestage: Egg	SEEN (Y/N)	HEARD (Y/N)	Number Retained	Number Photos Taken
Desmognathus fuscus – Northern Dusky		X		Y	N	0	0
~~Frog~~ Frog (unknown)	X			Y	N	0	0

MUSSELS

☑ None Observed

Species	LIVE	DEAD	Number Retained	Num. Photos Taken

Corbicula — LIVE ☐ DEAD ☐ NONE ☑

CRAYFISH

☑ None Observed

Species	Number Retained

Crayfish Burrows (A,P,E): A

COMMENTS:

v. 2014

MBSS SPRING HABITAT DATA SHEET

SITE — Watershed Code: MP36 — Segment: — — Type: P — Year: 2016 — Reviewer: First: JP / Second: [illegible]

DATE — Year: 16 — Month: 03 — Day: 31

1150 Dist. from Nearest Road to Site (m)

16 16 Trash Rating 0 - 20

LANDUSE (Y/N)

N	Old Field	N	Residential
Y	Deciduous Forest	N	Commercial/Industrial
N	Coniferous Forest	N	Cropland
Y	Wetland	N	Pasture
N	Surface Mine	N	Orchard/Vineyard/Nursery
N	Landfill	N	Golf Course

RIPARIAN VEGETATION
(facing upstream)

	LEFT BANK	RIGHT BANK
Width (50m max)	50	50
Adj. Land Cover	FR	FR
Veg Type	YRM	YRM
Buffer Breaks (Y/N)	N	N

ROAD CULVERT

Present in Segment? (Y/N)	N
Sampleable? (Y/N)	
Width of Culvert (m)	
Length of Culvert (m)	

STREAM GRADIENT

	Location (m)	Height (m)
1		
2		
3		

BUFFER BREAKS

	LEFT BANK	RIGHT BANK
Storm Drain		
Tile Drain		
Imperv. Drainage		
New Construction		
Orchard		
Crop		
Pasture		
Gully		
Dirt Road		
Gravel Road		
Raw Sewage		
Railroad		

N/A

Buffer Break Types (M = Minor; S = Severe)

CHANNELIZATION

N — Evidence of Channel Straightening or Dredging (Y/N)

TYPE	EXTENT (m) LEFT BANK	BOTTOM	RIGHT BANK
Concrete			
Gabion			
Rip-Rap			
Earthen Berm			
Dredge Spoil Off Channel			
Pipe Culvert			

Actual Site Midpoint Coordinates
(Taken at Time of Sampling)

Lat

Long

Stream Blockages

Stream Block Ht. (m)

Stream Block Type

Lat

Long

Physical Habitat Assessment and Water Quality Data Sheet

Site ID: MP36
Subwatershed: _____
Length of Reach: 75m Date: 03/31/16
Team Members: JP | GZ Time: 12:30

Weather
Current: P-cloudy
Past 24hrs: clear
Past 48hrs: clear

Parameter	Down-stream	Mid-stream	Up-stream
Description			
pH	6.51	6.45	6.39
Temperature (°C)	14.3	14.2	14.3
DO (mg/l)	8.21	8.29	8.21
Conductivity (uS/cm)	61	61	61
TDS (mg/l)	31	31	31
Turbidity (NTU)	6.01	5.77	5.65

Notes: _____

Stream Character

E Meandering	A Channelized
A Braided	A Straight
P Riffle	E Run/Glide
A Deep Pool >.5m	P Silt/Clay
P Shallow Pool <.5m	E Sand
P Gravel	A Cobble
A Boulder >2m	A Boulder <2m
A Concrete/Gabion	A Bedrock
P Undercut Bank	P Rootwad
P Overhead Cover	A Storm Drain
A Effluent Discharge	A Human Refuse
E Emergent Vegetation	A Beaver Pond
A Floating Vegetation	

A=Absent P=Present E=Extensive

Bar Formation
☒ None ☐ Moderate
☐ Minor ☐ Extensive

Bank Erosion (see guidance sheet)

	Left Bank	Right Bank
Extent (m)	0	0
Severity	0	0
Avg. Height	0	0

Severity: 0=none 1=mild 2=mod 3=severe

Maximum stream depth (cm): 15

Benthic Habitat Sampled (20 total)

	Sq. ft.
Riffle	14
Rootwad/Woody Debris	1
Leaf Pack	5
Submerged Vegetation	—
Undercut Banks	—
Other: _____	

Rootwads/Woody Debris

# Instream Woody Debris	4	IIII
# Dewatered Woody Debris	8	IIIT III
# Instream Rootwads	1	I
# Dewatered Rootwads	8	IIIT III

Stream Gradient

Location (ft)	Height (ft)	Water Depth (ft)

Photographs/Observations:

MBSS Physical Habitat Assessment Sheet

Stream Habitat Assessment Guidance Sheet				
Habitat Parameter	Optima 16-20	Sub-Optima 11-15	Marginal 6-10	Poor 0-5
1. Instream Habitat[4] SCORE 12	Greater than 50% of a variety of cobble, boulder, submerged logs, undercut banks, snags, rootwads, aquatic plants or other stable habitat	30-50% of stable habitat. Adequate habitat	10-30% mix of stable habitat. Habitat availability less than desirable	Less than 10% stable habitat. Lack of habitat is obvious
2. Epifaunal Substrate[1] SCORE 9	Preferred substrate abundant, stable, and at full colonization potential (riffles well developed and dominated by cobble; and/or woody debris prevalent; not new, and not transient)	Abund. of cobble with gravel and/or boulders common; or woody debris, aquatic veg., undercut banks common but not prevalent/suited for full colonization	Large boulders and/or bedrock prevalent; cobble, woody debris, or other preferred surfaces uncommon	Stable substrate lacking; or particles are over 75% surrounded by fine sediment or flocculent material
3. Velocity/Depth Diversity[2] SCORE 10	Slow (<0.3m/s), deep (>0.5m); slow, shallow (<0.5m); fast (>0.3m/s), deep; fast, shallow habitats all present	Only 3 of the 4 habitat categories present	Only 2 of the 4 habitat categories present	Dominated by 1 velocity/depth category (usually pools)
4. Pool/Glide/Eddy Quality[3] SCORE 8	Complex cover &/or depth >1.5m; both deep (>0.5m) shallows (<0.2m) present	Deep (>0.5m) areas present; but only moderate cover	Shallows (<0.2m) prevalent in pool/glide/eddy habitat; little cover	Max depth <0.2m in pool/glide/eddy habitat; or absent completely
5. Riffle/Run Quality[4] SCORE 12	Riffle/run depth generally >10cm, with maximum depth greater than 50 cm (maximum score); substrate stable (e.g. cobble, boulder) & variety of current velocities	Riffle/run depth generally 5-10cm, variety of current velocities	Riffle/run depth generally 1-5cm, primarily a single current velocity	Riffle/run depth <1cm, or riffle/run substrates concreted
6. Bank Stability[4] (facing downstream) Score each bank LB SCORE 9 RB SCORE 9	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected. 10 9	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion 8 7 6	Moderately unstable; 30-50% of bank in reach has areas of erosion; high erosion potential during floods. 5 4 3	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars. 2 1 0
7. Embeddedness SCORE 40 %	Percentage that gravel, cobble, and boulder particles are surrounded by fine sediment or flocculent material			
8. Shading SCORE 70 %	Percentage of segment that is shaded (duration is considered in scoring). 0% = fully exposed to sunlight all day in summer, 100% = fully and densely shaded all day in summer			
9. Riparian Buffer Zone Width (m)[1] LB 50 RB 50	Zone width in which human activity is not evident. 50m (164ft) is the maximum recorded value			
10. Remoteness SCORE 14	Roads greater than 400 meters (0.25 mi) from stream	Roads within 400 meters (0.25 mi) of stream; stream NOT accessible by trail	Roads within 400 meters (0.25 mi) of stream; stream accessible by trail	Roads adjacent to stream
11. Aesthetics (trash) Rating[3] SCORE 16	Little or no human refuse visible from stream channel or riparian zone	Refuse present in minor amounts	Refuse present in moderate amounts	Refuse abundant and unsightly
12. Number of Woody Debris and Rootwads[1] SCORE 5	Count only woody debris and rootwads within the wetted portion of the sampling segment. Count only woody debris >10cm (4in) diameter and >1.5m (5ft) long and rootwads with trunk diameter (at chest height) >15cm (6in) that are functional habitat within the wetted portion of the stream.			

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS (FRONT)

STREAM NAME MP36	LOCATION	
STATION #_____ RIVERMILE_____	STREAM CLASS	
LAT _____ LONG _____	RIVER BASIN	
STORET #	AGENCY	
INVESTIGATORS JP & GZ		
FORM COMPLETED BY Biohabitats	DATE 03/31/16 TIME 12:30 AM (PM)	REASON FOR SURVEY Bug Sampling

Parameters to be evaluated in sampling reach

Habitat Parameter	Condition Category			
	Optimal	Suboptimal	Marginal	Poor
1. Epifaunal Substrate/ Available Cover	Greater than 50% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient).	30-50% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale).	10-30% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 10% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
SCORE 9	20 19 18 17 16	15 14 13 12 11	10 (9) 8 7 6	5 4 3 2 1 0
2. Pool Substrate Characterization	Mixture of substrate materials, with gravel and firm sand prevalent; root mats and submerged vegetation common.	Mixture of soft sand, mud, or clay; mud may be dominant; some root mats and submerged vegetation present.	All mud or clay or sand bottom; little or no root mat; no submerged vegetation.	Hard-pan clay or bedrock; no root mat or vegetation.
SCORE 9	20 19 18 17 16	15 14 13 12 11	10 (9) 8 7 6	5 4 3 2 1 0
3. Pool Variability	Even mix of large-shallow, large-deep, small-shallow, small-deep pools present.	Majority of pools large-deep; very few shallow.	Shallow pools much more prevalent than deep pools.	Majority of pools small-shallow or pools absent.
SCORE 5	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	(5) 4 3 2 1 0
4. Sediment Deposition	Little or no enlargement of islands or point bars and less than <20% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 20-50% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 50-80% of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; more than 80% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
SCORE 7	20 19 18 17 16	15 14 13 12 11	10 9 8 (7) 6	5 4 3 2 1 0
5. Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills >75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
SCORE 16	20 19 18 17 (16)	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS (BACK)

Parameters to be evaluated broader than sampling reach

Habitat Parameter	Condition Category			
	Optimal	Suboptimal	Marginal	Poor
6. Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr) may be present, but recent channelization is not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.
SCORE 19	20 (19) 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
7. Channel Sinuosity	The bends in the stream increase the stream length 3 to 4 times longer than if it was in a straight line. (Note - channel braiding is considered normal in coastal plains and other low-lying areas. This parameter is not easily rated in these areas.)	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	Channel straight; waterway has been channelized for a long distance.
SCORE 16	20 19 18 17 (16)	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
8. Bank Stability (score each bank)	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.
SCORE 9 (LB)	Left Bank 10 (9)	8 7 6	5 4 3	2 1 0
SCORE 9 (RB)	Right Bank 10 (9)	8 7 6	5 4 3	2 1 0
9. Vegetative Protection (score each bank) Note: determine left or right side by facing downstream.	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
SCORE 9 (LB)	Left Bank 10 (9)	8 7 6	5 4 3	2 1 0
SCORE 9 (RB)	Right Bank 10 (9)	8 7 6	5 4 3	2 1 0
10. Riparian Vegetative Zone Width (score each bank riparian zone)	Width of riparian zone >18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone.	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6-12 meters; human activities have impacted zone a great deal.	Width of riparian zone <6 meters: little or no riparian vegetation due to human activities.
SCORE 10 (LB)	Left Bank (10) 9	8 7 6	5 4 3	2 1 0
SCORE 10 (RB)	Right Bank (10) 9	8 7 6	5 4 3	2 1 0

Total Score 137

v. 2014

MBSS SPRING INDEX PERIOD DATA SHEET

SITE — Watershed Code: MP38 | Segment: | Type: | Year: 2016

Reviewer: First: JR / Second: JP

DATE — Year: 04 | Month: 25 | Day: 16

CREW: Jeff Reagan Justin Park

STREAM NAME:

LOCALITY:

TIME: 1230 (Military)

SAMPLEABILITY

- [X] Benthos
- [ ] Facies Mapping
- [X] Habitat Assessment
- [X] Water Quality
- [ ] Vernal Pool
- [N] Present (Y/N)

Other:

SITE ACCESS ROUTE: Parked of Rt 258 and hiked in.

SAMPLE LABELS

Verified by:

QC LABELS

Watershed Code | Segment (Letters Only) | Type | Year

Dup. (D) or Blank (B): Verified by:

TEMP. LOGGERS

	(Y/N)	(TIME - Military)	
WATER			#
AIR			#

LOCATION:

PHOTODOCUMENTATION

Number		Voucher (Y/N)

BENTHIC HABITAT SAMPLED

- [18] Riffle
- [ ] Rootwad/Woody Debris
- [02] Leaf Pack
- [ ] Macrophytes
- [ ] Undercut Banks
- Other:

SAMPLING CONSIDERATIONS: (02 NUM. ANODES)

STREAM WIDTH (m): 1.0 (0 m) | .2.0 (75 m)

6.

v. 2014

MBSS SPRING FAUNAL DATA SHEET

SITE | Watershed Code: MP38 | Segment: | Type: | Year: 2016 | Reviewer: First: JR / Second: JP

HERPETOFAUNA

☐ None Observed

Species	Lifestage: Adult	Larval	Egg	SEEN (Y/N)	HEARD (Y/N)	Number Retained	Number Photos Taken
Amphib Frogs jumping (2-3)	X			Y	N		

MUSSELS

☒ None Observed

Species	LIVE	DEAD	Number Retained	Num. Photos Taken

Corbicula: LIVE ☐ DEAD ☐ NONE ☒

CRAYFISH

☒ None Observed

Species	Number Retained

Crayfish Burrows (A,P,E): A

COMMENTS:

v. 2014

MBSS SPRING HABITAT DATA SHEET

Page 4 of 4

SITE — Watershed Code: MP38 | Segment: | Type: | Year: 2016 | Reviewer: First: JR / Second: JP

DATE — Year: 16 | Month: 04 | Day: 25

150 Dist. from Nearest Road to Site (m)

19 Trash Rating 0 - 20

LANDUSE (Y/N)

N	Old Field	N	Residential
Y	Deciduous Forest	N	Commercial/Industrial
N	Coniferous Forest	N	Cropland
N	Wetland	N	Pasture
N	Surface Mine	N	Orchard/Vineyard/Nursery
N	Landfill	N	Golf Course

RIPARIAN VEGETATION
(facing upstream)

	LEFT BANK	RIGHT BANK
Width (50m max)	50	50
Adj. Land Cover	FR	FR
Veg Type	YMGR	YRMG
Buffer Breaks (Y/N)	N	N

ROAD CULVERT

Present in Segment? (Y/N)	N
Sampleable? (Y/N)	
Width of Culvert (m)	
Length of Culvert (m)	

STREAM GRADIENT

	Location (m)	Height (m)
1		
2		
3		

BUFFER BREAKS

	LEFT BANK	RIGHT BANK
Storm Drain		
Tile Drain		
Imperv. Drainage		
New Construction		
Orchard		
Crop		
Pasture		
Gully		
Dirt Road		
Gravel Road		
Raw Sewage		
Railroad		

Buffer Break Types (M = Minor; S = Severe)

CHANNELIZATION

N Evidence of Channel Straightening or Dredging (Y/N)

TYPE	EXTENT (m) LEFT BANK	BOTTOM	RIGHT BANK
Concrete			
Gabion			
Rip-Rap			
Earthen Berm			
Dredge Spoil Off Channel			
Pipe Culvert			

Actual Site Midpoint Coordinates
(Taken at Time of Sampling)

Lat

Long

Stream Blockages

Stream Block Ht. (m)

Stream Block Type

Lat

Long

Physical Habitat Assessment and Water Quality Data Sheet

Site ID: MP 38
Subwatershed: _____
Length of Reach: 75m Date: 04/25/16
Team Members: JR/JP Time: 12:30

Weather
Current: 78° Clear
Past 24hrs: 73° Clear
Past 48hrs: 75° Rain

Parameter	Down-stream	Mid-stream	Up-stream
Description			
pH	6.54	6.66	6.69
Temperature (°C)	15.6	15.5	15.5
DO (mg/l)	11.75	12.03	11.84
Conductivity (uS/cm)	210	214	213
TDS (mg/l)	106	107	106
Turbidity (NTU)	3.61	3.31	4.11

Notes: _____

Stream Character

P Meandering	A Channelized
A Braided	P Straight
P Riffle	P Run/Glide
A Deep Pool >.5m	P Silt/Clay
P Shallow Pool <.5m	E Sand
P Gravel	A Cobble
A Boulder >2m	A Boulder <2m
A Concrete/Gabion	P Bedrock
P Undercut Bank	P Rootwad
E Overhead Cover	A Storm Drain
A Effluent Discharge	A Human Refuse
A Emergent Vegetation	A Beaver Pond
A Floating Vegetation	

A=Absent P=Present E=Extensive

Bar Formation
☐ None ☒ Moderate
☐ Minor ☐ Extensive

Bank Erosion (see guidance sheet)

	DS Left Bank	DS Right Bank	
Extent (m)	35	35	Severity
Severity	3	2	0=none
Avg. Height	5'	5'	1=mild
			2=mod
Maximum stream depth (cm)	6"		3=severe

Benthic Habitat Sampled (20 total)

	Sq. ft.
Riffle	18
Rootwad/Woody Debris	
Leaf Pack	2
Submerged Vegetation	
Undercut Banks	
Other: _____	

Rootwads/Woody Debris

# Instream Woody Debris	0
# Dewatered Woody Debris	3
# Instream Rootwads	0
# Dewatered Rootwads	3

Stream Gradient

Location (ft)	Height (ft)	Water Depth (ft)

Photographs/Observations:

MBSS Physical Habitat Assessment Sheet

Stream Habitat Assessment Guidance Sheet

Habitat Parameter	Optima 16-20	Sub-Optima 11-15	Marginal 6-10	Poor 0-5
1. In-stream Habitat[1] score 4	Greater than 50% of a variety of cobble, boulder, submerged logs, undercut banks, snags, rootwads, aquatic plants or other stable habitat	30-50% of stable habitat. Adequate habitat	10-30% mix of stable habitat. Habitat availability less than desireable	Less than 10% stable habitat. Lack of habitat is obvious
2. Epifaunal Substrate[2] score 4	Preferred substrate abundant, stable, and at full colonization potential (riffles well developed and dominated by cobble; and/or woody debris prevalent; not new, and not transient	Abund. of cobble with gravel and/or boulders common; or woody debris, aquatic veg., undercut banks common but not prevalent/suited for full colonization	Large boulders and/or bedrock prevalent; cobble, woody debris, or other preferred surfaces uncommon	Stable substrate lacking; or particles are over 75% surrounded by fine sediment or flocculent material
3. Velocity/Depth Diversity[3] score 13	Slow (<0.3m/s), deep (>0.5m); slow, shallow (<0.5m); fast (>0.3m/s), deep; fast, shallow habitats all present	Only 3 of the 4 habitat categories present	Only 2 of the 4 habitat categories present	Dominated by 1 velocity/depth category (usually pools)
4. Pool/Glide/Eddy Quality[4] score 4	Complex cover &/or depth >1.5m; both deep (>0.5m) shallows (<0.2m) present	Deep (>0.5m) areas present; but only moderate cover	Shallows (<0.2m) prevalent in pool/glide/eddy habitat; little cover	Max depth <0.2m in pool/glide/eddy habitat; or absent completely
5. Riffle/Run Quality[5] score 11	Riffle/run depth generally >10cm, with maximum depth greater than 50 cm (maximum score); substrate stable (e.g. cobble, boulder) & variety of current velocities	Riffle/run depth generally 5-10cm, variety of current velocities	Riffle/run depth generally 1-5cm, primarily a single current velocity	Riffle/run depth <1cm, or riffle/run substrates contreted
6. Bank Stability[6] (facing downstream) Score each bank LB score 4 RB score 4	Banks stable; evidence of erosion or bank failure absent or minimal, little potential for future problems. <5% of bank affected. 10 9	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion 8 7 6	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods. 5 4 3	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing. 60-100% of bank has erosional scars. 2 1 0
7. Embeddedness score 80 %	Percentage that gravel, cobble, and boulder particles are surrounded by fine sediment or flocculent material sand + silt dominant			
8. Shading score 70 %	Percentage of segment that is shaded (duration is considered in scoring). 0% = fully exposed to sunlight all day in summer. 100% = fully and densely shaded all day in summer			
9. Riparian Buffer Zone Width (m)[7] LB 50 RB 50	Zone width in which human activity is not evident. 50m (164ft) is the maximum recorded value			
10. Remoteness score 7	Roads greater than 400 meters (0.25 mi) from stream	Roads within 400 meters (0.25 mi) of stream; stream NOT accessible by trail	Roads within 400 meters (0.25 mi) of stream; stream accessible by trail	Roads adjacent to stream
11. Aesthetic (trash) Rating[8] score 19	Little or no human refuse visible from stream channel or riparian zone	Refuse present in minor amounts	Refuse present in moderate amounts	Refuse abundant and unsightly
12. Number of Woody Debris and Rootwads[9] score 0	Count only woody debris and rootwads within the wetted portion of the sampling segment. Count only woody debris >10cm (4in) diameter and >1.5m (5ft) long and rootwads with trunk diameter (at chest height) >15cm (6in) that are functional habitat within the wetted portion of the stream.			

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS (FRONT)

STREAM NAME MP38	LOCATION
STATION # _____ RIVERMILE _____	STREAM CLASS
LAT _____ LONG _____	RIVER BASIN
STORET #	AGENCY
INVESTIGATORS JR, JP	
FORM COMPLETED BY JP	DATE 07/25/16 TIME 12:30 AM (PM)
REASON FOR SURVEY Bug Sampling	

Parameters to be evaluated in sampling reach

Habitat Parameter	Condition Category			
	Optimal	Suboptimal	Marginal	Poor
1. Epifaunal Substrate/ Available Cover	Greater than 50% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient).	30-50% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale).	10-30% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 10% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
SCORE (4)	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 (4) 3 2 1 0
2. Pool Substrate Characterization	Mixture of substrate materials, with gravel and firm sand prevalent; root mats and submerged vegetation common.	Mixture of soft sand, mud, or clay; mud may be dominant; some root mats and submerged vegetation present.	All mud or clay or sand bottom; little or no root mat; no submerged vegetation.	Hard-pan clay or bedrock; no root mat or vegetation.
SCORE 7	20 19 18 17 16	15 14 13 12 11	10 9 8 (7) 6	5 4 3 2 1 0
3. Pool Variability	Even mix of large-shallow, large-deep, small-shallow, small-deep pools present.	Majority of pools large-deep; very few shallow.	Shallow pools much more prevalent than deep pools.	Majority of pools small-shallow or pools absent.
SCORE (4)	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 (4) 3 2 1 0
4. Sediment Deposition	Little or no enlargement of islands or point bars and less than <20% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 20-50% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 50-80% of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; more than 80% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
SCORE (4)	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 (4) 3 2 1 0
5. Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills >75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
SCORE (8)	20 19 18 17 16	15 14 13 12 11	10 9 (8) 7 6	5 4 3 2 1 0

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS (BACK)

Parameters to be evaluated broader than sampling reach

Habitat Parameter	Condition Category			
	Optimal	Suboptimal	Marginal	Poor
6. Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr) may be present, but recent channelization is not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.
SCORE 18	20 19 (18) 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
7. Channel Sinuosity	The bends in the stream increase the stream length 3 to 4 times longer than if it was in a straight line. (Note - channel braiding is considered normal in coastal plains and other low-lying areas. This parameter is not easily rated in these areas.)	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	Channel straight; waterway has been channelized for a long distance.
SCORE 6	20 19 18 17 16	15 14 13 12 11	10 9 8 7 (6)	5 4 3 2 1 0
8. Bank Stability (score each bank)	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.
SCORE 4 (LB)	Left Bank 10 9	8 7 6	5 (4) 3	2 1 0
SCORE 4 (RB)	Right Bank 10 9	8 7 6	5 (4) 3	2 1 0
9. Vegetative Protection (score each bank) Note: determine left or right side by facing downstream.	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
SCORE 4 (LB)	Left Bank 10 9	8 7 6	5 (4) 3	2 1 0
SCORE 4 (RB)	Right Bank 10 9	8 7 6	5 (4) 3	2 1 0
10. Riparian Vegetative Zone Width (score each bank riparian zone)	Width of riparian zone >18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone.	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6-12 meters; human activities have impacted zone a great deal.	Width of riparian zone <6 meters: little or no riparian vegetation due to human activities.
SCORE 10 (LB)	Left Bank (10) 9	8 7 6	5 4 3	2 1 0
SCORE 10 (RB)	Right Bank (10) 9	8 7 6	5 4 3	2 1 0

Total Score 87

v. 2014

MBSS SPRING INDEX PERIOD DATA SHEET

SITE Watershed Code: MPS7 | Segment: | Type: | Year: 2016

Reviewer: First: MT / Second: JP

DATE: Year: 16 | Month: 04 | Day: 21

CREW: Mike Thompson, Justin Park

STREAM NAME:

LOCALITY:

TIME: 1300 (Military)

SAMPLEABILITY

- [X] Benthos
- [N] Facies Mapping
- [X] Habitat Assessment
- [X] Water Quality
- [N] Vernal Pool
- [N] Present (Y/N)

Other:

SITE ACCESS ROUTE:

SAMPLE LABELS

Verified by:

QC LABELS

Watershed Code | Segment (Letters Only) | Type | Year

Dup. (D) or Blank (B): Verified by:

TEMP. LOGGERS

	(Y/N)	(TIME - Military)		
WATER			#	
AIR			#	

LOCATION:

PHOTODOCUMENTATION

Number		Voucher (Y/N)

BENTHIC HABITAT SAMPLED

- [10] Riffle
- [08] Rootwad/Woody Debris
- [02] Leaf Pack
- [ ] Macrophytes
- [ ] Undercut Banks
- Other:

SAMPLING CONSIDERATIONS: (01 NUM. ANODES)

STREAM WIDTH (m): 1.0 (0 m) | 1.0 (75 m)

6.

v. 2014

MBSS SPRING FAUNAL DATA SHEET

Page 2 of 4

SITE — Watershed Code: MP57 | Segment: | Type: | Year: 2016

Reviewer: First: MT / Second: JP

HERPETOFAUNA

☐ None Observed

Species	Lifestage: Adult	Larval	Egg	SEEN (Y/N)	HEARD (Y/N)	Number Retained	Number Photos Taken
Cricket Frog	X			Y	Y		
Pickerel Frog	X			Y	N		
Green Tree Frog	X			Y	N		
Grey Tree Frog	X			N	Y		
Green Frog	X			Y	N		

MUSSELS

☒ None Observed

Species	LIVE	DEAD	Number Retained	Num. Photos Taken

Corbicula — LIVE ☐ DEAD ☐ NONE ☒

CRAYFISH

☒ None Observed

Species	Number Retained

Crayfish Burrows (A,P,E): P

COMMENTS:

v. 2014

MBSS SPRING HABITAT DATA SHEET

Page 4 of 4

SITE — Watershed Code: MPS7 | Segment: | Type: | Year: 2016

Reviewer: First: MT / Second: JP

DATE — Year: 16 | Month: 04 | Day: 21

200 Dist. from Nearest Road to Site (m)

05 Trash Rating 0 - 20

LANDUSE (Y/N)

N	Old Field	Y	Residential
Y	Deciduous Forest	N	Commercial/Industrial
N	Coniferous Forest	N	Cropland
Y	Wetland	N	Pasture
N	Surface Mine	N	Orchard/Vineyard/Nursery
N	Landfill	N	Golf Course

RIPARIAN VEGETATION
(facing upstream)

	LEFT BANK	RIGHT BANK
Width (50m max)	50	50
Adj. Land Cover	FR	FR
Veg Type	RYMG	YRMG
Buffer Breaks (Y/N)	N	N

ROAD CULVERT

Present in Segment? (Y/N)	N
Sampleable? (Y/N)	
Width of Culvert (m)	
Length of Culvert (m)	

STREAM GRADIENT

	Location (m)	Height (m)
1		
2		
3		

BUFFER BREAKS

	LEFT BANK	RIGHT BANK
Storm Drain		
Tile Drain		
Imperv. Drainage		
New Construction		
Orchard		
Crop		
Pasture		
Gully		
Dirt Road		
Gravel Road		
Raw Sewage		
Railroad		

Buffer Break Types (M = Minor; S = Severe)

CHANNELIZATION

N Evidence of Channel Straightening or Dredging (Y/N)

TYPE	EXTENT (m) LEFT BANK	BOTTOM	RIGHT BANK
Concrete			
Gabion			
Rip-Rap			
Earthen Berm			
Dredge Spoil Off Channel			
Pipe Culvert			

Actual Site Midpoint Coordinates
(Taken at Time of Sampling)

Lat

Long

Stream Blockages

Stream Block Ht. (m)

Stream Block Type

Lat

Long

Physical Habitat Assessment and Water Quality Data Sheet

Site ID: MP57
Subwatershed: _____
Length of Reach: 75 m Date: 4/21/16
Team Members: MT, JP Time: 1:00

Weather
Current: 73° Partly cloudy
Past 24hrs: 73° Clear
Past 48hrs: 75° Clear

Stream Character

E Meandering	A Channelized
P Braided	A Straight
P Riffle	P Run/Glide
A Deep Pool >.5m	E Silt/Clay
P Shallow Pool <.5m	E Sand
P Gravel	A Cobble
A Boulder >2m	A Boulder <2m
A Concrete/Gabion	A Bedrock
P Undercut Bank	P Rootwad
P Overhead Cover	A Storm Drain
A Effluent Discharge	E Human Refuse
A Emergent Vegetation	A Beaver Pond
A Floating Vegetation	

A=Absent P=Present E=Extensive

Bar Formation
☐ None ☐ Moderate
☒ Minor ☐ Extensive

Bank Erosion (see guidance sheet)

	(DS) Left Bank	(DS) Right Bank
Extent (m)	40	40
Severity	1	1
Avg. Height	1m	1m

Severity: 0=none, 1=minor, 2=moderate, 3=severe

Maximum stream depth (cm): 30

Benthic Habitat Sampled (20 total)	Sq. ft.
Riffle	10
Rootwad/Woody Debris	8
Leaf Pack	2
Submerged Vegetation	
Undercut Banks	
Other:	

Rootwads/Woody Debris

# Instream Woody Debris	18
# Dewatered Woody Debris	14
# Instream Rootwads	2
# Dewatered Rootwads	3

Stream Gradient

Location (ft)	Height (ft)	Water Depth (ft)

Parameter	Down-stream	Mid-stream	Up-stream
Description			
pH	6.40	6.44	6.44
Temperature (°C)	14.5	14.5	15.0
DO (mg/l)	6.50	10.52	10:52
Conductivity (uS/cm)	142	142	142
TDS (mg/l)	71	70	71
Turbidity (NTU)	5.14	6.29	5.88

Notes: _____

Photographs/Observations:

MBSS Physical Habitat Assessment Sheet

Stream Habitat Assessment Guidance Sheet

Habitat Parameter	Optima 16-20	Sub-Optima 11-15	Marginal 6-10	Poor 0-5
1. Instream Habitat[1] SCORE 13	Greater than 50% of a variety of cobble, boulder, submerged logs, undercut banks, snags, rootwads, aquatic plants or other stable habitat	30-50% of stable habitat. Adequate habitat	10-30% mix of stable habitat. Habitat availability less than desireable	Less than 10% stable habitat. Lack of habitat is obvious
2. Epifaunal Substrate[2] SCORE 13	Preferred substrate abundant, stable, and at full colonization potential (riffles well developed and dominated by cobble; and/or woody debris prevalent; not new, and not transient	Abund. of cobble with gravel and/or boulders common; or woody debris, aquatic veg., undercut banks common but not prevalent/suited for full colonization	Large boulders and/or bedrock prevalent; cobble, woody debris, or other preferred surfaces uncommon	Stable substrate lacking; or particles are over 75% surrounded by fine sediment or flocculent material
3. Velocity/Depth Diversity[3] SCORE 7	Slow (<0.3m/s), deep (>0.5m); slow, shallow (<0.5m); fast (>0.3m/s), deep; fast, shallow habitats all present	Only 3 of the 4 habitat categories present	Only 2 of the 4 habitat categories present	Dominated by 1 velocity/depth category (usually pools)
4. Pool/Glide/Eddy Quality[4] SCORE 11	Complex cover & or depth >1.5m; both deep (>0.5m) shallows (<0.2m) present	Deep (>0.5m) areas present; but only moderate cover	Shallows (<0.2m) prevalent in pool/glide/eddy habitat; little cover	Max depth <0.2m in pool/glide/eddy habitat; or absent completely
5. Riffle Run Quality[5] SCORE 7	Riffle/run depth generally >10cm, with maximum depth greater than 50 cm (maximum score); substrate stable (e.g. cobble, boulder) & variety of current velocities	Riffle run depth generally 5-10cm, variety of current velocities	Riffle run depth generally 1-5cm, primarily a single current velocity	Riffle run depth <1cm, or riffle run substrates contrived
6. Bank Stability[6] (facing downstream) Score each bank LB SCORE 3 RB SCORE 3	Banks stable; evidence of erosion or bank failure absent or minimal, little potential for future problems. <5% of bank affected. 10 9	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion 8 7 6	Moderately unstable; 30-60% of bank in reach as areas of erosion; high erosion potential during floods. 5 4 3	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars. 2 1 0
7. Embeddedness SCORE 100 %	Percentage that gravel, cobble, and boulder particles are surrounded by fine sediment or flocculent material Muck/silt/sand/clay			
8. Shading SCORE 90 %	Percentage of segment that is shaded (during op/considered in scoring). 0% = fully exposed to sunlight all day in summer, 100% = fully and densely shaded all day in summer			
9. Riparian Buffer Zone Width (m)[7] LB 35 RB 35	Zone width in which human activity is not evident. 50m (164ft) is the maximum recorded value			
10. Remoteness SCORE 6	Roads greater than 400 meters (0.25 mi) from stream	Roads within 400 meters (0.25 mi) of stream; stream NOT accessible by trail	Roads within 400 meters (0.25 mi) of stream; stream accessible by trail	Roads adjacent to stream
11. Aesthetic (trash) Rating[8] SCORE 5	Little or no human refuse visible from stream channel or riparian zone	Refuse present in minor amounts	Refuse present in moderate amounts	Refuse abundant and unsightly
12. Number of Woody Debris and Rootwads[9] SCORE 37	Count only woody debris and rootwads within the wetted portion of the sampling segment. Count only woody debris >10cm (4in) diameter and >1.5m (5ft) long and rootwads with trunk diameter (at chest height) >15cm (6in) that are functional habitat within the wetted portion of the stream.			

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS (FRONT)

STREAM NAME MP57	LOCATION	
STATION #_____ RIVERMILE_____	STREAM CLASS	
LAT _____ LONG _____	RIVER BASIN	
STORET #	AGENCY	
INVESTIGATORS MT JP		
FORM COMPLETED BY JP	DATE 4/21/16 TIME 1:00 AM (PM)	REASON FOR SURVEY Big Survey

Parameters to be evaluated in sampling reach

Habitat Parameter	Condition Category			
	Optimal	Suboptimal	Marginal	Poor
1. Epifaunal Substrate/ Available Cover	Greater than 50% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient).	30-50% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale).	10-30% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 10% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
SCORE (13)	20 19 18 17 16	15 14 (13) 12 11	10 9 8 7 6	5 4 3 2 1 0
2. Pool Substrate Characterization	Mixture of substrate materials, with gravel and firm sand prevalent; root mats and submerged vegetation common.	Mixture of soft sand, mud, or clay; mud may be dominant; some root mats and submerged vegetation present.	All mud or clay or sand bottom; little or no root mat; no submerged vegetation.	Hard-pan clay or bedrock; no root mat or vegetation.
SCORE (7)	20 19 18 17 16	15 14 13 12 11	10 9 8 (7) 6	5 4 3 2 1 0
3. Pool Variability	Even mix of large-shallow, large-deep, small-shallow, small-deep pools present.	Majority of pools large-deep; very few shallow.	Shallow pools much more prevalent than deep pools.	Majority of pools small-shallow or pools absent.
SCORE (6)	20 19 18 17 16	15 14 13 12 11	10 9 8 7 (6)	5 4 3 2 1 0
4. Sediment Deposition	Little or no enlargement of islands or point bars and less than <20% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 20-50% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 50-80% of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; more than 80% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
SCORE (9)	20 19 18 17 16	15 14 13 12 11	10 9 8 (7) 6	5 4 3 2 1 0
5. Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills >75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
SCORE (14)	20 19 18 17 16	15 (14) 13 12 11	10 9 8 7 6	5 4 3 2 1 0

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS (BACK)

Parameters to be evaluated broader than sampling reach

Habitat Parameter	Condition Category			
	Optimal	**Suboptimal**	**Marginal**	**Poor**
6. Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr) may be present, but recent channelization is not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.
SCORE (19)	20 (19) 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
7. Channel Sinuosity	The bends in the stream increase the stream length 3 to 4 times longer than if it was in a straight line. (Note - channel braiding is considered normal in coastal plains and other low-lying areas. This parameter is not easily rated in these areas.)	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	Channel straight; waterway has been channelized for a long distance.
SCORE (14)	20 19 18 17 16	15 (14) 13 12 11	10 9 8 7 6	5 4 3 2 1 0
8. Bank Stability (score each bank)	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.
SCORE 3 (LB)	Left Bank 10 9	8 7 6	5 4 (3)	2 1 0
SCORE 3 (RB)	Right Bank 10 9	8 7 6	5 4 (3)	2 1 0
9. Vegetative Protection (score each bank) Note: determine left or right side by facing downstream.	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
SCORE 3 (LB)	Left Bank 10 9	8 7 6	5 4 (3)	2 1 0
SCORE 3 (RB)	Right Bank 10 9	8 7 6	5 4 (3)	2 1 0
10. Riparian Vegetative Zone Width (score each bank riparian zone)	Width of riparian zone >18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone.	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6-12 meters; human activities have impacted zone a great deal.	Width of riparian zone <6 meters: little or no riparian vegetation due to human activities.
SCORE 10 (LB)	Left Bank (10) 9	8 7 6	5 4 3	2 1 0
SCORE 10 (RB)	Right Bank (10) 9	8 7 6	5 4 3	2 1 0

Total Score 107

v. 2014

MBSS SPRING INDEX PERIOD DATA SHEET

SITE: Watershed Code MP60 | Segment | Type | Year 2016

Reviewer: First MWT / Second JCR

DATE: Year 16 | Month 04 | Day 06

CREW: MWT / JCR

STREAM NAME:

LOCALITY:

TIME: 1325 (Military)

SAMPLEABILITY

- Y Benthos
- N Facies Mapping
- Y Habitat Assessment
- Y Water Quality
- N Vernal Pool
- N Present (Y/N)

Other:

SITE ACCESS ROUTE:

SAMPLE LABELS

Verified by:

QC LABELS

Watershed Code | Segment (Letters Only) | Type | Year

Dup. (D) or Blank (B): | Verified by:

TEMP. LOGGERS

	(Y/N)	(TIME - Military)	#
WATER			#
AIR			

LOCATION:

PHOTODOCUMENTATION

Number		Voucher (Y/N)

BENTHIC HABITAT SAMPLED

- 14 / 3 Riffle / Rootwad/Woody Debris
- 3 / Leaf Pack / Macrophytes
- Undercut Banks
- Other:

SAMPLING CONSIDERATIONS: (1 NUM. ANODES) Small fish observed.

STREAM WIDTH (m): 2.0 (0 m) | 2.0 (75 m)

v. 2014

MBSS SPRING FAUNAL DATA SHEET

SITE | Watershed Code: MP60 | Segment: | Type: | Year: 2016 | Reviewer: First: MWT / Second: JCR

HERPETOFAUNA

☐ None Observed

Species	Lifestage: Adult	Larval	Egg	SEEN (Y/N)	HEARD (Y/N)	Number Retained	Number Photos Taken
Green frog tadpole		X		Y	N	0	0
Cricket frog	X			Y	Y	0	0
American Toad			X	Y	N		

MUSSELS

☒ None Observed

Species	LIVE	DEAD	Number Retained	Num. Photos Taken

Corbicula: LIVE ☐ DEAD ☐ NONE ☒

CRAYFISH

☒ None Observed

Species	Number Retained

Crayfish Burrows (A,P,E): ☒

COMMENTS:

v. 2014

MBSS SPRING HABITAT DATA SHEET

SITE — Watershed Code: mP60 | Segment: | Type: | Year:

Reviewer: First: mWT / Second: JCR

DATE — Year: 16 | Month: 04 | Day: 06

50 Dist. from Nearest Road to Site (m)

17 Trash Rating 0 - 20

LANDUSE (Y/N)

N	Old Field	N	Residential
Y	Deciduous Forest	N	Commercial/Industrial
N	Coniferous Forest	N	Cropland
Y	Wetland	N	Pasture
N	Surface Mine	N	Orchard/Vineyard/Nursery
N	Landfill	N	Golf Course

RIPARIAN VEGETATION
(facing upstream)

	LEFT BANK	RIGHT BANK
Width (50m max)	50	50
Adj. Land Cover	FR	FR
Veg Type	RYMG	YRMG
Buffer Breaks (Y/N)	N	N

ROAD CULVERT

Present in Segment? (Y/N)	N
Sampleable? (Y/N)	
Width of Culvert (m)	
Length of Culvert (m)	

STREAM GRADIENT

	Location (m)	Height (m)
1		
2		
3		

BUFFER BREAKS

None

	LEFT BANK	RIGHT BANK
Storm Drain		
Tile Drain		
Imperv. Drainage		
New Construction		
Orchard		
Crop		
Pasture		
Gully		
Dirt Road		
Gravel Road		
Raw Sewage		
Railroad		

Buffer Break Types (M = Minor; S = Severe)

CHANNELIZATION

N Evidence of Channel Straightening or Dredging (Y/N)

TYPE	EXTENT (m) LEFT BANK	BOTTOM	RIGHT BANK
Concrete			
Gabion			
Rip-Rap			
Earthen Berm			
Dredge Spoil Off Channel			
Pipe Culvert			

Actual Site Midpoint Coordinates
(Taken at Time of Sampling)

Lat

Long

Stream Blockages

Stream Block Ht. (m) None

Stream Block Type

Lat

Long

Physical Habitat Assessment and Water Quality Data Sheet

Site ID: MP60
Subwatershed: _____
Length of Reach: 75 Date: 4/6/16
Team Members: MbT/JCR Time: 13:25

Weather
Current: Sunny high 40's
Past 24hrs: Sunny 50 windy
Past 48hrs: Rain Monday ~50°

Stream Character

P Meandering	P Channelized
A Braided	P Straight
P Riffle	P Run/Glide
A Deep Pool >.6m	E Silt/Clay
E Shallow Pool <.6m	E Sand
P Gravel	A Cobble
A Boulder >2m	A Boulder <2m
A Concrete/Gabion	A Bedrock
P Undercut Bank	P Rootwad
P Overhead Cover	A Storm Drain
A Effluent Discharge	P Human Refuse
A Emergent Vegetation	A Beaver Pond
A Floating Vegetation	

A=Absent P=Present E=Extensive

Bar Formation
☐ None ☐ Moderate
☒ Minor ☐ Extensive

Bank Erosion (see guidance sheet)

	Left Bank	Right Bank	
Extent (m)	65	10	Severity
Severity	2	2	0=none
Avg. Height	1.5	1.5	1=mild
			2=moderate
			3=severe

Maximum stream depth (cm) 80

Benthic Habitat Sampled (20 total)	Sq. ft.
Riffle	14
Rootwad/Woody Debris	3
Leaf Pack	3
Submerged Vegetation	0
Undercut Banks	0
Other:	0

Rootwads/Woody Debris

# Instream Woody Debris	2
# Dewatered Woody Debris	2
# Instream Rootwads	1
# Dewatered Rootwads	2

Stream Gradient

Location (ft)	Height (ft)	Water Depth (ft)

Parameter	Down-stream	Mid-stream	Up-stream
Description	Riffle	Pool	Riffle
pH	6.43	6.59	6.36
Temperature (°C)	12.9	12.4	12.6
DO (mg/l)	11.12	11.38	10.88
Conductivity (uS/cm)	408	412	417
TDS (mg/l)	203	206	209
Turbidity (NTU)	11.65	7.55	6.19

Notes: _____

Photographs/Observations:

MBSS Physical Habitat Assessment Sheet

Stream Habitat Assessment Guidance Sheet				
Habitat Parameter	Optima 16-20	Sub-Optima 11-15	Marginal 6-10	Poor 0-5
1. In-stream Habitat[1] SCORE 4	Greater than 50% of a variety of cobble, boulder, submerged logs, undercut banks, snags, rootwads, aquatic plants or other stable habitat	30-50% of stable habitat. Adequate habitat	10-30% mix of stable habitat. Habitat availability less than desireable	Less than 10% stable habitat. Lack of habitat is obvious
2. Epifaunal Substrate[2] SCORE 4	Preferred substrate abundant, stable, and at full colonization potential (riffles well developed and dominated by cobble; and/or woody debris prevalent; not new, and not transient	Abund. of cobble with gravel and/or boulders common; or woody debris, aquatic veg., undercut banks common but not prevalent/suited for full colonization	Large boulders and/or bedrock prevalent; cobble, woody debris, or other preferred surfaces uncommon	Scarce substrate lacking; or particles are over 75% surrounded by fine sediment or flocculent material
3. Velocity/Depth Diversity[3] SCORE 6	Slow (<0.3m/s), deep (>0.5m); slow, shallow (<0.5m); fast (>0.3m/s), deep; fast, shallow habitats all present	Only 3 of the 4 habitat categories present	Only 2 of the 4 habitat categories present	Dominated by 1 velocity/depth category (usually pools)
4. Pool/Glide/Eddy Quality[4] SCORE 6	Complex cover &/or depth >1.5m; both deep (>0.5m) shallows (<0.2m) present	Deep (>0.5m) areas present; but only moderate cover	Shallows (<0.2m) prevalent in pool/glide/eddy habitat; little cover	Max depth <0.2m in pool/glide/eddy habitat; or absent completely
5. Riffle/Run Quality[5] SCORE 5	Riffle/run depth generally >10cm, with maximum depth greater than 50 cm (maximum score); substrate stable (e.g. cobble, boulder) & variety of current velocities	Riffle/run depth generally 5-10cm, variety of current velocities	Riffle/run depth generally 1-5cm; primarily a single current velocity	Riffle/run depth <1cm, or riffle/run substrates consreted
6. Bank Stability[6] (facing downstream) Score each bank LB SCORE 2 RB SCORE 3	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected. 10 9	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion 8 7 6	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods. 5 4 3	Unstable; many eroded areas, "raw" areas frequent along straight sections and bends; obvious bank sloughing. 60-100% of bank has erosional scars. 2 1 0
7. Embeddedness SCORE 25 %	Percentage that gravel, cobble, and boulder particles are surrounded by fine sediment or flocculent material Sand/Silt bed stream			
8. Shading SCORE 80 %	Percentage of segment that is shaded (duration is considered in scoring). 0% = fully exposed to sunlight all day in summer. 100% = fully and densely shaded all day in summer			
9. Riparian Buffer Zone Width (m)[7] LB 50 RB 50	Zone width in which human activity is not evident. 50m (164ft) is the maximum recorded value			
10. Remoteness SCORE 3	Roads greater than 400 meters (0.25 mi) from stream	Roads within 400 meters (0.25 mi) of stream; stream NOT accessible by trail.	Roads within 400 meters (0.25 mi) of stream; stream accessible by trail.	Roads adjacent to stream
11. Aesthetic (trash) Rating[8] SCORE 17	Little or no human refuse visible from stream channel or riparian zone	Refuse present in minor amounts	Refuse present in moderate amounts	Refuse abundant and unsightly
12. Number of Woody Debris and Rootwads[9] SCORE 6	Count only woody debris and rootwads within the wetted portion of the sampling segment. Count only woody debris >10cm (4in) diameter and >1.5m (5ft) long and rootwads with trunk diameter (at chest height) >15cm (6in) that are "functional habitat within the wetted portion of the stream.			

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS (FRONT)

STREAM NAME MP60	LOCATION
STATION #_____ RIVERMILE_____	STREAM CLASS
LAT _____ LONG _____	RIVER BASIN
STORET #	AGENCY
INVESTIGATORS MWT / JCR	
FORM COMPLETED BY JCR	DATE 4/6/16 TIME 1:25 AM (PM)
REASON FOR SURVEY Bug Sampling	

Parameters to be evaluated in sampling reach

Habitat Parameter	Condition Category			
	Optimal	Suboptimal	Marginal	Poor
1. Epifaunal Substrate/ Available Cover	Greater than 50% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient).	30-50% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale).	10-30% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 10% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
SCORE 4	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
2. Pool Substrate Characterization	Mixture of substrate materials, with gravel and firm sand prevalent; root mats and submerged vegetation common.	Mixture of soft sand, mud, or clay; mud may be dominant; some root mats and submerged vegetation present.	All mud or clay or sand bottom; little or no root mat; no submerged vegetation.	Hard-pan clay or bedrock; no root mat or vegetation.
SCORE 8	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
3. Pool Variability	Even mix of large-shallow, large-deep, small-shallow, small-deep pools present.	Majority of pools large-deep; very few shallow.	Shallow pools much more prevalent than deep pools.	Majority of pools small-shallow or pools absent.
SCORE 7	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
4. Sediment Deposition	Little or no enlargement of islands or point bars and less than <20% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 20-50% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 50-80% of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; more than 80% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
SCORE 4	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
5. Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills >75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
SCORE 7	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS (BACK)

Parameters to be evaluated broader than sampling reach

Habitat Parameter	Condition Category			
	Optimal	Suboptimal	Marginal	Poor
6. Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr) may be present, but recent channelization is not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.
SCORE 7	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
7. Channel Sinuosity	The bends in the stream increase the stream length 3 to 4 times longer than if it was in a straight line. (Note - channel braiding is considered normal in coastal plains and other low-lying areas. This parameter is not easily rated in these areas.)	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	Channel straight; waterway has been channelized for a long distance.
SCORE 3	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
8. Bank Stability (score each bank)	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.
SCORE 4 (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE 4 (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0
9. Vegetative Protection (score each bank) Note: determine left or right side by facing downstream.	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
SCORE 8 (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE 8 (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0
10. Riparian Vegetative Zone Width (score each bank riparian zone)	Width of riparian zone >18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone.	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6-12 meters; human activities have impacted zone a great deal.	Width of riparian zone <6 meters: little or no riparian vegetation due to human activities.
SCORE 10 (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE 10 (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0

Total Score 84

v. 2014 # MBSS SPRING INDEX PERIOD DATA SHEET

Page 1 of 4

SITE — Watershed Code: MP61 | Segment: | Type: P | Year: 2016

Reviewer: First: KT / Second: MWT

DATE — Year: 16 | Month: 03 | Day: 25

CREW: KT/MWT

STREAM NAME:

LOCALITY:

TIME: 1315 (Military)

SAMPLEABILITY

- [Y] Benthos
- [N] Facies Mapping
- [Y] Habitat Assessment
- [Y] Water Quality
- [N] Vernal Pool
- [N] Present (Y/N)

Other:

SITE ACCESS ROUTE:

SAMPLE LABELS

Verified by:

QC LABELS

Watershed Code | Segment (Letters Only) | Type | Year

Dup. (D) or Blank (B): Verified by:

TEMP. LOGGERS

	(Y/N)	(TIME - Military)	#
WATER			#
AIR			#

LOCATION:

PHOTODOCUMENTATION

Number | Voucher (Y/N)

BENTHIC HABITAT SAMPLED

- [16] Riffle
- [2] Rootwad/Woody Debris
- [2] Leaf Pack
- [0] Macrophytes
- [0] Undercut Banks
- [0] Other:

SAMPLING CONSIDERATIONS: ([1] NUM. ANODES)

STREAM WIDTH (m): 0 m [7] | 75 m [13]

6.

v. 2014

MBSS SPRING FAUNAL DATA SHEET

SITE — Watershed Code: MP61 — Segment: — Type: P — Year: 2016 — Reviewer: First: KT / Second: MWT

HERPETOFAUNA

☐ None Observed

Species	Lifestage: Adult	Larval	Egg	SEEN (Y/N)	HEARD (Y/N)	Number Retained	Number Photos Taken
GREY TREE FROG	X			N	Y	0	0
CRICKET FROG	X			Y	N	0	0
GREEN FROG	X			Y	Y	0	0
NORTHERN TWO LINE	X			Y	N	0	0
GREEN TREE FROG	X			N	Y	0	0

MUSSELS

☐ None Observed

Species	LIVE	DEAD	Number Retained	Num. Photos Taken

Corbicula — LIVE ☐ DEAD ☐ NONE ☐

CRAYFISH

☐ None Observed

Species	Number Retained

Crayfish Burrows (A,P,E): P

COMMENTS: _____

v. 2014

MBSS SPRING HABITAT DATA SHEET

SITE — Watershed Code: MP61 | Segment: | Type: P | Year: 2016

Reviewer: First: KT / Second: MWT

DATE — Year: 16 | Month: 03 | Day: 25

385 Dist. from Nearest Road to Site (m)

18 Trash Rating 0 - 20

LANDUSE (Y/N)

N	Old Field	N	Residential
Y	Deciduous Forest	N	Commercial/Industrial
N	Coniferous Forest	N	Cropland
N	Wetland	N	Pasture
N	Surface Mine	N	Orchard/Vineyard/Nursery
N	Landfill	N	Golf Course

RIPARIAN VEGETATION
(facing upstream)

	LEFT BANK	RIGHT BANK
Width (50m max)	50	50
Adj. Land Cover	FR	FR
Veg Type	YMRG	YMRG
Buffer Breaks (Y/N)	N	N

ROAD CULVERT

Present in Segment? (Y/N)	N
Sampleable? (Y/N)	
Width of Culvert (m)	
Length of Culvert (m)	

STREAM GRADIENT

	Location (m)	Height (m)
1		
2		
3		

BUFFER BREAKS

	LEFT BANK	RIGHT BANK
Storm Drain		
Tile Drain		
Imperv. Drainage		
New Construction		
Orchard		
Crop		
Pasture		
Gully		
Dirt Road		
Gravel Road		
Raw Sewage		
Railroad		

Buffer Break Types (M = Minor; S = Severe)

CHANNELIZATION

N Evidence of Channel Straightening or Dredging (Y/N)

TYPE	EXTENT (m) LEFT BANK	BOTTOM	RIGHT BANK
Concrete			
Gabion			
Rip-Rap			
Earthen Berm			
Dredge Spoil Off Channel			
Pipe Culvert			

Actual Site Midpoint Coordinates
(Taken at Time of Sampling)

Lat

Long

Stream Blockages

Stream Block Ht. (m)

Stream Block Type

Lat

Long

Physical Habitat Assessment and Water Quality Data Sheet

Site ID: MP01
Subwatershed: _____
Length of Reach: 75m Date: 3/25/2016
Team Members: KT/MWT Time: 1:15pm

Stream Character

P Meandering	A Channelized
A Braided	A Straight
P Riffle	P Run/Glide
A Deep Pool >.5m	P Silt/Clay
P Shallow Pool <.5m	P Sand
P Gravel	A Cobble
A Boulder >2m	A Boulder <2m
A Concrete/Gabion	A Bedrock
A Undercut Bank	P Rootwad
E Overhead Cover	A Storm Drain
A Effluent Discharge	A Human Refuse
A Emergent Vegetation	A Beaver Pond
A Floating Vegetation	

A=Absent P=Present E=Extensive

Bar Formation

☐ None ☒ Moderate
☐ Minor ☐ Extensive

Bank Erosion (see guidance sheet)

	Left Bank	Right Bank
Extent (m)	10	2
Severity	1	1
Avg. Height	1m	0.3m

Severity: 0=none, 1=mild, 2=moderate, 3=severe

Maximum stream depth (cm): 40

Benthic Habitat Sampled (20 total)

	Sq. ft.
Riffle	16
Rootwad/Woody Debris	1
Leaf Pack	2
Submerged Vegetation	0
Undercut Banks	0
Other:	0

Rootwads/Woody Debris

# Instream Woody Debris	5	HHT
# Dewatered Woody Debris	8	HHT III
# Instream Rootwads	3	III
# Dewatered Rootwads	2	II

Stream Gradient

Location (ft)	Height (ft)	Water Depth (ft)

Weather

Current: CLEAR
Past 24hrs: CLOUDY/CLEAR
Past 48hrs: CLEAR

Parameter	Down-stream	Mid-stream	Up-stream
Description	run	riffle	riffle
pH	6.25	6.36	6.35
Temperature (°C)	15.7	15.4	15.4
DO (mg/l)	9.66	10.40	10.11
Conductivity (uS/cm)	120	116	118
TDS (mg/l)	60	58	58
Turbidity (NTU)	1.79	1.86	1.84

Notes: _____

Photographs/Observations:

MBSS Physical Habitat Assessment Sheet

Stream Habitat Assessment Guidance Sheet				
Habitat Parameter	Optima 16-20	Sub-Optima 11-15	Marginal 6-10	Poor 0-5
1. Instream Habitat[1] SCORE 11	Greater than 50% of a variety of cobble, boulder, submerged logs, undercut banks, snags, rootwads, aquatic plants or other stable habitat	30-50% of stable habitat. Adequate habitat	10-30% mix of stable habitat. Habitat availability less than desireable	Less than 10% stable habitat. Lack of habitat is obvious
2. Epifaunal Substrate[2] SCORE 11	Preferred substrate abundant, stable, and at full colonization potential (riffles well developed and dominated by cobble; and/or woody debris prevalent, not new, and not transient	Abund. of cobble with gravel and/or boulders common; or woody debris, aquatic veg., undercut banks common but not prevalent/suited for full colonization	Large boulders and/or bedrock prevalent; cobble, woody debris, or other preferred surfaces uncommon	Stable substrate lacking; or particles are over 75% surrounded by fine sediment or flocculent material
3. Velocity/Depth Diversity[3] SCORE 12	Slow (<0.3m/s), deep (>0.5m); slow, shallow (<0.5m); fast (>0.3m/s), deep; fast, shallow habitats all present	Only 3 of the 4 habitat categories present	Only 2 of the 4 habitat categories present	Dominated by 1 velocity/depth category (usually pools)
4. Pool/Glide/Eddy Quality[4] SCORE 7	Complex cover &/or depth >1.5m; both deep (>0.5m) shallows (<0.2m) present	Deep (>0.5m) areas present; but only moderate cover	Shallows (<0.2m) prevalent in pool/glide/eddy habitat; little cover	Max depth <0.2m in pool/glide/eddy habitat; or absent completely
5. Riffle/Run Quality[5] SCORE 9	Riffle/run depth generally >10cm, with maximum depth greater than 50 cm (maximum score); substrate stable (e.g. cobble, boulder) & variety of current velocities	Riffle/run depth generally 5-10cm, variety of current velocities	Riffle/run depth generally 1-5cm, primarily a single current velocity	Riffle/run depth <1cm, or riffle/run substrates concreted
6. Bank Stability[6] (facing downstream) Score each bank LB SCORE 7 RB SCORE 8	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected. 10 9	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion 8 7 6	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods. 5 4 3	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars. 2 1 0
7. Embeddedness SCORE 70 %	Percentage that gravel, cobble, and boulder particles are surrounded by fine sediment or flocculent material			
8. Shading SCORE 90 %	Percentage of segment that is shaded (dusk or is considered in scoring). 0% = fully exposed to sunlight all day in summer, 100% = fully and densely shaded all day in summer			
9. Riparian Buffer Zone Width (m)[7] LB 50 RB 50	Zone width in which human activity is not evident. 50m (164ft) is the maximum recorded value			
10. Remoteness SCORE 10	Roads greater than 400 meters (0.25 mi) from stream	Roads within 400 meters (0.25 mi) of stream; stream NOT accessible by trail	Roads within 400 meters (0.25 mi) of stream; stream accessible by trail	Roads adjacent to stream
11. Aesthetic (trash) Rating[8] SCORE 18	Little or no human refuse visible from stream channel or riparian zone	Refuse present in minor amounts	Refuse present in moderate amounts	Refuse abundant and unsightly
12. Number of Woody Debris and Rootwads[9] SCORE 18	Count only woody debris and rootwads within the wetted portion of the sampling segment. Count only woody debris >10cm (4in) diameter and >1.5m (5ft) long and rootwads with trunk diameter (at chest height) >15cm (6in) that are "functional habitat within the wetted portion of the stream			

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS (FRONT)

STREAM NAME MP61	LOCATION
STATION #_____ RIVERMILE_____	STREAM CLASS
LAT _____ LONG _____	RIVER BASIN
STORET #	AGENCY BIOHABITATS
INVESTIGATORS KT/MWT	
FORM COMPLETED BY KT	DATE 3/25/16 TIME 115 AM (PM) — REASON FOR SURVEY BUGS

Parameters to be evaluated in sampling reach

Habitat Parameter	Condition Category			
	Optimal	Suboptimal	Marginal	Poor
1. Epifaunal Substrate/ Available Cover	Greater than 50% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient).	30-50% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale).	10-30% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 10% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
SCORE 11	20 19 18 17 16	15 14 13 12 (11)	10 9 8 7 6	5 4 3 2 1 0
2. Pool Substrate Characterization	Mixture of substrate materials, with gravel and firm sand prevalent; root mats and submerged vegetation common.	Mixture of soft sand, mud, or clay; mud may be dominant; some root mats and submerged vegetation present.	All mud or clay or sand bottom; little or no root mat; no submerged vegetation.	Hard-pan clay or bedrock; no root mat or vegetation.
SCORE 7	20 19 18 17 16	15 14 13 12 11	10 9 8 (7) 6	5 4 3 2 1 0
3. Pool Variability	Even mix of large-shallow, large-deep, small-shallow, small-deep pools present.	Majority of pools large-deep; very few shallow.	Shallow pools much more prevalent than deep pools.	Majority of pools small-shallow or pools absent.
SCORE 4	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 (4) 3 2 1 0
4. Sediment Deposition	Little or no enlargement of islands or point bars and less than <20% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 20-50% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 50-80% of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; more than 80% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
SCORE 7	20 19 18 17 16	15 14 13 12 11	10 9 8 (7) 6	5 4 3 2 1 0
5. Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills >75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
SCORE 8	20 19 18 17 16	15 14 13 12 11	10 9 (8) 7 6	5 4 3 2 1 0

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS (BACK)

Parameters to be evaluated broader than sampling reach

Habitat Parameter	Condition Category			
	Optimal	**Suboptimal**	**Marginal**	**Poor**
6. Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr) may be present, but recent channelization is not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.
SCORE 20	(20) 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
7. Channel Sinuosity	The bends in the stream increase the stream length 3 to 4 times longer than if it was in a straight line. (Note - channel braiding is considered normal in coastal plains and other low-lying areas. This parameter is not easily rated in these areas.)	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	Channel straight; waterway has been channelized for a long distance.
SCORE 8	20 19 18 17 16	15 14 13 12 11	10 9 (8) 7 6	5 4 3 2 1 0
8. Bank Stability (score each bank)	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.
SCORE 7 (LB)	Left Bank 10 9	8 (7) 6	5 4 3	2 1 0
SCORE 8 (RB)	Right Bank 10 9	(8) 7 6	5 4 3	2 1 0
9. Vegetative Protection (score each bank) Note: determine left or right side by facing downstream.	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
SCORE 7 (LB)	Left Bank 10 9	8 (7) 6	5 4 3	2 1 0
SCORE 7 (RB)	Right Bank 10 9	8 (7) 6	5 4 3	2 1 0
10. Riparian Vegetative Zone Width (score each bank riparian zone)	Width of riparian zone >18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone.	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6-12 meters; human activities have impacted zone a great deal.	Width of riparian zone <6 meters: little or no riparian vegetation due to human activities.
SCORE 10 (LB)	Left Bank (10) 9	8 7 6	5 4 3	2 1 0
SCORE 10 (RB)	Right Bank (10) 9	8 7 6	5 4 3	2 1 0

Total Score 114

v. 2014

MBSS SPRING INDEX PERIOD DATA SHEET

SITE — Watershed Code: MP62 | Segment: | Type: P | Year: 2016

Reviewer: First: KT / Second: MWT

DATE — Year: 16 | Month: 03 | Day: 25

CREW: KT/MWT

STREAM NAME:

LOCALITY:

TIME: 1122 (Military)

SAMPLEABILITY

- [Y] Benthos
- [N] Facies Mapping
- [Y] Habitat Assessment
- [Y] Water Quality
- [N] Vernal Pool
- [N] Present (Y/N)

Other:

SITE ACCESS ROUTE:

SAMPLE LABELS

Verified by:

QC LABELS

Watershed Code | Segment (Letters Only) | Type | Year

Dup. (D) or Blank (B): Verified by:

TEMP. LOGGERS

	(Y/N)	(TIME - Military)	
WATER			#
AIR			#

LOCATION:

PHOTODOCUMENTATION

Number		Voucher (Y/N)

BENTHIC HABITAT SAMPLED

- 14 Riffle
- 13 Rootwad/Woody Debris
- 13 Leaf Pack
- 10 Macrophytes
- 00 Undercut Banks
- 00 Other:

SAMPLING CONSIDERATIONS: (11 NUM. ANODES)

STREAM WIDTH (m): 11.5 (0 m) | .5 (75 m)

6.

v. 2014

MBSS SPRING FAUNAL DATA SHEET

SITE | Watershed Code: MP62 | Segment: | Type: P | Year: 2016 | Reviewer: First: KT / Second: MWT

HERPETOFAUNA

☐ None Observed

Species	Lifestage: Adult	Larval	Egg	SEEN (Y/N)	HEARD (Y/N)	Number Retained	Number Photos Taken
NORTHERN CRICKET FROG	X			Y	N	0	0
GREEN FROG	X			Y	N	0	2
SPRING PEEPER	X			N	Y	0	0
Gray Tree Frog	X			N	Y	0	0

MUSSELS

☒ None Observed

Species	LIVE	DEAD	Number Retained	Num. Photos Taken

Corbicula: LIVE ☐ DEAD ☐ NONE ☒

CRAYFISH

☒ None Observed

Species	Number Retained

Crayfish Burrows (A,P,E): A

COMMENTS:

v. 2014

MBSS SPRING HABITAT DATA SHEET

SITE — Watershed Code: MP62 | Segment: | Type: P | Year: 2016

Reviewer: First: KT / Second: MWT

DATE — Year: 16 | Month: 03 | Day: 25

136 Dist. from Nearest Road to Site (m)

17 Trash Rating 0 - 20

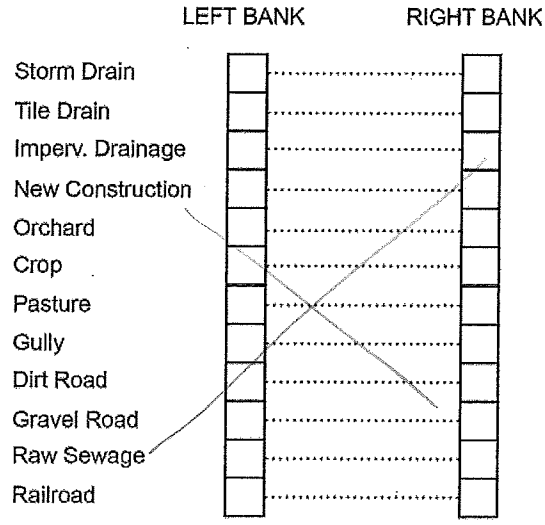
LANDUSE (Y/N)

N	Old Field	N	Residential
Y	Deciduous Forest	N	Commercial/Industrial
N	Coniferous Forest	N	Cropland
N	Wetland	N	Pasture
N	Surface Mine	N	Orchard/Vineyard/Nursery
N	Landfill	N	Golf Course

RIPARIAN VEGETATION
(facing upstream)

	LEFT BANK	RIGHT BANK
Width (50m max)	50	50
Adj. Land Cover	FR	FR
Veg Type	YMGR	YMGR
Buffer Breaks (Y/N)	N	N

BUFFER BREAKS



Buffer Break Types (M = Minor; S = Severe)

ROAD CULVERT

Present in Segment? (Y/N)	N
Sampleable? (Y/N)	
Width of Culvert (m)	
Length of Culvert (m)	

STREAM GRADIENT

	Location (m)	Height (m)
1		
2		
3		

CHANNELIZATION

N Evidence of Channel Straightening or Dredging (Y/N)

TYPE	EXTENT (m) LEFT BANK	BOTTOM	RIGHT BANK
Concrete			
Gabion			
Rip-Rap			
Earthen Berm			
Dredge Spoil Off Channel			
Pipe Culvert			

Actual Site Midpoint Coordinates
(Taken at Time of Sampling)

Lat

Long

Stream Blockages

Stream Block Ht. (m)

Stream Block Type

Lat

Long

Physical Habitat Assessment and Water Quality Data Sheet

Site ID: ~~MP03~~ MP02
Subwatershed: _____
Length of Reach: 75m Date: 3/25/16
Team Members: KT/MWT Time: 1122AM

Weather
Current: Cloudy
Past 24hrs: clear
Past 48hrs: clear

Stream Character

P Meandering	A Channelized
A Braided	A Straight
P Riffle	P Run/Glide
A Deep Pool >.5m	P Silt/Clay
P Shallow Pool <.5m	P Sand
P Gravel	A Cobble
A Boulder >2m	A Boulder <2m
A Concrete/Gabion	A Bedrock
A Undercut Bank	P Rootwad
E Overhead Cover	A Storm Drain
A Effluent Discharge	A Human Refuse
A Emergent Vegetation	A Beaver Pond
A Floating Vegetation	

A=Absent P=Present E=Extensive

Parameter	Down-stream	Mid-stream	Up-stream
Description	RUN	RUN	RUN
pH	6.22	6.41	6.59
Temperature (°C)	15.8	15.16	15.16
DO (mg/l)	10.25	10.20	10.31
Conductivity (uS/cm)	141	134	137
TDS (mg/l)	68	67	67
Turbidity (NTU)	1.42	2.64	1.72

Notes: _____

Bar Formation
☐ None ☐ Moderate
☒ Minor ☐ Extensive

Bank Erosion (see guidance sheet)

	Left Bank	Right Bank	Severity
Extent (m)	20	40	
Severity	1	1	0=none
Avg. Height	1m	1m	1=mild
			2=mod
Maximum stream depth (cm)	45		3=severe

Benthic Habitat Sampled (20 total)

	Sq. ft.
Riffle	14
Rootwad/Woody Debris	3
Leaf Pack	3
Submerged Vegetation	Ø
Undercut Banks	Ø
Other: _____	Ø

Rootwads/Woody Debris

# Instream Woody Debris	4
# Dewatered Woody Debris	3
# Instream Rootwads	2
# Dewatered Rootwads	1

Stream Gradient

Location (ft)	Height (ft)	Water Depth (ft)

Photographs/Observations:

MBSS Physical Habitat Assessment Sheet

Stream Habitat Assessment Guidance Sheet				
Habitat Parameter	Optima 16-20	Sub-Optima 11-15	Marginal 6-10	Poor 0-5
1. In-stream Habitat[1] SCORE 14	Greater than 50% of a variety of cobble, boulder, submerged logs, undercut banks, snags, rootwads, aquatic plants or other stable habitat	30-50% of stable habitat. Adequate habitat	10-30% mix of stable habitat. Habitat availability less than desireable	Less than 10% stable habitat. Lack of habitat is obvious
2. Epifaunal Substrate[2] SCORE 14	Preferred substrate abundant, stable, and at full colonization potential (riffles well developed and dominated by cobble; and/or woody debris prevalent, not new, and not transient	Abund. of cobble with gravel and/or boulders common; or woody debris, aquatic veg., undercut banks common but not prevalent/suited for full colonization	Large boulders and/or bedrock prevalent; cobble, woody debris, or other preferred surfaces uncommon	Stable substrate lacking; or particles are over 75% surrounded by fine sediment or flocculent material
3. Velocity/Depth Diversity[3] SCORE 10	Slow (<0.3m/s), deep (>0.5m); slow, shallow (<0.5m); fast (>0.3m/s), deep; fast, shallow habitats all present	Only 3 of the 4 habitat categories present	Only 2 of the 4 habitat categories present	Dominated by 1 velocity/depth category (usually pools)
4. Pool/Glide/Eddy Quality[4] SCORE 7	Complex cover & /or depth >1.5m; both deep (>0.5m) shallows (<0.2m) present	Deep (>0.5m) areas present; but only moderate cover	Shallows (<0.2m) prevalent in pool/glide/eddy habitat; little cover	Max depth <0.2m in pool/glide/eddy habitat; or absent completely
5. Riffle/Run Quality[5] SCORE 10	Riffle/run depth generally >10cm, with maximum depth greater than 50 cm (maximum score); substrate stable (e.g. cobble, boulder) & variety of current velocities	Riffle/run depth generally 5-10cm, variety of current velocities	Riffle/run depth generally 1-5cm, primarily a single current velocity	Riffle/run depth <1cm, or riffle/run substrates concreted
6. Bank Stability[6] (facing downstream) Score each bank LB SCORE 7 RB SCORE 7	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected. 10 9	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion 8 7 6	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods. 5 4 3	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars. 2 1 0
7. Embeddedness SCORE 70 %	Percentage that gravel, cobble, and boulder particles are surrounded by fine sediment or flocculent material			
8. Shading SCORE 100 %	Percentage of segment that is shaded (duration is considered in scoring). 0% = fully exposed to sunlight all day in summer. 100% = fully and densely shaded all day in summer			
9. Riparian Buffer Zone Width (m)[7] LB 50 RB 50	Zone width in which human activity is not evident. 50m (164ft) is the maximum recorded value			
10. Remoteness SCORE 10	Roads greater than 400 meters (0.25 mi) from stream	Roads within 400 meters (0.25 mi) of stream; stream NOT accessible by trail	Roads within 400 meters (0.25 mi) of stream; stream accessible by trail	Roads adjacent to stream
11. Aesthetic (trash) Rating[8] SCORE 17	Little or no human refuse visible from stream channel or riparian zone	Refuse present in minor amounts	Refuse present in moderate amounts	Refuse abundant and unsightly
12. Number of Woody Debris and Rootwads[9] SCORE 10	Count only woody debris and rootwads within the wetted portion of the sampling segment. Count only woody debris >10cm (4in) diameter and >1.5m (5ft) long and rootwads with trunk diameter (at chest height) >15cm (6in) that are "functional" habitat within the wetted portion of the stream.			

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS (FRONT)

STREAM NAME ~~MP05~~ MP102	LOCATION	
STATION #_____ RIVERMILE_____	STREAM CLASS	
LAT _____ LONG _____	RIVER BASIN	
STORET #	AGENCY BIOHABITATS	
INVESTIGATORS KT / MWT		
FORM COMPLETED BY KT	DATE 3/25/16 TIME 1122 (AM) PM	REASON FOR SURVEY BUGS

Parameters to be evaluated in sampling reach

Habitat Parameter	Condition Category			
	Optimal	Suboptimal	Marginal	Poor
1. Epifaunal Substrate/ Available Cover	Greater than 50% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient).	30-50% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale).	10-30% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 10% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
SCORE 14	20 19 18 17 16	15 (14) 13 12 11	10 9 8 7 6	5 4 3 2 1 0
2. Pool Substrate Characterization	Mixture of substrate materials, with gravel and firm sand prevalent; root mats and submerged vegetation common.	Mixture of soft sand, mud, or clay; mud may be dominant; some root mats and submerged vegetation present.	All mud or clay or sand bottom; little or no root mat; no submerged vegetation.	Hard-pan clay or bedrock; no root mat or vegetation.
SCORE 14	20 19 18 17 16	15 (14) 13 12 11	10 9 8 7 6	5 4 3 2 1 0
3. Pool Variability	Even mix of large-shallow, large-deep, small-shallow, small-deep pools present.	Majority of pools large-deep; very few shallow.	Shallow pools much more prevalent than deep pools.	Majority of pools small-shallow or pools absent.
SCORE 4	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 (4) 3 2 1 0
4. Sediment Deposition	Little or no enlargement of islands or point bars and less than <20% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 20-50% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 50-80% of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; more than 80% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
SCORE 9	20 19 18 17 16	15 14 13 12 11	10 (9) 8 7 6	5 4 3 2 1 0
5. Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills >75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
SCORE 11	20 19 18 17 16	15 14 13 12 (11)	10 9 8 7 6	5 4 3 2 1 0

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS (BACK)

Parameters to be evaluated broader than sampling reach

Habitat Parameter	Condition Category			
	Optimal	Suboptimal	Marginal	Poor
6. Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr) may be present, but recent channelization is not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.
SCORE 18	20 19 (18) 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
7. Channel Sinuosity	The bends in the stream increase the stream length 3 to 4 times longer than if it was in a straight line. (Note - channel braiding is considered normal in coastal plains and other low-lying areas. This parameter is not easily rated in these areas.)	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	Channel straight; waterway has been channelized for a long distance.
SCORE 8	20 19 18 17 16	15 14 13 12 11	10 9 (8) 7 6	5 4 3 2 1 0
8. Bank Stability (score each bank)	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.
SCORE 7 (LB)	Left Bank 10 9	8 (7) 6	5 4 3	2 1 0
SCORE 7 (RB)	Right Bank 10 9	8 (7) 6	5 4 3	2 1 0
9. Vegetative Protection (score each bank) Note: determine left or right side by facing downstream.	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
SCORE 4 (LB)	Left Bank 10 9	8 7 6	5 (4) 3	2 1 0
SCORE 4 (RB)	Right Bank 10 9	8 7 6	5 (4) 3	2 1 0
10. Riparian Vegetative Zone Width (score each bank riparian zone)	Width of riparian zone >18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone.	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6-12 meters; human activities have impacted zone a great deal.	Width of riparian zone <6 meters: little or no riparian vegetation due to human activities.
SCORE 10 (LB)	Left Bank (10) 9	8 7 6	5 4 3	2 1 0
SCORE 10 (RB)	Right Bank (10) 9	8 7 6	5 4 3	2 1 0

Total Score 120

REP site

v. 2014 # MBSS SPRING INDEX PERIOD DATA SHEET Page 1 of 4

SITE — Watershed Code: MP64 | Segment: | Type: | Year: 2016

Reviewer: First: MWT / Second: JCR

DATE — Year: 16 | Month: 04 | Day: 06

CREW: MWT / JCR

TIME: 1120 (Military)

STREAM NAME:

LOCALITY:

SAMPLEABILITY

- [Y] Benthos
- [N] Facies Mapping
- [Y] Habitat Assessment
- [Y] Water Quality
- [N] Vernal Pool
- [N] Present (Y/N)

Other:

SITE ACCESS ROUTE:

SAMPLE LABELS

Verified by:

QC LABELS

Watershed Code | Segment (Letters Only) | Type | Year

Dup. (D) or Blank (B): Verified by:

TEMP. LOGGERS

(Y/N) (TIME - Military)

WATER #

AIR #

LOCATION:

PHOTODOCUMENTATION

Number | Voucher (Y/N)

BENTHIC HABITAT SAMPLED

- [13] Riffle
- [3] Rootwad/Woody Debris
- [3] Leaf Pack
- [1] Macrophytes
- [ ] Undercut Banks
- [ ] Other:

SAMPLING CONSIDERATIONS: ([1] NUM. ANODES) some fish seen

STREAM WIDTH (m): 2.0 (0 m) | 2.0 (75 m)

6.

v. 2014

MBSS SPRING FAUNAL DATA SHEET

SITE — Watershed Code: MP64 — Segment: — Type: — Year: 2016 — Reviewer: First: MWT / Second: JCR

HERPETOFAUNA

☐ None Observed

Species	Lifestage: Adult	Larval	Egg	SEEN (Y/N)	HEARD (Y/N)	Number Retained	Number Photos Taken
Northern Dusky		X		Y		0	0
Cricket frog	X			Y	✓	0	0

MUSSELS

☒ None Observed

Species	LIVE	DEAD	Number Retained	Num. Photos Taken

Corbicula — LIVE ☐ DEAD ☐ NONE ☒

CRAYFISH

☐ None Observed

Species	Number Retained
some in sample (very small)	

Crayfish Burrows (A,P,E): P

COMMENTS:

v. 2014

MBSS SPRING HABITAT DATA SHEET

Page 4 of 4

SITE — Watershed Code: MP64 — Segment: — Type: — Year: 2016 — Reviewer: First: MWT / Second: JCR

DATE — Year: 16 — Month: 04 — Day: 06

500 Dist. from Nearest Road to Site (m)

17 Trash Rating 0 - 20

LANDUSE (Y/N)

N	Old Field	N	Residential
Y	Deciduous Forest	N	Commercial/Industrial
N	Coniferous Forest	N	Cropland
Y	Wetland	N	Pasture
N	Surface Mine	N	Orchard/Vineyard/Nursery
N	Landfill	N	Golf Course

RIPARIAN VEGETATION
(facing upstream)

	LEFT BANK	RIGHT BANK
Width (50m max)	50	50
Adj. Land Cover	FR	FR
Veg Type	RMYG	YMRG
Buffer Breaks (Y/N)	Y	Y

BUFFER BREAKS

	LEFT BANK	RIGHT BANK
Storm Drain		
Tile Drain		
Imperv. Drainage		
New Construction		
Orchard		
Crop		
Pasture		
Gully		
Dirt Road		
Gravel Road		
Raw Sewage		
Railroad		
Overhead Power	M	M

Buffer Break Types (M = Minor; S = Severe)

ROAD CULVERT

Present in Segment? (Y/N)	N
Sampleable? (Y/N)	
Width of Culvert (m)	
Length of Culvert (m)	

STREAM GRADIENT

	Location (m)	Height (m)
1		
2		
3		

CHANNELIZATION

N Evidence of Channel Straightening or Dredging (Y/N)

TYPE	EXTENT (m) LEFT BANK	BOTTOM	RIGHT BANK
Concrete			
Gabion			
Rip-Rap			
Earthen Berm			
Dredge Spoil Off Channel			
Pipe Culvert			

Actual Site Midpoint Coordinates
(Taken at Time of Sampling)

Lat

Long

Stream Blockages

Stream Block Ht. (m) None

Stream Block Type

Lat

Long

Physical Habitat Assessment and Water Quality Data Sheet

Site ID: MP64
Subwatershed: Two Run Br
Length of Reach: 75m Date: 4/6/16
Team Members: MWT/JCR Time: 11.20

Weather
Current: sunny low 40's
Past 24hrs: sunny 50 windy
Past 48hrs: rain on monday ~50

Stream Character

E	Meandering	A	Channelized
A	Braided	A	Straight
P	Riffle	E	Run/Glide
A	Deep Pool >.5m	P	Silt/Clay
P	Shallow Pool <.5m	E	Sand
P	Gravel	A	Cobble
A	Boulder >2m	A	Boulder <2m
A	Concrete/Gabion	A	Bedrock
P	Undercut Bank	P	Rootwad
P	Overhead Cover	A	Storm Drain
A	Effluent Discharge	P	Human Refuse
P	Emergent Vegetation	A	Beaver Pond
A	Floating Vegetation		

Submerged

A=Absent P=Present E=Extensive

Bar Formation
- [ ] None
- [ ] Minor
- [ ] Moderate
- [x] Extensive

Bank Erosion (see guidance sheet)

	Left Bank	Right Bank
Extent (m)		
Severity	0	0
Avg. Height	0.5	0.5

Severity: 0=none, 1=mild, 2=mod, 3=severe

Maximum stream depth (cm) _____

Benthic Habitat Sampled (20 total)

	Sq. ft.
Riffle	13
Rootwad/Woody Debris	3
Leaf Pack	3
Submerged Vegetation	1
Undercut Banks	0
Other:	0

Rootwads/Woody Debris

# Instream Woody Debris	3 III
# Dewatered Woody Debris	0
# Instream Rootwads	1 I
# Dewatered Rootwads	7 HH II

Stream Gradient

Location (ft)	Height (ft)	Water Depth (ft)

Parameter	Down-stream	Mid-stream	Up-stream
Description	glide	run	run
pH	6.62	6.62	6.64
Temperature (°C)	10.0	9.9	10.0
DO (mg/l)	12.88	13.08	13.52
Conductivity (uS/cm)	119	119	118
TDS (mg/l)	59	59	59
Turbidity (NTU)	2.09	1.64	1.65

Notes: nice floodplain & nice sinuous pattern

Photographs/Observations:

MBSS Physical Habitat Assessment Sheet

Stream Habitat Assessment Guidance Sheet				
Habitat Parameter	Optima 16-20	Sub-Optima 11-15	Marginal 6-10	Poor 0-5
1. In-stream Habitat[1] SCORE 10	Greater than 50% of a variety of cobble, boulder, submerged logs, undercut banks, snags, rootwads, aquatic plants or other stable habitat	30-50% of stable habitat. Adequate habitat	10-30% mix of stable habitat. Habitat availability less than desireable	Less than 10% stable habitat. Lack of habitat is obvious
2. Epifaunal Substrate[2] SCORE 3	Preferred substrate abundant, stable, and at full colonization potential (riffles well developed and dominated by cobble; and/or woody debris prevalent; not new, and not transient	Abund. of cobble with gravel and/or boulders common; or woody debris, aquatic veg., undercut banks common but not prevalent/suited for full colonization	Large boulders and/or bedrock prevalent; cobble, woody debris, or other preferred surfaces uncommon	Stable substrate lacking; or particles are over 75% surrounded by fine sediment or flocculent material
3. Velocity/Depth Diversity[3] SCORE 7	Slow (<0.3m/s), deep (>0.5m); slow, shallow (<0.5m); fast (>0.3m/s), deep; fast, shallow habitats all present	Only 3 of the 4 habitat categories present	Only 2 of the 4 habitat categories present	Dominated by 1 velocity/depth category (usually pools)
4. Pool/Glide/Eddy Quality[4] SCORE ____	Complex cover & /or depth >1.5m; both deep (>0.5m) shallows (<0.2m) present	Deep (>0.5m) areas present; but only moderate cover	Shallows (<0.2m) prevalent in pool/glide/eddy habitat; little cover	Max depth <0.2m in pool/glide/eddy habitat; or absent completely
5. Riffle/Run Quality[5] SCORE 8	Riffle/run depth generally >10cm, with maximum depth greater than 50 cm (maximum score); substrate stable (e.g. cobble, boulder) & variety of current velocities	Riffle/run depth generally 5-10cm, variety of current velocities	Riffle/run depth generally 1-5cm, primarily a single current velocity	Riffle/run depth <1cm, or riffle/run substrates contrived
6. Bank Stability[6] (facing downstream) Score each bank LB SCORE 10 RB SCORE 10	Banks stable; evidence of erosion or bank failure absent or minima; little potential for future problems. <5% of bank affected. 10 9	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion 8 7 6	Moderately unstable; 30-60% of bank in reach as areas of erosion; high erosion potential during floods. 5 4 3	Unstable; many eroded areas, "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars. 2 1 0
7. Embeddedness SCORE 25 %	Percentage that gravel, cobble, and boulder particles are surrounded by fine sediment or flocculent material. sand bed stream			
8. Shading SCORE 60 %	Percentage of segment that is shaded (duration is considered in scoring). 0% = fully exposed to sunlight all day in summer, 100% = fully and densely shaded all day in summer			
9. Riparian Buffer Zone Width (m)[7] LB 50 RB 50	Zone width in which human activity is not evident; 50m (164ft) is the maximum recorded value			
10. Remoteness SCORE 17	Roads greater than 400 meters (0.25 mi) from stream	Roads within 400 meters (0.25 mi) of stream; stream NOT accessible by trail	Roads within 400 meters (0.25 mi) of stream; stream accessible by trail	Roads adjacent to stream
11. Aesthetic (trash) Rating[8] SCORE 17	Little or no human refuse visible from stream channel or riparian zone	Refuse present in minor amounts	Refuse present in moderate amounts	Refuse abundant and unsightly
12. Number of Woody Debris and Rootwads[9] SCORE 11	Count only woody debris and rootwads within the wetted portion of the sampling segment. Count only woody debris >10cm (4in) diameter and >1.5m (5ft) long and rootwads with trunk diameter (at chest height) >15cm (6in) that are "functional habitat within the wetted portion of the stream.			

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS (FRONT)

STREAM NAME MP64	LOCATION
STATION #_____ RIVERMILE_____	STREAM CLASS
LAT _____ LONG _____	RIVER BASIN
STORET #	AGENCY
INVESTIGATORS MWT / JCR	
FORM COMPLETED BY MWT	DATE 4/6/16 TIME 11:11 (AM) PM
~~REASON FOR SURVEY~~ Bug Sampling	

Parameters to be evaluated in sampling reach

Habitat Parameter	Condition Category			
	Optimal	Suboptimal	Marginal	Poor
1. Epifaunal Substrate/ Available Cover	Greater than 50% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient).	30-50% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale).	10-30% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 10% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
SCORE 3	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 (3) 2 1 0
2. Pool Substrate Characterization	Mixture of substrate materials, with gravel and firm sand prevalent; root mats and submerged vegetation common.	Mixture of soft sand, mud, or clay; mud may be dominant; some root mats and submerged vegetation present.	All mud or clay or sand bottom; little or no root mat; no submerged vegetation.	Hard-pan clay or bedrock; no root mat or vegetation.
SCORE 12	20 19 18 17 16	15 14 13 (12) 11	10 9 8 7 6	5 4 3 2 1 0
3. Pool Variability	Even mix of large-shallow, large-deep, small-shallow, small-deep pools present.	Majority of pools large-deep; very few shallow.	Shallow pools much more prevalent than deep pools.	Majority of pools small-shallow or pools absent.
SCORE 4	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 (4) 3 2 1 0
4. Sediment Deposition	Little or no enlargement of islands or point bars and less than <20% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 20-50% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 50-80% of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; more than 80% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
SCORE 7	20 19 18 17 16	15 14 13 12 11	10 9 8 (7) 6	5 4 3 2 1 0
5. Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills >75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
SCORE 7	20 19 18 17 16	15 14 13 12 11	10 9 8 (7) 6	5 4 3 2 1 0

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS (BACK)

Parameters to be evaluated broader than sampling reach

Habitat Parameter	Condition Category			
	Optimal	Suboptimal	Marginal	Poor
6. Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr) may be present, but recent channelization is not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.
SCORE 19	20 (19) 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
7. Channel Sinuosity	The bends in the stream increase the stream length 3 to 4 times longer than if it was in a straight line. (Note - channel braiding is considered normal in coastal plains and other low-lying areas. This parameter is not easily rated in these areas.)	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	Channel straight; waterway has been channelized for a long distance.
SCORE 14	20 19 18 17 16	15 (14) 13 12 11	10 9 8 7 6	5 4 3 2 1 0
8. Bank Stability (score each bank)	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.
SCORE 10 (LB)	Left Bank (10) 9	8 7 6	5 4 3	2 1 0
SCORE 10 (RB)	Right Bank (10) 9	8 7 6	5 4 3	2 1 0
9. Vegetative Protection (score each bank) Note: determine left or right side by facing downstream.	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
SCORE 5 (LB)	Left Bank 10 9	8 7 6	(5) 4 3	2 1 0
SCORE 5 (RB)	Right Bank 10 9	8 7 6	(5) 4 3	2 1 0
10. Riparian Vegetative Zone Width (score each bank riparian zone)	Width of riparian zone >18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone.	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6-12 meters; human activities have impacted zone a great deal.	Width of riparian zone <6 meters: little or no riparian vegetation due to human activities.
SCORE 10 (LB)	Left Bank (10) 9	8 7 6	5 4 3	2 1 0
SCORE 10 (RB)	Right Bank (10) 9	8 7 6	5 4 3	2 1 0

Total Score 116

v. 2009

MBSS SPRING INDEX PERIOD DATA SHEET

Page 1 of 4

SITE: Watershed Code MP64 | Segment | Type | Year 2016

Reviewer: First JCR / Second MWT

DATE: Year 16 Month 04 Day 06

CREW: JCR/MWT

STREAM: MP64 - Upstream Rep Site

TIME: 1213 (Military)

LOCALITY:

QC - Representative Site

SAMPLEABILITY

- [1] Benthos
- [1] Habitat Assessment
- [1] Water Quality
- [N] Vernal Pool [N] PRESENT/ABSENT

OTHER (SPECIFY):

SITE ACCESS ROUTE

SAMPLE LABELS

Verified by:

QC LABEL

Watershed Code | Segment (Letters only) | Type | Year

Dup. (D) or Blank (B): Verified by:

TEMP. LOGGER

	(Y/N)	(TIME - Military)	#
WATER			#
AIR			#

LOCATION

PHOTODOCUMENTATION

Number	Title	Voucher (Y/N)

BENTHIC HABITAT SAMPLED

- [14] Riffle
- [3] Rootwad/Woody Debris
- [3] Leaf Pack
- [ ] Macrophytes
- [ ] Undercut Banks
- [ ] Other

SAMPLING CONSID.: ([1] NUM. ANODES) Fish observed

STREAM WIDTH (m): 20 (0 m) 15 (75 m)

v. 2009

MBSS SPRING FAUNA DATA SHEET

SITE Watershed Code: MR64 | Segment: | Type: | Year: 2010 | U.S. Rep. | First: JCR | Second: MWT | Reviewer:

HERPETOFAUNA

☐ None Observed

Species	Lifestage (Adult / Juv. / Larval / Egg)	SEEN (Y/N)	HEARD (Y/N)	NUMBER RETAINED	NUMBER PHOTOS TAKEN
Northern Cricket frog	A	Y	N	0	2

MUSSELS

☒ None Observed

Species	LIVE	DEAD	NUMBER RETAINED	NUMBER PHOTOS TAKEN

Corbicula — LIVE ☐ DEAD ☐ NONE ☒

CRAYFISHES

☐ None Observed

Species	NUMBER RETAINED
observed.	

Crayfish Burrows ☒
(Absent, Present, Extensive)

COMMENTS

v. 2009

MBSS SPRING HABITAT DATA SHEET

SITE: Watershed Code MP64 | Segment | Type | Year 2016

Reviewer: First JCR / Second MWT

DATE: Year 16 | Month 04 | Day 06 — MS. Rep Site.

500 Dist. from Nearest Road to Site (m)

17 Trash Rating 0 - 20

LANDUSE (Y/N)

N	Old Field	N	Residential
Y	Deciduous Forest	N	Commercial/Industrial
N	Coniferous Forest	N	Cropland
Y	Wetland	N	Pasture
N	Surface Mine	N	Orchard/Vineyard/Nursery
N	Landfill	N	Golf Course

ROAD CULVERT

Present in Segment (Y/N): N

Sampleable? (Y/N):

Width of Culvert (m):

Length of Culvert (m):

STREAM GRADIENT

	Location (m)	Height (m)
1		
2		
3		

RIPARIAN VEGETATION

(facing upstream)

	LEFT BANK	RIGHT BANK
Width (50m max)	50	50
Adjacent Land Cover	FR	FR
Vegetation Type	RMYG	YMRG
Buffer Breaks (Y/N)	N	N

LEFT BANK / RIGHT BANK

Storm Drain
Tile Drain
Impervious Drainage
Gully
Orchard
Crop
Pasture
New Construction
Dirt Road
Gravel Road
Raw Sewage
Railroad

Buffer Break Types
(M = minor; S = severe)

CHANNELIZATION

Y Evidence of Channel Straightening or Dredging (Y/N)

TYPE	EXTENT (m) LEFT BANK	BOTTOM	RIGHT BANK
Concrete			
Gabion			
Rip-Rap			
Earthen Berm		N/A	
Dredge Spoil Off Channel		N/A	
Pipe Culvert			

Actual Coordinates
(If >30m distance between original coordinates and stream)

Lat

Lon

Stream Block Ht. (m)

Stream Block Type

Lat

Lon

MBSS Physical Habitat Assessment Sheet

Stream Habitat Assessment Guidance Sheet				
Habitat Parameter	Optimal 16-20	Sub-Optimal 11-15	Marginal 6-10	Poor 0-5
1. Instream Habitat[1] SCORE 10	Greater than 50% of a variety of cobble, boulder, submerged logs, undercut banks, snags, rootwads, aquatic plants or other stable habitat	30-50% of stable habitat. Adequate habitat	10-30% mix of stable habitat. Habitat availability less than desireable	Less than 10% stable habitat. Lack of habitat is obvious
2. Epifaunal Substrate[2] SCORE 3	Preferred substrate abundant, stable, and at full colonization potential (riffles well developed and dominated by cobble; and/or woody debris prevalent, not new, and not transient	Abund. of cobble with gravel and/or boulders common; or woody debris, aquatic veg., undercut banks common but not prevalent/suited for full colonization	Large boulders and/or bedrock prevalent; cobble, woody debris, or other preferred surfaces uncommon	Stable substrate lacking; or particles are over 75% surrounded by fine sediment or flocculent material
3. Velocity/Depth Diversity[3] SCORE 7	Slow (<0.3m/s), deep (>0.5m); slow, shallow (<0.5m); fast (>0.3m/s), deep; fast, shallow habitats all present	Only 3 of the 4 habitat categories present	Only 2 of the 4 habitat categories present	Dominated by 1 velocity/depth category (usually pools)
4. Pool/Glide/Eddy Quality[4] SCORE 7	Complex cover/&/or depth >1.5m; both deep (>0.5m)/shallows (<0.2m) present	Deep (>0.5m) areas present; but only moderate cover	Shallows (<0.2m) prevalent in pool/glide/eddy habitat; little cover	Max depth <0.2m in pool/glide/eddy habitat; or absent completely
5. Riffle/Run Quality[5] SCORE 8	Riffle/run depth generally >10cm, with maximum depth greater than 50 cm (maximum score); substrate stable (e.g. cobble, boulder) & variety of current velocities	Riffle/run depth generally 5-10cm, variety of current velocities	Riffle/run depth generally 1-5cm; primarily a single current velocity	Riffle/run depth <1cm; or riffle/run substrates concreted
6. Bank Stability[2] (facing downstream) Score each bank LB SCORE 10 RB SCORE 10	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected. 10 9	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion. 8 7 6	Moderately unstable; 30-60% of bank in reach as areas of erosion; high erosion potential during floods. 5 4 3	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars. 2 1 0
7. Embeddedness SCORE 25 %	Percentage that gravel, cobble, and boulder particles are surrounded by fine sediment or flocculent material Sand bottom			
8. Shading SCORE 66 %	Percentage of segment that is shaded (duration is considered in scoring). 0% = fully exposed to sunlight all day in summer; 100% = fully and densely shaded all day in summer			
9. Riparian Buffer Zone Width (m)[6] LB 50 RB 50	Zone width in which human activity is not evident. 50m (164ft) is the maximum recorded value.			
10. Remoteness SCORE 17	Roads greater than 400 meters (0.25 mi) from stream	Roads within 400 meters (0.25 mi) of stream; stream NOT accessible by trail.	Roads within 400 meters (0.25 mi) of stream; stream accessible by trail.	Roads adjacent to stream.
11. Aesthetic (trash) Rating[7] SCORE 17	Little or no human refuse visible from stream channel or riparian zone	Refuse present in minor amounts	Refuse present in moderate amounts	Refuse abundant and unsightly
12. Number of Woody Debris and Rootwads[3] SCORE 11	Count only woody debris and rootwads within the wetted portion of the sampling segment. Count only woody debris >10cm (4in) diameter and >1.5m (5ft) long and rootwads with trunk diameter (at chest height) >15cm (6in) that are functional habitat within the wetted portion of the stream.			

Physical Habitat Assessment and Water Quality Data Sheet

Site ID: MP64 RcpSite
Subwatershed: Two Run Branch
Length of Reach: 75 m Date: 4/16/16
Team Members: CR | MW Time: 12:13

Weather
Current: Sunny ~40°
Past 24hrs: Sunny 50° Windy
Past 48hrs: Rain 50°

Parameter	Down-stream	Mid-stream	Up-stream
Description	C.I.de	Run	Run
pH	6.62	6.62	6.64
Temperature (°C)	10.0	9.9	10.0
DO (mg/l)	12.58	13.66	13.52
Conductivity (uS/cm)	119	119	118
TDS (mg/l)	59	59	59
Turbidity (NTU)	0.09	1.64	1.65

Notes: _____

Stream Character

[E] Meandering	[A] Channelized	
[A] Braided	[A] Straight	
[P] Riffle	[E] Run/Glide	
[A] Deep Pool >.5m	[A] Silt/Clay	
[P] Shallow Pool <.5m	[E] Sand	
[P] Gravel	[A] Cobble	
[A] Boulder >2m	[A] Boulder <2m	
[A] Concrete/Gabion	[A] Bedrock	
[P] Undercut Bank	[P] Rootwad	
[P] Overhead Cover	[A] Storm Drain	
[A] Effluent Discharge	[A] Human Refuse	
[P] Emergent Vegetation	[A] Beaver Pond	
[A] Floating Vegetation		

A=Absent P=Present E=Extensive

Bar Formation
☐ None ☐ Moderate
☐ Minor ☒ Extensive

Bank Erosion (see guidance sheet)

	Left Bank	Right Bank
Extent (m)		
Severity	0	0
Avg. Height	0.5	0.5

Severity: 0=none 1=min 2=mod 3=severe

Maximum stream depth (cm) _____

Benthic Habitat Sampled (20 total)

	Sq. ft.
Riffle	14
Rootwad/Woody Debris	3
Leaf Pack	3
Submerged Vegetation	
Undercut Banks	1
Other: _____	

Rootwads/Woody Debris

# Instream Woody Debris	3
# Dewatered Woody Debris	2
# Instream Rootwads	1
# Dewatered Rootwads	5

Stream Gradient

Location (ft)	Height (ft)	Water Depth (ft)

Photographs/Observations:

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS (FRONT)

STREAM NAME MP64 Reposite	LOCATION U.S. of MP 64
STATION # _____ RIVERMILE _____	STREAM CLASS
LAT _____ LONG _____	RIVER BASIN
STORET #	AGENCY
INVESTIGATORS JCR/MWT	
FORM COMPLETED BY JCR	DATE 4/16/12 TIME 12:13 AM (PM)
	REASON FOR SURVEY String Index - Benthic

Parameters to be evaluated in sampling reach	Habitat Parameter	Condition Category			
		Optimal	**Suboptimal**	**Marginal**	**Poor**
	1. Epifaunal Substrate/ Available Cover	Greater than 50% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient).	30-50% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale).	10-30% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 10% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
	SCORE 3	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 (3) 2 1 0
	2. Pool Substrate Characterization	Mixture of substrate materials, with gravel and firm sand prevalent; root mats and submerged vegetation common.	Mixture of soft sand, mud, or clay; mud may be dominant; some root mats and submerged vegetation present.	All mud or clay or sand bottom; little or no root mat; no submerged vegetation.	Hard-pan clay or bedrock; no root mat or vegetation.
	SCORE 12	20 19 18 17 16	15 14 13 (12) 11	10 9 8 7 6	5 4 3 2 1 0
	3. Pool Variability	Even mix of large-shallow, large-deep, small-shallow, small-deep pools present.	Majority of pools large-deep; very few shallow.	Shallow pools much more prevalent than deep pools.	Majority of pools small-shallow or pools absent.
	SCORE 4	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 (4) 3 2 1 0
	4. Sediment Deposition	Little or no enlargement of islands or point bars and less than <20% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 20-50% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 50-80% of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; more than 80% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
	SCORE 7	20 19 18 17 16	15 14 13 12 11	10 9 8 (7) 6	5 4 3 2 1 0
	5. Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills >75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
	SCORE 7	20 19 18 17 16	15 14 13 12 11	10 9 8 (7) 6	5 4 3 2 1 0

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS (BACK)

Parameters to be evaluated broader than sampling reach

Habitat Parameter	Condition Category			
	Optimal	Suboptimal	Marginal	Poor
6. Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr) may be present, but recent channelization is not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.
SCORE 19	20 (19) 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
7. Channel Sinuosity	The bends in the stream increase the stream length 3 to 4 times longer than if it was in a straight line. (Note - channel braiding is considered normal in coastal plains and other low-lying areas. This parameter is not easily rated in these areas.)	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	Channel straight; waterway has been channelized for a long distance.
SCORE 14	20 19 18 17 16	15 (14) 13 12 11	10 9 8 7 6	5 4 3 2 1 0
8. Bank Stability (score each bank)	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.
SCORE 10 (LB)	Left Bank (10) 9	8 7 6	5 4 3	2 1 0
SCORE 10 (RB)	Right Bank (10) 9	8 7 6	5 4 3	2 1 0
9. Vegetative Protection (score each bank) Note: determine left or right side by facing downstream.	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
SCORE 5 (LB)	Left Bank 10 9	8 7 6	(5) 4 3	2 1 0
SCORE 5 (RB)	Right Bank 10 9	8 7 6	(5) 4 3	2 1 0
10. Riparian Vegetative Zone Width (score each bank riparian zone)	Width of riparian zone >18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone.	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6-12 meters; human activities have impacted zone a great deal.	Width of riparian zone <6 meters: little or no riparian vegetation due to human activities.
SCORE 10 (LB)	Left Bank (10) 9	8 7 6	5 4 3	2 1 0
SCORE 10 (RB)	Right Bank (10) 9	8 7 6	5 4 3	2 1 0

Total Score 116

v. 2014

MBSS SPRING INDEX PERIOD DATA SHEET

SITE — Watershed Code: MP80A | Segment: | Type: P | Year: 2016

Reviewer: First: KT / Second: MWT

DATE — Year: 16 | Month: 04 | Day: 13

CREW: KT/MWT

STREAM NAME:

LOCALITY:

TIME: 1144 (Military)

SAMPLEABILITY

- [Y] Benthos
- [N] Facies Mapping
- [Y] Habitat Assessment
- [Y] Water Quality
- [N] Vernal Pool
- [N] Present (Y/N)

Other:

SITE ACCESS ROUTE:

SAMPLE LABELS

Verified by:

QC LABELS NA

Watershed Code | Segment | Type | Year

(Letters Only)

Dup. (D) or Blank (B): Verified by:

TEMP. LOGGERS

	(Y/N)	(TIME - Military)	
WATER		NA	#
AIR			#

LOCATION:

PHOTODOCUMENTATION

Number		Voucher (Y/N)

BENTHIC HABITAT SAMPLED

14	Riffle	1	Leaf Pack	0	Undercut Banks
5	Rootwad/Woody Debris	0	Macrophytes	0	Other:

SAMPLING CONSIDERATIONS: (1 NUM. ANODES)

STREAM WIDTH (m): 0 m: 12 | 75 m: 10

6.

v. 2014

MBSS SPRING FAUNAL DATA SHEET

SITE — Watershed Code: MP80A — Segment: — Type: P — Year: 2016 — Reviewer: First: KT / Second: MWT

HERPETOFAUNA

☐ None Observed

Species	Lifestage: Adult	Lifestage: Larval	Lifestage: Egg	SEEN (Y/N)	HEARD (Y/N)	Number Retained	Number Photos Taken
NORTHERN TWOLINE SALAMANDER	X			Y	N	0	0

MUSSELS

☒ None Observed

Species	LIVE	DEAD	Number Retained	Num. Photos Taken

Corbicula: ☐ LIVE ☐ DEAD ☒ NONE

CRAYFISH

☒ None Observed

Species	Number Retained

Crayfish Burrows (A,P,E): A

COMMENTS:

v. 2014

MBSS SPRING HABITAT DATA SHEET

SITE — Watershed Code: MP80A | Segment: | Type: P | Year: 2016

Reviewer: First: KT / Second: MWT

DATE — Year: 16 | Month: 04 | Day: 13

25 Dist. from Nearest Road to Site (m)

13 Trash Rating 0 - 20

LANDUSE (Y/N)

N	Old Field	Y	Residential
Y	Deciduous Forest	N	Commercial/Industrial
N	Coniferous Forest	N	Cropland
N	Wetland	N	Pasture
N	Surface Mine	N	Orchard/Vineyard/Nursery
N	Landfill	N	Golf Course

RIPARIAN VEGETATION
(facing upstream)

	LEFT BANK	RIGHT BANK
Width (50m max)	25	50
Adj. Land Cover	PV	FR
Veg Type	YRMG	YRMG
Buffer Breaks (Y/N)	Y	N

ROAD CULVERT

Present in Segment? (Y/N)	N
Sampleable? (Y/N)	
Width of Culvert (m)	
Length of Culvert (m)	

STREAM GRADIENT

	Location (m)	Height (m)
1		
2		
3		

NA

BUFFER BREAKS

	LEFT BANK	RIGHT BANK
Storm Drain		
Tile Drain		
Imperv. Drainage	M	
New Construction		
Orchard		
Crop		
Pasture		
Gully		
Dirt Road		
Gravel Road		
Raw Sewage		
Railroad		

NA

Buffer Break Types (M = Minor; S = Severe)

CHANNELIZATION

N Evidence of Channel Straightening or Dredging (Y/N)

TYPE	EXTENT (m)		
	LEFT BANK	BOTTOM	RIGHT BANK
Concrete			
Gabion			
Rip-Rap			
Earthen Berm			
Dredge Spoil Off Channel			
Pipe Culvert			

Actual Site Midpoint Coordinates
(Taken at Time of Sampling)

NA

Lat

Long

Stream Blockages

NA

Stream Block Ht. (m)

Stream Block Type

Lat

Long

Physical Habitat Assessment and Water Quality Data Sheet

Site ID: MP80A
Subwatershed: _____
Length of Reach: 75m Date: 4/13/10
Team Members: KT/MWT Time: 1144 AM

Weather
Current: Clear
Past 24hrs: Cloudy/RAIN
Past 48hrs: Cloudy/RAIN

Stream Character

P Meandering	A Channelized
A Braided	A Straight
P Riffle	P Run/Glide
P Deep Pool >.5m	P Silt/Clay
P Shallow Pool <.5m	P Sand
P Gravel	A Cobble
A Boulder >2m	A Boulder <2m
A Concrete/Gabion	A Bedrock
P Undercut Bank	P Rootwad
P Overhead Cover	A Storm Drain
A Effluent Discharge	P Human Refuse
A Emergent Vegetation	A Beaver Pond
A Floating Vegetation	

A=Absent P=Present E=Extensive

Bar Formation
☐ None ☑ Minor ☐ Moderate ☐ Extensive

Bank Erosion (see guidance sheet)

	Left Bank	Right Bank	Severity
Extent (m)	7	5	
Severity	2	1	0=None
Avg. Height	1.5 (5ft)	1.0 (3ft)	1=Low
			2=Med
			3=Severe

Maximum stream depth (cm): 75

Benthic Habitat Sampled (20 total)	Sq. ft.
Riffle	14
Rootwad/Woody Debris	5
Leaf Pack	1
Submerged Vegetation	8
Undercut Banks	
Other: _____	0

Rootwads/Woody Debris

# Instream Woody Debris	8
# Dewatered Woody Debris	1
# Instream Rootwads	7
# Dewatered Rootwads	0

Stream Gradient

Location (ft)	Height (ft)	Water Depth (ft)
NA		

Parameter	Down-stream	Mid-stream	Up-stream
Description	POOL	POOL	RIFFLE
pH	6.63	6.70	6.68
Temperature (°C)	12.7	12.4	12.1
DO (mg/l)	4.98	6.12	6.25
Conductivity (uS/cm)	264	270	260
TDS (mg/l)	132	132	130
Turbidity (NTU)	20.9	5.33	3.83

Notes: _____

Photographs/Observations:

MBSS Physical Habitat Assessment Sheet

Stream Habitat Assessment Guidance Sheet				
Habitat Parameter	Optima 16-20	Sub-Optima 11-15	Marginal 6-10	Poor 0-5
1. In-stream Habitat[1] SCORE 11	Greater than 50% of a variety of cobble, boulder, submerged logs, undercut banks, snags, rootwads, aquatic plants or other stable habitat	30-50% of stable habitat. Adequate habitat	10-30% mix of stable habitat. Habitat availability less than desireable	Less than 10% stable habitat. Lack of habitat is obvious
2. Epifaunal Substrate[2] SCORE 6	Preferred substrate abundant, stable, and at full colonization potential (riffles well developed and dominated by cobble; and/or woody debris prevalent; not new, and not transient	Abund. of cobble with gravel and/or boulders common; or woody debris, aquatic veg., undercut banks common but not prevalent/suited for full colonization	Large boulders and/or bedrock prevalent; cobble, woody debris, or other preferred surfaces uncommon	Stable substrate lacking; or particles are over 75% surrounded by fine sediment or flocculent material
3. Velocity/Depth Diversity[3] SCORE 12	Slow (<0.3m/s), deep (>0.5m); slow, shallow (<0.5m); fast (>0.3m/s), deep; fast, shallow habitats all present	Only 3 of the 4 habitat categories present	Only 2 of the 4 habitat categories present	Dominated by 1 velocity/depth category (usually pools)
4. Pool/Glide/Eddy Quality[4] SCORE 7	Complex cover &/or depth >1.5m; both deep (>0.5m) shallows (<0.2m) present	Deep (>0.5m) areas present; but only moderate cover	Shallows (<0.2m) prevalent in pool/glide/eddy habitat; little cover	Max depth <0.2m in pool/glide/eddy habitat; or absent completely
5. Riffle/Run Quality[5] SCORE 8	Riffle/run depth generally >10cm, with maximum depth greater than 50 cm (maximum score); substrate stable (e.g. cobble, boulder) & variety of current velocities	Riffle/run depth generally 5-10cm, variety of current velocities	Riffle/run depth generally 1-5cm, primarily a single current velocity	Riffle/run depth <1cm, or riffle/run substrates concreted
6. Bank Stability[6] (facing downstream) Score each bank LB SCORE 5 RB SCORE 7	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected. 10 9	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion 8 7 6	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods. 5 4 3	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing. 60-100% of bank has erosional scars. 2 1 0
7. Embeddedness SCORE 90 %	Percentage that gravel, cobble, and boulder particles are surrounded by fine sediment or flocculent material			
8. Shading SCORE 80 %	Percentage of segment that is shaded (duration is considered in scoring). 0% = fully exposed to sunlight all day in summer, 100% = fully and densely shaded all day in summer			
9. Riparian Buffer Zone Width (m)[7] LB 50 RB 25	Zone width in which human activity is not evident. 50m (164ft) is the maximum recorded value			
10. Remoteness SCORE 2	Roads greater than 400 meters (0.25 mi) from stream	Roads within 400 meters (0.25 mi) of stream; stream NOT accessible by trail	Roads within 400 meters (0.25 mi) of stream; stream accessible by trail	Roads adjacent to stream
11. Aesthetic (trash) Rating[8] SCORE 13	Little or no human refuse visible from stream channel or riparian zone	Refuse present in minor amounts	Refuse present in moderate amounts	Refuse abundant and unsightly
12. Number of Woody Debris and Rootwads[9] SCORE 16	Count only woody debris and rootwads within the wetted portion of the sampling segment. Count only woody debris >10cm (4in) diameter and >1.5m (5ft) long and rootwads with trunk diameter (at chest height) >15cm (6in) that are "functional habitat within the wetted portion of the stream.			

looking

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS (FRONT)

STREAM NAME MP80A	LOCATION	
STATION #_____ RIVERMILE_____	STREAM CLASS	
LAT _____ LONG _____	RIVER BASIN	
STORET #	AGENCY BIO HABITATS	
INVESTIGATORS KT/MWT		
FORM COMPLETED BY KT	DATE 4/13/10 TIME 1144 (AM) PM	REASON FOR SURVEY BUG SAMPLING

Parameters to be evaluated in sampling reach

Habitat Parameter	Condition Category			
	Optimal	Suboptimal	Marginal	Poor
1. Epifaunal Substrate/ Available Cover	Greater than 50% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient).	30-50% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale).	10-30% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 10% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
SCORE 11	20 19 18 17 16	15 14 13 12 (11)	10 9 8 7 6	5 4 3 2 1 0
2. Pool Substrate Characterization	Mixture of substrate materials, with gravel and firm sand prevalent; root mats and submerged vegetation common.	Mixture of soft sand, mud, or clay; mud may be dominant; some root mats and submerged vegetation present.	All mud or clay or sand bottom; little or no root mat; no submerged vegetation.	Hard-pan clay or bedrock; no root mat or vegetation.
SCORE 8	20 19 18 17 16	15 14 13 12 11	10 9 (8) 7 6	5 4 3 2 1 0
3. Pool Variability	Even mix of large-shallow, large-deep, small-shallow, small-deep pools present.	Majority of pools large-deep; very few shallow.	Shallow pools much more prevalent than deep pools.	Majority of pools small-shallow or pools absent.
SCORE 4	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 (4) 3 2 1 0
4. Sediment Deposition	Little or no enlargement of islands or point bars and less than <20% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 20-50% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 50-80% of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; more than 80% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
SCORE 10	20 19 18 17 16	15 14 13 12 11	(10) 9 8 7 6	5 4 3 2 1 0
5. Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills >75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
SCORE 8	20 19 18 17 16	15 14 13 12 11	10 9 (8) 7 6	5 4 3 2 1 0

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS (BACK)

Parameters to be evaluated broader than sampling reach

Habitat Parameter	Condition Category			
	Optimal	Suboptimal	Marginal	Poor
6. Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr) may be present, but recent channelization is not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.
SCORE 18	20 19 (18) 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
7. Channel Sinuosity	The bends in the stream increase the stream length 3 to 4 times longer than if it was in a straight line. (Note - channel braiding is considered normal in coastal plains and other low-lying areas. This parameter is not easily rated in these areas.)	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	Channel straight; waterway has been channelized for a long distance.
SCORE 9	20 19 18 17 16	15 14 13 12 11	10 (9) 8 7 6	5 4 3 2 1 0
8. Bank Stability (score each bank)	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.
SCORE 5 (LB)	Left Bank 10 9	8 7 6	(5) 4 3	2 1 0
SCORE 7 (RB)	Right Bank 10 9	8 (7) 6	5 4 3	2 1 0
9. Vegetative Protection (score each bank) Note: determine left or right side by facing downstream.	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
SCORE 7 (LB)	Left Bank 10 9	8 7 (6)	5 4 3	2 1 0
SCORE 7 (RB)	Right Bank 10 9	8 (7) 6	5 4 3	2 1 0
10. Riparian Vegetative Zone Width (score each bank riparian zone)	Width of riparian zone >18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone.	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6-12 meters; human activities have impacted zone a great deal.	Width of riparian zone <6 meters: little or no riparian vegetation due to human activities.
SCORE 10 (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE 9 (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0

Total Score 113

v. 2014

MBSS SPRING INDEX PERIOD DATA SHEET

SITE — Watershed Code: MP97A; Segment: ; Type: ; Year: 2016

Reviewer: First: JR / Second: JP

DATE — Year: 04; Month: 25; Day: 16

CREW: Jeff Reagan, Justin Parlc

STREAM NAME:

LOCALITY:

TIME: 1430 (Military)

SAMPLEABILITY

- [X] Benthos
- [X] Habitat Assessment
- [X] Water Quality
- [ ] Vernal Pool
- [N] Facies Mapping
- [N] Present (Y/N)

Other:

SITE ACCESS ROUTE: Farm road off Greenock Rd. that took us around to adjacent woods to Stream

SAMPLE LABELS

Verified by:

QC LABELS

Watershed Code | Segment (Letters Only) | Type | Year

Dup. (D) or Blank (B): Verified by:

TEMP. LOGGERS

	(Y/N)	(TIME - Military)	
WATER			#
AIR			#

LOCATION:

PHOTODOCUMENTATION

Number		Voucher (Y/N)

BENTHIC HABITAT SAMPLED

- 17 Riffle
- 01 Rootwad/Woody Debris
- 02 Leaf Pack
- Macrophytes
- Undercut Banks
- Other:

SAMPLING CONSIDERATIONS: (01 NUM. ANODES)

STREAM WIDTH (m): 1.0 (0 m); 1.0 (75 m)

6.

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MBSS SPRING FAUNAL DATA SHEET

SITE | Watershed Code: M P 99 A | Segment: | Type: | Year: 2016 | Reviewer: First JR / Second JP

HERPETOFAUNA

☐ None Observed

Species	Lifestage: Adult	Larval	Egg	SEEN (Y/N)	HEARD (Y/N)	Number Retained	Number Photos Taken
Spring peepers	X			N	Y		
Amphib frogs (unknown) (6-8)	X			Y	N		
dusky salamander	X			Y	N		
Gray Tree frog	X			N	Y		

MUSSELS

☒ None Observed

Species	LIVE	DEAD	Number Retained	Num. Photos Taken

Corbicula: LIVE ☐ DEAD ☐ NONE ☒

CRAYFISH

☒ None Observed

Species	Number Retained

Crayfish Burrows (A,P,E): A

COMMENTS:

v. 2014

MBSS SPRING HABITAT DATA SHEET

Page 4 of 4

SITE — Watershed Code: MP97A; Segment: ; Type: ; Year: 2016

Reviewer: First: JR / Second: JP

DATE — Year: 16; Month: 04; Day: 25

460 † Dist. from Nearest Road to Site (m)

12 Trash Rating 0 - 20

LANDUSE (Y/N)

Y	Old Field	N	Residential
Y	Deciduous Forest	N	Commercial/Industrial
N	Coniferous Forest	N	Cropland
N	Wetland	N	Pasture
N	Surface Mine	N	Orchard/Vineyard/Nursery
N	Landfill	N	Golf Course

RIPARIAN VEGETATION
(facing upstream)

	LEFT BANK	RIGHT BANK
Width (50m max)	18	50
Adj. Land Cover	FR	FR
Veg Type	YRMG	YMRG
Buffer Breaks (Y/N)	N	N

ROAD CULVERT

Present in Segment? (Y/N)	N
Sampleable? (Y/N)	
Width of Culvert (m)	
Length of Culvert (m)	

STREAM GRADIENT

	Location (m)	Height (m)
1		
2		
3		

BUFFER BREAKS

	LEFT BANK	RIGHT BANK
Storm Drain		
Tile Drain		
Imperv. Drainage		
New Construction		
Orchard		
Crop		
Pasture		
Gully		
Dirt Road		
Gravel Road		
Raw Sewage		
Railroad		

Buffer Break Types (M = Minor; S = Severe)

CHANNELIZATION

N Evidence of Channel Straightening or Dredging (Y/N)

TYPE	EXTENT (m)		
	LEFT BANK	BOTTOM	RIGHT BANK
Concrete			
Gabion			
Rip-Rap			
Earthen Berm			
Dredge Spoil Off Channel			
Pipe Culvert			

Actual Site Midpoint Coordinates
(Taken at Time of Sampling)

Lat

Long

Stream Blockages

Stream Block Ht. (m)

Stream Block Type

Lat

Long

Physical Habitat Assessment and Water Quality Data Sheet

Site ID: MP97A
Subwatershed: _____
Length of Reach: 75 m Date: 04/25/16
Team Members: JR | JP Time: 2:30

Stream Character

E Meandering	A Channelized
A Braided	A Straight
P Riffle	A Run/Glide
A Deep Pool >.5m	E Silt/Clay
P Shallow Pool <.5m	E Sand
P Gravel	A Cobble
A Boulder >2m	A Boulder <2m
A Concrete/Gabion	A Bedrock
P Undercut Bank	P Rootwad
P Overhead Cover	A Storm Drain
A Effluent Discharge	P Human Refuse
A Emergent Vegetation	A Beaver Pond
A Floating Vegetation	

A=Absent P=Present E=Extensive

Bar Formation

☐ None	☐ Moderate
☒ Minor	☐ Extensive

Bank Erosion (see guidance sheet)

	(DS) Left Bank	(DS) Right Bank	Severity
Extent (m)	20	45	
Severity	1	2	0=none
Avg. Height	2.5'	3.0'	1=mild
			2=mod
Maximum stream depth (cm)	10"		3=severe

Benthic Habitat Sampled (20 total)

	Sq. ft.
Riffle	17
Rootwad/Woody Debris	1
Leaf Pack	2
Submerged Vegetation	
Undercut Banks	
Other:	

Rootwads/Woody Debris

# Instream Woody Debris	4
# Dewatered Woody Debris	2
# Instream Rootwads	2
# Dewatered Rootwads	1

Stream Gradient

Location (ft)	Height (ft)	Water Depth (ft)

Weather
Current: 75° Clear
Past 24hrs: 73° Clear
Past 48hrs: 75° Rain

Parameter	Down-stream	Mid-stream	Up-stream
Description			
pH	6.91	6.93	6.93
Temperature (°C)	18.4	18.4	18.2°
DO (mg/l)	9.70	10.10	10.15
Conductivity (uS/cm)	164	162	165
TDS (mg/l)	81	81	81
Turbidity (NTU)	9.05	9.06	8.58

Notes: _____

Photographs/Observations:

MBSS Physical Habitat Assessment Sheet

Stream Habitat Assessment Guidance Sheet				
Habitat Parameter	Optima 16-20	Sub-Optima 11-15	Marginal 6-10	Poor 0-5
1. In-stream Habitat[4] SCORE 12	Greater than 50% of a variety of cobble, boulder, submerged logs, undercut banks, snags, rootwads, aquatic plants or other stable habitat	30-50% of stable habitat. Adequate habitat	10-30% mix of stable habitat. Habitat availability less than desireable	Less than 10% stable habitat. Lack of habitat is obvious
2. Epifaunal Substrate[2] SCORE 12	Preferred substrate abundant, stable, and at full colonization potential (riffles well developed and dominated by cobble; and/or woody debris prevalent; not new, and not transient)	Abund. of cobble with gravel and/or boulders common; or woody debris, aquatic veg., undercut banks common but not prevalent/suited for full colonization	Large boulders and/or bedrock prevalent; cobble, woody debris, or other preferred surfaces uncommon	Cobble substrate lacking; or particles are over 75% surrounded by fine sediment or flocculent material
3. Velocity/Depth Diversity[3] SCORE 10	Slow (<0.3m/s), deep (>0.5m); slow, shallow (<0.5m); fast (>0.3m/s), deep; fast, shallow habitats all present	Only 3 of the 4 habitat categories present	Only 2 of the 4 habitat categories present	Dominated by 1 velocity/depth category (usually pools)
4. Pool/Glide/Eddy Quality[4] SCORE 10	Complex cover & or depth >1.5m; both deep (>0.5m) shallows (<0.2m) present	Deep (>0.5m) areas present; but only moderate cover	Shallows (<0.2m) prevalent in pool/glide/eddy habitat; little cover	Max depth <0.2m in pool/glide/eddy habitat; or absent completely
5. Riffle Run Quality[4] SCORE 10	Riffle/run depth generally >10cm, with maximum depth greater than 50 cm (maximum score), substrate stable (e.g. cobble, boulder) & variety of current velocities	Riffle run depth generally 5-10cm, variety of current velocities	Riffle run depth generally 1-5cm, primarily a single current velocity	Riffle run depth <1cm, or riffle run substrates contrated
6. Bank Stability[2] (facing downstream) Score each bank LB SCORE 6 RB SCORE 4	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected. 10 9	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion 8 7 6	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods. 5 4 3	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars. 2 1 0
7. Embeddedness SCORE 70 %	Percentage that gravel, cobble, and boulder particles are surrounded by fine sediment or flocculent material sand/silt			
8. Shading SCORE 65 %	Percentage of segment that is shaded (duration is considered in scoring). 0% = fully exposed to sunlight all day in summer, 100% = fully and densely shaded all day in summer			
9. Riparian Buffer Zone Width (m)[4] LB 50 RB 18	Zone width in which human activity is not evident. 50m (164ft) is the maximum recorded value			
10. Remoteness SCORE 8	Roads greater than 400 meters (0.25 mi) from stream	Roads within 400 meters (0.25 mi) of stream; stream NOT accessible by trail	Roads within 400 meters (0.25 mi) of stream; stream accessible by trail	Roads adjacent to stream
11. Aesthetic (trash) Rating[4] SCORE 12	Little or no human refuse visible from stream channel or riparian zone	Refuse present in minor amounts	Refuse present in moderate amounts	Refuse abundant and unsightly
12. Number of Woody Debris and Rootwads[1] SCORE	Count only woody debris and rootwads within the wetted portion of the sampling segment. Count only woody debris >10cm (4in) diameter and >1.5m (5ft) long and rootwads with trunk diameter (at chest height) >15cm (6in) that are functional habitat within the wetted portion of the stream.			

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS (FRONT)

STREAM NAME MP 97A	LOCATION	
STATION #_____ RIVERMILE_____	STREAM CLASS	
LAT _____ LONG _____	RIVER BASIN	
STORET #	AGENCY	
INVESTIGATORS JR, JP		
FORM COMPLETED BY JP	DATE 04/25/16 TIME 2:30 AM (PM)	REASON FOR SURVEY Bug Sampling

Parameters to be evaluated in sampling reach

Habitat Parameter	Condition Category			
	Optimal	Suboptimal	Marginal	Poor
1. Epifaunal Substrate/ Available Cover	Greater than 50% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient).	30-50% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale).	10-30% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 10% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
SCORE (12)	20 19 18 17 16	15 14 13 (12) 11	10 9 8 7 6	5 4 3 2 1 0
2. Pool Substrate Characterization	Mixture of substrate materials, with gravel and firm sand prevalent; root mats and submerged vegetation common.	Mixture of soft sand, mud, or clay; mud may be dominant; some root mats and submerged vegetation present.	All mud or clay or sand bottom; little or no root mat; no submerged vegetation.	Hard-pan clay or bedrock; no root mat or vegetation.
SCORE (6)	20 19 18 17 16	15 14 13 12 11	10 9 8 7 (6)	5 4 3 2 1 0
3. Pool Variability	Even mix of large-shallow, large-deep, small-shallow, small-deep pools present.	Majority of pools large-deep; very few shallow.	Shallow pools much more prevalent than deep pools.	Majority of pools small-shallow or pools absent.
SCORE (10)	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 (4) 3 2 1 0
4. Sediment Deposition	Little or no enlargement of islands or point bars and less than <20% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 20-50% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 50-80% of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; more than 80% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
SCORE (6)	20 19 18 17 16	15 14 13 12 11	10 9 8 7 (6)	5 4 3 2 1 0
5. Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills >75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
SCORE 6	20 19 18 17 16	15 14 13 12 11	10 9 8 7 (6)	5 4 3 2 1 0

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS (BACK)

Parameters to be evaluated broader than sampling reach

Habitat Parameter	Condition Category			
	Optimal	Suboptimal	Marginal	Poor
6. Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr) may be present, but recent channelization is not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.
SCORE (18)	20 19 **(18)** 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
7. Channel Sinuosity	The bends in the stream increase the stream length 3 to 4 times longer than if it was in a straight line. (Note - channel braiding is considered normal in coastal plains and other low-lying areas. This parameter is not easily rated in these areas.)	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	Channel straight; waterway has been channelized for a long distance.
SCORE (7)	20 19 18 17 16	15 14 13 12 11	10 9 8 **(7)** 6	5 4 3 2 1 0
8. Bank Stability (score each bank)	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.
SCORE 6 (LB)	Left Bank 10 9	8 7 **(6)**	5 4 3	2 1 0
SCORE 4 (RB)	Right Bank 10 9	8 7 6	5 **(4)** 3	2 1 0
9. Vegetative Protection (score each bank) Note: determine left or right side by facing downstream.	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
SCORE 2 (LB)	Left Bank 10 9	8 7 6	5 4 3	**(2)** 1 0
SCORE 1 (RB)	Right Bank 10 9	8 7 6	5 **(4)** 3	2 **(1)** 0
10. Riparian Vegetative Zone Width (score each bank riparian zone)	Width of riparian zone >18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone.	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6-12 meters; human activities have impacted zone a great deal.	Width of riparian zone <6 meters: little or no riparian vegetation due to human activities.
SCORE 10 (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE 8 (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0

Total Score 90

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MBSS SPRING INDEX PERIOD DATA SHEET

SITE: Watershed Code MP98A | Segment — | Type P | Year 2016

Reviewer: First GZ / Second JCR

DATE: Year 16 | Month 04 | Day 14

CREW: GZ / JCR

STREAM NAME:

LOCALITY:

TIME: 1000 (Military)

SAMPLEABILITY

- [Y] Benthos
- [N] Facies Mapping
- [Y] Habitat Assessment
- [Y] Water Quality
- [N] Vernal Pool
- [ ] Present (Y/N)

Other:

SITE ACCESS ROUTE: From clubhouse, to 18 Hole

SAMPLE LABELS

Verified by: Greg Zutnick

QC LABELS

Watershed Code: MP98A | Segment: — (Letters Only) | Type: P | Year: 2016

Dup. (D) or Blank (B): | Verified by: JCR

TEMP. LOGGERS

	(Y/N)	(TIME - Military)	#
WATER			#
AIR			#

LOCATION:

PHOTODOCUMENTATION

Number	Voucher (Y/N)

BENTHIC HABITAT SAMPLED

16	Riffle
03	Rootwad/Woody Debris
01	Leaf Pack
00	Macrophytes
00	Undercut Banks
00	Other:

SAMPLING CONSIDERATIONS: (NUM. ANODES)

STREAM WIDTH (m): 8.0 (0 m) | 12.0 (75 m)

upstream downstream

6.

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MBSS SPRING FAUNAL DATA SHEET

SITE Watershed Code: M 0 9 8 | Segment: | Type: P | Year: 2016 | Reviewer: First: LZ / Second: JR

HERPETOFAUNA

[X] None Observed

Species	Lifestage: Adult	Lifestage: Larval	Lifestage: Egg	SEEN (Y/N)	HEARD (Y/N)	Number Retained	Number Photos Taken

MUSSELS

[X] None Observed

Species	LIVE	DEAD	Number Retained	Num. Photos Taken

Corbicula: LIVE [ ] DEAD [ ] NONE [✓]

CRAYFISH

[ ] None Observed

Species	Number Retained
unknown	0 / 1

Crayfish Burrows (A,P,E): P

COMMENTS:

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MBSS SPRING HABITAT DATA SHEET

Page 4 of 4

SITE — Watershed Code: M 0 9 8 4 | Segment: [ ] | Type: P | Year: 2 0 1 6

Reviewer: First: GZ / Second: JR

DATE — Year: 1 6 | Month: 0 4 | Day: 1 4

2 5 0 Dist. from Nearest Road to Site (m)

1 7 Trash Rating 0 - 20

LANDUSE (Y/N)

N	Old Field	Y	Residential
Y	Deciduous Forest	N	Commercial/Industrial
N	Coniferous Forest	N	Cropland
Y	Wetland	N	Pasture
N	Surface Mine	N	Orchard/Vineyard/Nursery
N	Landfill	Y	Golf Course

RIPARIAN VEGETATION
(facing upstream)

	LEFT BANK	RIGHT BANK
Width (50m max)	5 0	2 0
Adj. Land Cover	F R	F R
Veg Type	Y M R G	Y R M G
Buffer Breaks (Y/N)	N	N

ROAD CULVERT

Present in Segment? (Y/N)	N
Sampleable? (Y/N)	
Width of Culvert (m)	
Length of Culvert (m)	

STREAM GRADIENT

	Location (m)	Height (m)
1		
2		
3		

BUFFER BREAKS

	LEFT BANK	RIGHT BANK
Storm Drain		
Tile Drain		
Imperv. Drainage		
New Construction		
Orchard		
Crop		
Pasture		
Gully		
Dirt Road		
Gravel Road		
Raw Sewage		
Railroad		

NA

Buffer Break Types (M = Minor; S = Severe)

CHANNELIZATION

N Evidence of Channel Straightening or Dredging (Y/N)

TYPE	EXTENT (m)		
	LEFT BANK	BOTTOM	RIGHT BANK
Concrete			
Gabion			
Rip-Rap			
Earthen Berm			
Dredge Spoil Off Channel			
Pipe Culvert			

Actual Site Midpoint Coordinates
(Taken at Time of Sampling)

Lat

Long

Stream Blockages

Stream Block Ht. (m)

Stream Block Type

Lat

Long

Physical Habitat Assessment and Water Quality Data Sheet

Site ID: MP98A
Subwatershed: _____
Length of Reach: 75 m Date: 4/14/16
Team Members: GZ / JLR Time: 10:00 AM

Weather
Current: clear
Past 24hrs: clear
Past 48hrs: clear

Stream Character

[P] Meandering	[A] Channelized
[A] Braided	[P] Straight
[P] Riffle	[E] Run/Glide
[P] Deep Pool >.5m	[P] Silt/Clay
[P] Shallow Pool <.5m	[P] Sand
[E] Gravel	[P] Cobble
[A] Boulder >2m	[A] Boulder <2m
[A] Concrete/Gabion	[A] Bedrock
[A] Undercut Bank	[P] Rootwad
[P] Overhead Cover	[A] Storm Drain
[A] Effluent Discharge	[P] Human Refuse
[P] Emergent Vegetation	[A] Beaver Pond
[P] Floating Vegetation	

A=Absent P=Present E=Extensive

Bar Formation
[ ] None [ ] Moderate
[X] Minor [ ] Extensive

Bank Erosion (see guidance sheet)

	Left Bank	Right Bank
Extent (m)	75	75
Severity	2	2
Avg. Height	6.5	5

Severity
0=none
1=weak
2=mod
3=severe

Maximum stream depth (cm): 80

Benthic Habitat Sampled (20 total)

	Sq. ft.
Riffle	16
Rootwad/Woody Debris	3
Leaf Pack	1
Submerged Vegetation	
Undercut Banks	
Other:	

Rootwads/Woody Debris

# Instream Woody Debris	5
# Dewatered Woody Debris	4
# Instream Rootwads	2
# Dewatered Rootwads	17

Stream Gradient

Location (ft)	Height (ft)	Water Depth (ft)

Parameter	Down-stream	Mid-stream	Up-stream
Description			
pH	6.91	6.85	6.71
Temperature (°C)	9.7	10.3	10.1
DO (mg/l)	3.34	2.93	3.56
Conductivity (uS/cm)	224	223	227
TDS (mg/l)	111	111	111
Turbidity (NTU)	8.98	8.86	6.75

Notes: _____

Photographs/Observations:

MBSS Physical Habitat Assessment Sheet

Stream Habitat Assessment Guidance Sheet				
Habitat Parameter	Optima 16-20	Sub-Optima 11-15	Marginal 6-10	Poor 0-5
1. In-stream Habitat[1] score 10	Greater than 50% of a variety of cobble, boulder, submerged logs, undercut banks, snags, rootwads, aquatic plants or other stable habitat	30-50% of stable habitat. Adequate habitat	10-30% mix of stable habitat. Habitat availability less than desireable	Less than 10% stable habitat. Lack of habitat is obvious
2. Epifaunal Substrate[2] score 8	Preferred substrate abundant, stable, and at full colonization potential (riffles well developed and dominated by cobble; and/or woody debris prevalent; not new, and not transient	Abund. of cobble with gravel and/or boulders common; or woody debris, aquatic veg., undercut banks common but not prevalent/suited for full colonization	Large boulders and/or bedrock prevalent; cobble, woody debris, or other preferred surfaces uncommon	Stable substrate lacking; or particles are over 75% surrounded by fine sediment or flocculent material
3. Velocity/Depth Diversity[3] score 11	Slow (<0.3m/s), deep (>0.5m); slow, shallow (<0.5m); fast (>0.3m/s), deep; fast, shallow habitats all present	Only 3 of the 4 habitat categories present	Only 2 of the 4 habitat categories present	Dominated by 1 velocity/depth category (usually pools)
4. Pool/Glide/Eddy Quality[4] score 8	Complex cover, & or depth >1.5m; both deep (>0.5m) shallows (<0.2m) present	Deep (>0.5m) areas present; but only moderate cover	Shallows (<0.2m) prevalent in pool/glide/eddy habitat; little cover	Max depth <0.2m in pool/glide/eddy habitat; or absent completely
5. Riffle/Run Quality[5] score 7	Riffle/run depth generally >10cm, with maximum depth greater than 50 cm (maximum score), substrate stable (e.g. cobble, boulder) & variety of current velocities	Riffle/run depth generally 5-10cm, variety of current velocities	Riffle/run depth generally 1-5cm, primarily a single current velocity	Riffle/run depth <1cm, or riffle/run substrates concreted
6. Bank Stability[6] (facing downstream) Score each bank LB SCORE 1 RB SCORE 1	Banks stable; evidence of erosion or bank failure absent or minimal, little potential for future problems. <5% of bank affected. 10 9	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion 8 7 6	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods. 5 4 3	Unstable; many eroded areas, "raw" areas frequent along straight sections and bends; obvious bank sloughing. 60-100% of bank has erosional scars. 2 1 0
7. Embeddedness score 40 %	Percentage that gravel, cobble, and boulder particles are surrounded by fine sediment or flocculent material			
8. Shading score 80 %	Percentage of segment that is shaded (duration is considered in scoring). 0% = fully exposed to sunlight all day in summer. 100% = fully and densely shaded all day in summer			
9. Riparian Buffer Zone Width (m)[7] LB 30 RB 50	Zone width in which human activity is not evident. 50m (164ft) is the maximum recorded value			
10. Remoteness score 10	Roads greater than 400 meters (0.25 mi) from stream	Roads within 400 meters (0.25 mi) of stream; stream NOT accessible by trail	Roads within 400 meters (0.25 mi) of stream; stream accessible by trail	Roads adjacent to stream
11. Aesthetic (trash) Rating[8] score 17	Little or no human refuse visible from stream channel or riparian zone	Refuse present in minor amounts	Refuse present in moderate amounts	Refuse abundant and unsightly
12. Number of Woody Debris and Rootwads[9] score 10	Count only woody debris and rootwads within the wetted portion of the sampling segment. Count only woody debris >10cm (4in) diameter and >1.5m (5ft) long and rootwads with trunk diameter (at chest height) >15cm (6in) that are functional habitat within the wetted portion of the stream.			

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS (FRONT)

STREAM NAME MP98A	LOCATION MP98A
STATION # _____ RIVERMILE _____	STREAM CLASS
LAT _____ LONG _____	RIVER BASIN
STORET #	AGENCY
INVESTIGATORS GZ / JLR	
FORM COMPLETED BY Biohabitats	DATE 4/14/16 TIME 1400 AM PM
REASON FOR SURVEY	

Parameters to be evaluated in sampling reach

Habitat Parameter	Condition Category			
	Optimal	Suboptimal	Marginal	Poor
1. Epifaunal Substrate/ Available Cover	Greater than 50% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient).	30-50% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale).	10-30% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 10% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
SCORE 9	20 19 18 17 16	15 14 13 12 11	10 (9) 8 7 6	5 4 3 2 1 0
2. Pool Substrate Characterization	Mixture of substrate materials, with gravel and firm sand prevalent; root mats and submerged vegetation common.	Mixture of soft sand, mud, or clay; mud may be dominant; some root mats and submerged vegetation present.	All mud or clay or sand bottom; little or no root mat; no submerged vegetation.	Hard-pan clay or bedrock; no root mat or vegetation.
SCORE 7	20 19 18 17 16	15 14 13 12 11	10 9 8 (7) 6	5 4 3 2 1 0
3. Pool Variability	Even mix of large-shallow, large-deep, small-shallow, small-deep pools present.	Majority of pools large-deep; very few shallow.	Shallow pools much more prevalent than deep pools.	Majority of pools small-shallow or pools absent.
SCORE 5	20 19 18 17 16	15 14 13 12 11	10 9 (8) 7 6	(5) 4 3 2 1 0
4. Sediment Deposition	Little or no enlargement of islands or point bars and less than <20% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 20-50% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 50-80% of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; more than 80% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
SCORE 6	20 19 18 17 16	15 14 13 12 11	10 9 8 7 (6)	5 4 3 2 1 0
5. Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills >75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
SCORE 14	20 19 18 17 16	15 (14) 13 12 11	10 9 8 7 6	5 4 3 2 1 0

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS (BACK)

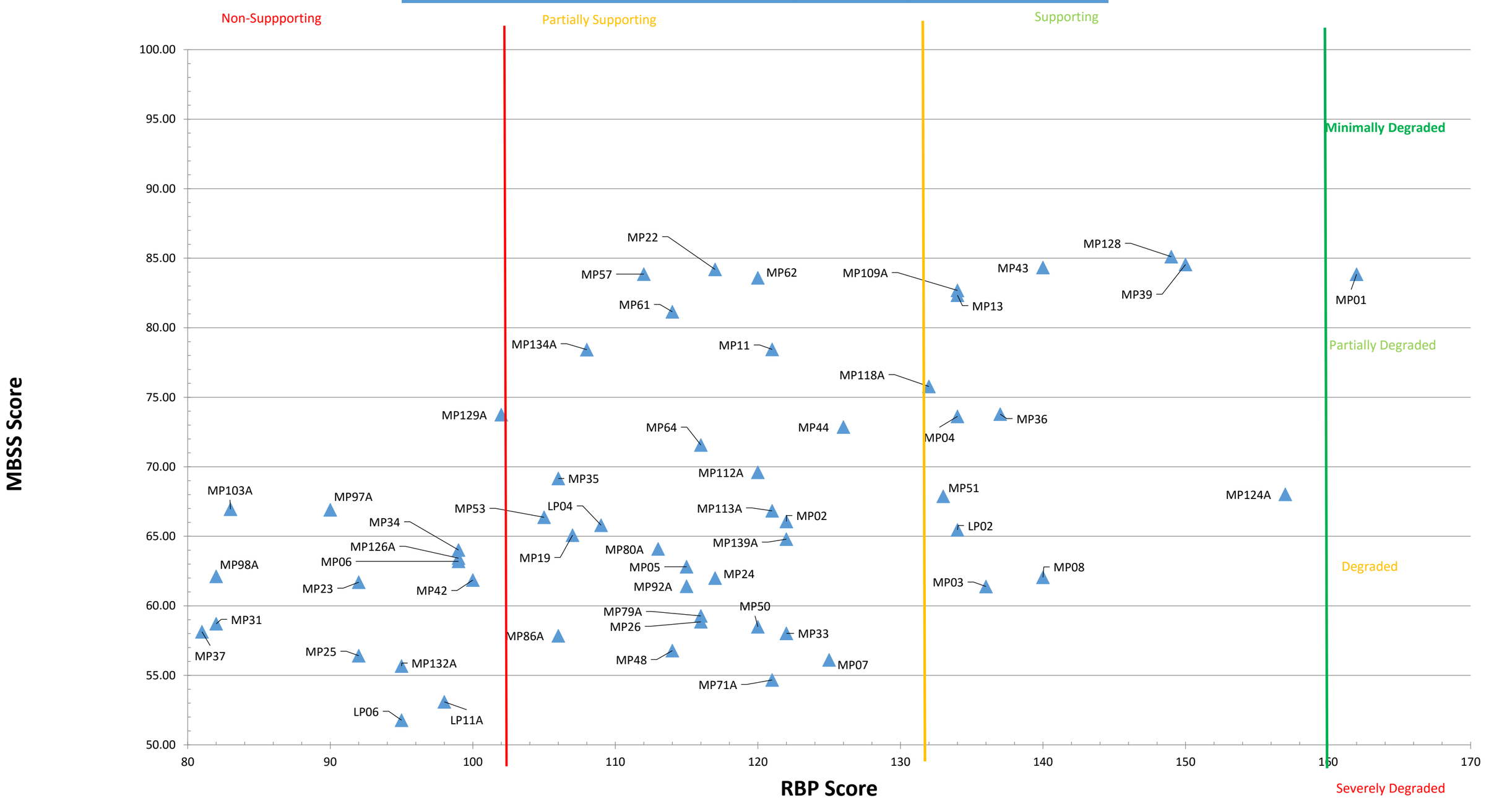
Parameters to be evaluated broader than sampling reach

Habitat Parameter	Condition Category: Optimal	Suboptimal	Marginal	Poor
6. Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr) may be present, but recent channelization is not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.
SCORE 12	20 19 18 17 16	15 14 13 (12) 11	10 9 8 7 6	5 4 3 2 1 0
7. Channel Sinuosity	The bends in the stream increase the stream length 3 to 4 times longer than if it was in a straight line. (Note - channel braiding is considered normal in coastal plains and other low-lying areas. This parameter is not easily rated in these areas.)	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	Channel straight; waterway has been channelized for a long distance.
SCORE 6	20 19 18 17 16	15 14 13 12 11	10 9 8 7 (6)	5 4 3 2 1 0
8. Bank Stability (score each bank)	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.
SCORE 1 (LB)	Left Bank 10 9	8 7 6	5 4 3	2 (1) 0
SCORE 1 (RB)	Right Bank 10 9	8 7 6	5 4 3	2 (1) 0
9. Vegetative Protection (score each bank) Note: determine left or right side by facing downstream.	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
SCORE 3 (LB)	Left Bank 10 9	8 7 6	5 4 (3)	2 1 0
SCORE 3 (RB)	Right Bank 10 9	8 7 6	5 4 (3)	2 1 0
10. Riparian Vegetative Zone Width (score each bank riparian zone)	Width of riparian zone >18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone.	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6-12 meters; human activities have impacted zone a great deal.	Width of riparian zone <6 meters: little or no riparian vegetation due to human activities.
SCORE 6 (LB)	Left Bank 10 9	8 7 (6)	5 4 3	2 1 0
SCORE 9 (RB)	Right Bank 10 (9)	8 7 6	5 4 3	2 1 0

Total Score 82

APPENDIX C –
RBP & PHI DIRECT COMPARISON GRAPH

Middle and Lower Patuxent Watershed Sites - 2016 Spring Habitat Index
RBP & PHI Direct Comparison Graph



APPENDIX D –
RBP ASSESSMENT TABLE

APPENDIX D

Contract Name: AA County Middle and Lower Patuxent Watersheds Biological Monitoring Open End Agreement #8551
Project Name: Middle and Lower Patuxent Watersheds - Spring 2016 Bioassessment
Project Number: 111075.28
Data Entered by: CLR
Data QC by: ETW

Site ID	Longitude	Latitude	Description	Drainage Area (acres)	Date	Completed by	Epifaunal Substrate/Available Cover	Pool Substrate Characterization	Pool Variability	Sediment Deposition	Channel Flow Status	Channel Alteration	Channel Sinuosity	Bank Stability - Left Bank	Bank Stability - Right Bank	Vegetative Protection - Left Bank	Vegetative Protection - Right Bank	Riparian Vegetative Zone Width - Left Bank	Riparian Vegetative Zone Width - Right Bank	Total	Percent[1]	Rating
LP02	-76.6210032487	38.7358258783	Hall Creek 1	1474.49	3/29/2016	KB & JT	13	15	10	14	18	19	11	5	5	4	4	9	7	134	79.76	Supporting
LP04	-76.5852373915	38.7313517257	Hall Creek 2	937.85	3/29/2016	KB & JT	12	12	2	6	11	17	11	4	4	5	5	10	10	109	64.88	Partially Supporting
LP06	-76.6090045764	38.7245846469	Hall Creek 3	810.82	4/19/2016	KB & JT	7	8	7	2	8	19	7	6	6	5	5	5	10	95	56.55	Non-Supporting
LP09A	-76.6132786263	38.7403841145	Hall Creek 1	1474.49	4/19/2016	KB & JT	5	11	5	5	11	18	10	6	6	4	4	9	9	103	61.31	Partially Supporting
LP11A	-76.6000008110	38.7292581471	Hall Creek 3	810.82	4/22/2016	KB & JT	8	8	8	8	10	18	13	2	2	2	2	9	8	98	58.33	Non-Supporting
MP01	-76.6752930853	38.8726662756	Unnamed Tributary 2	781.43	4/4/2016	JS & JT	15	16	16	16	15	18	17	9	8	6	6	10	10	162	96.43	Comparable to Ref.
MP02	-76.6607555390	38.8736513178	Unnamed Tributary 2	781.43	4/6/2016	EW & CR	12	10	7	11	8	20	16	6	5	8	8	4	7	122	72.62	Partially Supporting
MP03	-76.6856112182	38.8540283870	Rock Branch 1	916.05	4/19/2016	KB & JT	15	16	16	15	14	17	11	5	5	4	4	9	5	136	80.95	Supporting
MP04	-76.6693015459	38.8596894564	Rock Branch 1	916.05	4/4/2016	JT & JS	13	13	10	10	10	20	17	7	4	8	8	4	10	134	79.76	Supporting
MP05	-76.6574360092	38.8675974083	Unnamed Tributary 3	1060.12	4/15/2016	CR & JT	7	11	10	13	7	20	7	4	4	6	6	10	10	115	68.45	Partially Supporting
MP06	-76.6302148023	38.8664992988	Unnamed Tributary 3	1060.12	3/30/2016	KB & JT	8	11	5	6	12	19	11	4	4	2	2	6	9	99	58.93	Non-Supporting
MP07	-76.6653062384	38.8532468188	Rock Branch 2	1315.48	4/4/2016	JS & JT	15	10	11	10	16	16	9	8	7	8	8	5	2	125	74.40	Partially Supporting
MP08	-76.6414362404	38.8489458607	Rock Branch 2	1315.48	4/6/2016	EW & CR	10	12	12	15	15	20	15	7	6	7	5	9	7	140	83.33	Supporting
MP09	-76.6300955872	38.8475566514	Rock Branch 3	1664.90	4/6/2016	KB & JT	7	7	6	8	16	16	7	4	4	2	2	10	5	94	55.95	Non-Supporting
MP103A	-76.6880027000	38.7922534000	Two Run Branch 1	732.35	4/25/2016	JCR/JP	14	8	7	6	8	15	6	1	1	3	3	8	3	83	49.40	Not Supporting
MP109A	-76.6499147472	38.7937694993	Cabin Branch 5	547.47	4/19/2016	JS & DV	13	16	8	13	11	19	7	5	6	8	8	10	10	134	79.76	Supporting
MP11	-76.6910585640	38.8416271177	Ferry Branch 1	919.52	3/31/2016	KB & JT	10	9	16	9	8	18	11	5	5	5	5	10	10	121	72.02	Partially Supporting
MP112A	-76.6148656770	38.7988712944	Lyons Creek 1	733.60	4/14/2016	JS & CR	7	7	6	5	16	19	8	10	10	6	6	10	10	120	71.43	Partially Supporting
MP113A	-76.6177431514	38.7885766644	Lyons Creek 4	656.90	4/15/2016	JS & CR	10	9	8	9	10	18	10	5	7	9	9	9	8	121	72.02	Partially Supporting
MP117A	-76.6009251993	38.7872536637	Lyons Creek 3	777.68	3/29/2016	JS & CR	1	1	6	1	17	16	3	2	3	2	2	9	9	72	42.86	Non-Supporting
MP117A-REP	-76.6015182459	38.7884996973	Lyons Creek 3	777.68	3/29/2016	JS & CR	1	1	3	1	16	16	4	2	2	2	2	9	9	68	40.48	Non-Supporting
MP118A	-76.6002589174	38.7797293042	Lyons Creek 3	777.68	4/15/2016	JS & JA	12	10	13	9	16	18	8	6	6	9	8	9	8	132	78.57	Supporting
MP119A	-76.5979925418	38.7607286055	Lyons Creek 7	396.09	4/18/2016	JS & CR	3	3	3	3	11	20	11	5	5	4	4	10	10	92	54.76	Non-Supporting
MP121A	-76.6195504531	38.7654773946	Lyons Creek 8	315.02	4/18/2016	JS & CR	4	4	4	5	6	20	6	2	2	3	3	10	10	79	47.02	Non-Supporting
MP124A	-76.6124565267	38.7679217483	Lyons Creek 2	388.41	4/20/2016	EW & CR	13	15	16	16	18	20	9	8	8	7	7	10	10	157	93.45	Comparable to Ref.
MP126A	-76.6336469872	38.7836962551	Lyons Creek 10	1078.58	4/15/2016	CR & JT	8	12	8	9	8	19	7	4	6	4	4	6	6	99	58.93	Non-Supporting
MP128A	-76.6526570000	38.7798720000	Cabin Branch 2	645.36	3/31/2016	EW & DV	14	13	15	12	14	19	12	5	7	9	9	10	10	149	88.69	Supporting
MP129A	-76.6483818000	38.7746081000	Cabin Branch 2	645.36	4/21/2016	MWT/JP	8	6	5	5	13	19	12	7	7	1	1	9	9	102	60.71	Partially Supporting
MP13	-76.6790416445	38.8320349065	Wilson Owens Branch 3	707.66	3/31/2016	KB & JT	15	16	13	12	13	18	11	4	4	5	3	10	10	134	79.76	Supporting
MP132A	-76.6560683000	38.7647921000	Cabin Branch 1	902.12	4/21/2016	MWT/JP	1	6	7	4	17	18	1	8	8	2	3	10	10	95	56.55	Not Supporting
MP134A	-76.6662257000	38.7851949000	Deep Creek	964.91	4/14/2016	GZ/JCR	11	7	6	9	9	15	14	5	6	5	7	5	9	108	64.29	Partially Supporting
MP139A	-76.6879070000	38.8214737000	Wilson Owens Branch	1167.83	4/13/2016	MKT/MWT	9	8	11	8	13	18	9	8	5	7	6	10	10	122	72.62	Partially Supporting
MP139A-REP	-76.6879070000	38.8214737000	Wilson Owens Branch	1167.83	4/13/2016	MKT/MWT	9	8	11	8	13	18	9	8	5	7	6	10	10	122	72.62	Partially Supporting
MP15	-76.6637483727	38.8291373462	Ferry Branch 2	1072.47	3/25/2016	KB & CR	2	9	16	6	7	18	11	2	2	2	2	9	7	93	55.36	Non-Supporting
MP16	-76.6448853467	38.8227748589	Ferry Branch 2	1072.47	4/11/2016	JS & KB	8	8	8	6	10	16	10	6	6	5	5	9	9	106	63.10	Partially Supporting
MP16-REP	-76.6441791874	38.8223774124	Ferry Branch 2	1072.47	4/11/2016	JS & KB	6	7	7	7	10	17	17	7	6	7	6	9	7	113	67.26	Partially Supporting
MP19	-76.6958574000	38.8143952000	Wilson Owens Branch 3	1167.83	4/13/2016	MKT/MWT	11	9	4	3	9	18	6	8	7	6	6	10	10	107	63.69	Partially Supporting
MP22	-76.6672743000	38.8126660000	Wilson Owens Branch 2	645.31	4/14/2016	GZ/JCR	13	8	5	12	13	15	14	7	3	6	4	9	8	117	69.64	Partially Supporting
MP23	-76.6518280182	38.8131951811	Wilson Owens Branch 1	527.27	4/14/2016	KB & JA	8	11	5	5	8	18	11	5	5	2	2	5	7	92	54.76	Non-Supporting
MP24	-76.6401237243	38.8138783419	Wilson Owens Branch 1	527.27	3/30/2016	KB & JT	8	8	7	7	10	20	11	6	6	7	7	10	10	117	69.64	Partially Supporting
MP25	-76.6237856431	38.8103464073	Lyons Creek 5	1064.64	4/22/2016	KB & JT	4	7	3	12	9	17	7	4	4	5	5	9	6	92	54.76	Non-Supporting
MP26	-76.6178211389	38.8183585170	Lyons Creek 5	1064.64	4/14/2016	JS & CR	8	8	6	7	11	20	8	6	6	9	9	9	9	116	69.05	Partially Supporting
MP31	-76.6426054690	38.7992428540	Cabin Branch 4	827.29	4/4/2016	KB & CR	5	6	4	6	7	18	6	3	3	3	3	9	9	82	48.81	Not Supporting
MP31-REP	-76.6414549416	38.7999815319	Cabin Branch 4	827.29	4/4/2016	KB & CR	5	6	3	6	7	18	7	5	3	4	3	3	9	79	47.02	Non-Supporting
MP33	-76.7003565000	38.8084556000	Galloway Creek	1309.87	3/25/2016	MKT/MWT	8	12	7	7	16	18	8	6	6	8	8	10	8	122	72.62	Partially Supporting
MP34	-76.6766793000	38.8013447000	Galloway Creek	1309.87	3/31/2016	JP/GZ	8	10	3	7	16	16	7	4	4	2	2	10	10	99	58.93	Partially Supporting
MP35	-76.6961104000	38.7950552000	Two Run Branch 2	814.30	3/31/2016	JP/GZ	10	9	3	7	12	18	12	3	7	1	4	10	10	106	63.10	Partially Supporting
MP36	-76.7034360000	38.7953443000	Two Run Branch 2	814.30	3/31/2016	JP/GZ	9	9	5	7	16	19	16	9	9	9	9	10	10	137	81.55	Supporting
MP37	-76.6593869901	38.7989851083	Cabin Branch 3	488.08	4/4/2016	KB & CR	5	8	8	8	10	6	11	2	2	2	2	8	9	81	48.21	Non-Supporting
MP38	-76.6593496000	38.7900549000	Cabin Branch 3	488.08	4/25/2016	JCR/JP	4	7	4	4	8	18	6	4	4	4	4	10	10	87	51.79	Not Supporting
MP39	-76.6510020000	38.7850080000	Cabin Branch 5	547.47	3/31/2016	EW & DV	15	16	10	9	13	19	16	5	7	10	10	10	10	150	89.29	Supporting
MP39-REP	-76.6508080000	38.7840080000	Cabin Branch 5	547.47	3/31/2016	EW & DV	15	14	10	12	13	19	17	4	5	10	10	10	10	149	88.69	Supporting
MP42	-76.6201369125	38.7803678166	Lyons Creek 4	656.90	4/11/2016	CR & JT	10	11	11	11	9	20	6	6	6	4	4	1	1	100	59.52	Partially Supporting
MP43	-76.6196545046	38.7694249523	Lyons Creek 9	357.05	4/19/2016	JS & DV	12	16	9	13	12	18	13	7	7	6	7	10	10	140	83.33	Supporting
MP44	-76.6102020286	38.7770370282	Lyons Creek 9	357.05	4/11/2016	CR & JT	11	10	8	13	8	20	16	5	5	5	5	10	10	126	75.00	Supporting
MP48	-76.5984305738	38.7594666261	Lyons Creek 7	396.09	4/20/2016	EW & CR	8	7	2	6	16	15	17	7	7	6	7	7	9	114	67.86	Partially Supporting
MP50	-76.6106733940	38.7609378941	Lyons Creek 8	315.02	4/18/2016	JS & CR	7	7	7	14	7	20	11	6	8	6	9	9	9	120	71.43	Partially Supporting
MP51	-76.6179662845	38.7672193481	Lyons Creek 2	388.41	4/20/2016	EW & CR	11	13	9	6	14	19	12	7	8	6	8	10	10	133	79.17	Supporting
MP53	-76.6383941554	38.7689890836	Lyons Creek 10	1078.58	4/16/2016	CR & JT	7	8	7	9	8	19	7	4	6	5	5	10	10	105	62.50	Partially Supporting
MP57	-76.6645116000	38.7654610000	Cabin Branch 1	902.12	4/21/2016	MWT/JP	13	7	6	7	14	19	14	3	3	3	3	10	10	112	66.67	Partially Supporting
MP60	-76.6697537000	38.7794964000	Deep Creek	964.91	4/6/2016	MWT/JCR	4	8	7	4	7	7	3	4	4	8	8	10	10	84	50.00	Not Supporting
MP61	-76.6912386000	38.7751811000	Pindell Branch	648.26	3/25/2016	MKT/MWT	11	7	4	7	8	20	8	7	8	7	7	10	10	114	67.86	Partially Supporting
MP62	-76.6891356000	38.7795740000	Pindell Branch	648.26	3/25/2016	MKT/MWT	14	14	4	9	11	18	8	7	7	4	4	10	10	120	71.43	Partially Supporting
MP64	-76.7005768000	38.7823277000	Two Run Branch 1	732.35	4/6/2016	MWT/JCR	3	12	4	7	7	19	14	10	10	5	5	10	10	116	69.05	Partially Supporting
MP64-REP	-76.7005768000	38.7823277000	Two Run Branch 1	732.35	4/6/2016	MWT/JCR	3	12	4	7	7	19	14	10	10	5	5	10	10	116	69.05	Partially Supporting
MP71	-76.6211975611	38.8448078844	Rock Branch 3	1664.90	4/6/2016	KB & JT	9	10	8	8	10	18	12	6	6	7	7	10	10	121	72.02	Partially Supporting
MP71A-REP	-76.6195229685	38.8446866010	Rock Branch 3	1664.90	4/6/2016	KB & JT	8	8	8	8	13	18	11	2	4	2	4	7	9	102	60.71	Partially Supporting
MP79A	-76.6679218012	38.8417570504	Ferry Branch 1	919.52	4/22/2016	KB & JT	14	16	10	10	9	17	14	2	2	2	2	9	9	116	69.05	Partially Supporting
MP80A	-76.6739095000	38.8279864000	Wilson Owens Branch 3	707.66	4/13/2016	MKT/MWT	11	8	4	10	8	18	9	5	7	7	7	10	9	113	67.26	Partially Supporting
MP86A	-76.6234728766	38.8308363056	Ferry Branch 3	857.43	4/14/2016	JS & JA	8	11	5	8	13	18	13	5	5	2	2	7	9	106	63.10	Partially Supporting
MP88A	-76.6343984107	38.8388054800	Ferry Branch 3	857.43	4/15/2016	JS & JA	5	6	4	4	6	5	4	1	1	3	6	1	5	51	30.36	Non-Supporting
MP92A	-76.5975985768	38.8070898821	Lyons Creek 6	465.91	4/14/2016	JS & CR	8	6	6	10	11	20	16	5	5	5	5	9	9	115	68.45	Partially Supporting
MP97A	-76.6403920000	38.8041042000	Cabin Branch 4	827.29	4/25/2016	JCR/JP	12	6	4	6	6	18	7	6	4	2	1	10	8	90	53.57	Not Supporting
MP98A	-76.6580006000	38.8157613000	Wilson Owens Branch 2	645.31	4/14/2016	GZ/JCR	9	7	5	6	14	12	6	1	1	3	3	6	9	82	48.81	Not Supporting

APPENDIX E –
PHI ASSESSMENT TABLE

APPENDIX E

Contract Name: AA County Middle and Lower Patuxent Watersheds Biological Monitoring Open End Agreement #8551
Project Name: Middle and Lower Patuxent Watersheds - Spring 2016 Bioassessment
Project Number: 111075.28
Data Entered by: CLR
Data QC by: ETW

							RAW DATA									
Site ID	**Longitude**	**Latitude**	**Site Name**	**Drainage Area (acres)**	**Date**	**Completed by**	**Instream Habitat**	**Epifaunal Substrate**	**Velocity/Depth Diversity**	**Pool/ Glide/Eddy Quality**	**Bank Stability**	**Embeddedness (%)**	**Shading (%)**	**Remoteness Score**	**Aesthetic Rating (Trash)**	**# Woody Debris & Rootwads**
LP02	-76.6210032487	38.7358258783	Hall Creek 1	1474.49	3/29/2016	KB & JT	10	5	10	10	10	60	75	15	16	10
LP04	-76.5852373915	38.7313517257	Hall Creek 2	937.85	3/29/2016	KB & JT	10	3	11	6	8	80	20	18	18	25
LP06	-76.6090045764	38.7245846469	Hall Creek 3	810.82	4/19/2016	KB & JT	7	2	7	7	8	90	75	6	13	7
LP09A	-76.6132786263	38.7403841145	Hall Creek 1	1474.49	4/19/2016	KB & JT	5	3	5	6	12	80	40	9	8	6
LP11A	-76.6000008110	38.7292581471	Hall Creek 3	810.82	4/22/2016	KB & JT	8	3	8	8	4	75	75	11	11	3
MP01	-76.6752930853	38.8726662756	Unnamed Tributary 2	781.43	4/4/2016	JS & JT	15	15	18	16	17	75	80	14	15	5
MP02	-76.6607555390	38.8736513178	Unnamed Tributary 2	781.43	4/6/2016	EW & CR	11	12	6	6	11	60	80	6	18	3
MP03	-76.6856112182	38.8540283870	Rock Branch 1	916.05	4/19/2016	KB & JT	13	13	16	15	10	45	50	5	10	2
MP04	-76.6693015459	38.8596894564	Rock Branch 1	916.05	4/4/2016	JT & JS	11	11	7	16	8	60	90	16	17	3
MP05	-76.6574360092	38.8675974083	Unnamed Tributary 3	1060.12	4/15/2016	CR & JT	7	7	11	8	10	30	50	20	19	2
MP06	-76.6302148023	38.8664992988	Unnamed Tributary 3	1060.12	3/30/2016	KB & JT	9	5	8	7	10	75	80	13	15	6
MP07	-76.6653062384	38.8532468188	Rock Branch 2	1315.48	4/4/2016	JS & JT	10	10	15	15	14	60	35	8	16	1
MP08	-76.6414362404	38.8489458607	Rock Branch 2	1315.48	4/6/2016	EW & CR	11	10	13	12	2	60	80	11	18	9
MP09	-76.6300955872	38.8475566514	Rock Branch 3	1664.90	4/6/2016	KB & JT	6	5	7	6	6	75	75	2	11	1
MP103A	-76.6880027000	38.7922534000	Two Run Branch 1	732.35	4/25/2016	JCR/JP	14	14	8	13	2	80	85	6	4	7
MP109A	-76.6499147472	38.7937694993	Cabin Branch 5	547.47	4/19/2016	JS & DV	14	13	12	10	11	70	65	18	17	9
MP11	-76.6910585640	38.8416271177	Ferry Branch 1	919.52	3/31/2016	KB & JT	15	5	15	14	12	75	90	20	11	5
MP112A	-76.6148656370	38.7988712944	Lyons Creek 1	733.60	4/14/2016	JS & CR	7	5	6	5	18	75	60	20	17	5
MP113A	-76.6177431514	38.7885766644	Lyons Creek 4	656.90	4/15/2016	JS & CR	7	12	9	10	12	60	80	10	16	2
MP117A	-76.6009251993	38.7872536637	Lyons Creek 3	777.68	3/29/2016	JS & CR	4	1	3	6	5	95	60	13	16	5
MP117A-REP	-76.6015182459	38.7884996973	Lyons Creek 3	777.68	3/29/2016	JS & CR	2	2	4	6	6	95	50	15	19	5
MP118A	-76.6002589174	38.7797293042	Lyons Creek 3	777.68	4/15/2016	JS & JA	16	12	10	16	12	80	60	7	16	17
MP119A	-76.5979925418	38.7607286055	Lyons Creek 7	396.09	4/18/2016	JS & CR	2	3	3	3	8	70	80	6	16	1
MP121A	-76.6195504531	38.7654773946	Lyons Creek 8	315.02	4/18/2016	JS & CR	4	4	4	4	4	60	60	5	18	1
MP124A	-76.6124565267	38.7679217483	Lyons Creek 2	388.41	4/20/2016	EW & CR	15	13	16	16	16	70	0	11	19	10
MP126A	-76.6336469872	38.7836962551	Lyons Creek 10	1078.58	4/15/2016	CR & JT	11	11	8	8	10	50	75	8	5	2
MP128A	-76.6526570000	38.7798720000	Cabin Branch 2	645.36	3/31/2016	EW & DV	13	12	16	10	15	70	80	18	18	10
MP129A	-76.6483818000	38.7746081000	Cabin Branch 2	645.36	4/21/2016	MWT/JP	8	5	7	5	14	25	80	12	17	22
MP13	-76.6790416445	38.8320349065	Wilson Owens Branch 3	707.66	3/31/2016	KB & JT	16	11	12	10	20	40	85	12	14	6
MP132A	-76.6560683000	38.7647921000	Cabin Branch 1	902.12	4/21/2016	MWT/JP	1	1	11	11	16	100	90	5	17	16
MP134A	-76.6662257000	38.7851949000	Deep Creek	964.91	4/14/2016	GZ/JCR	11	10	11	10	11	50	70	20	13	12
MP139A	-76.6879070000	38.8214737000	Wilson Owens Branch	1167.83	4/13/2016	MKT/MWT	9	3	13	15	13	100	75	10	18	18
MP139A-REP	-76.6879070000	38.8214737000	Wilson Owens Branch	1167.83	4/13/2016	MWT/KT	9	3	13	15	13	100	75	10	18	18
MP15	-76.6637483727	38.8291373462	Ferry Branch 2	1072.47	3/25/2016	KB & CR	5	3	7	16	3	90	60	8	15	9
MP16	-76.6448853467	38.8227748589	Ferry Branch 2	1072.47	4/11/2016	JS & KB	8	3	6	6	10	70	75	5	15	0
MP16-REP	-76.6441791874	38.8223774124	Ferry Branch 2	1072.47	4/11/2016	JS & KB	7	3	6	5	12	85	80	5	15	1
MP19	-76.6958574000	38.8143952000	Wilson Owens Branch 3	1167.83	4/13/2016	MKT/MWT	11	3	11	4	15	90	90	6	3	14
MP22	-76.6672743000	38.8126660000	Wilson Owens Branch 2	645.31	4/14/2016	GZ/JCR	14	12	12	9	10	25	80	20	17	8
MP23	-76.6518280182	38.8131951811	Wilson Owens Branch 1	527.27	4/14/2016	KB & JA	10	5	6	8	8	80	60	15	11	0
MP24	-76.6401237243	38.8138783419	Wilson Owens Branch 1	527.27	3/30/2016	KB & JT	6	3	6	3	8	75	80	13	14	9
MP25	-76.6237856431	38.8103464073	Lyons Creek 5	1064.64	4/22/2016	KB & JT	2	2	6	2	10	90	75	18	4	4
MP26	-76.6178211389	38.8183585170	Lyons Creek 5	1064.64	4/14/2016	JS & CR	10	8	8	6	10	70	75	6	6	4
MP31	-76.6426054696	38.7992428540	Cabin Branch 4	827.29	4/4/2016	KB & CR	6	5	5	4	6	50	75	11	17	11
MP31-REP	-76.6414549416	38.7999815319	Cabin Branch 4	827.29	4/4/2016	KB & CR	6	5	5	4	6	50	75	6	17	6
MP33	-76.7003565000	38.8084556000	Galloway Creek	1309.87	3/25/2016	MKT/MWT	8	11	11	8	12	100	60	2	11	12
MP34	-76.6766793000	38.8013447000	Galloway Creek	1309.87	3/31/2016	JP/GZ	7	8	8	6	14	30	70	15	0	3
MP35	-76.6961104000	38.7950552000	Two Run Branch 2	814.30	3/31/2016	JP/GZ	11	10	12	11	8	50	80	10	10	10
MP36	-76.7034369000	38.7953443000	Two Run Branch 2	814.30	3/31/2016	JP/GZ	12	9	10	8	18	40	70	14	16	5
MP37	-76.6593869901	38.7989851083	Cabin Branch 3	488.08	4/4/2016	KB & CR	5	5	5	5	4	60	75	16	15	1
MP38	-76.6593496000	38.7900549000	Cabin Branch 3	488.08	4/25/2016	JCR/JP	4	4	13	4	8	80	70	7	19	0
MP39	-76.6510020000	38.7850080000	Cabin Branch 5	547.47	3/31/2016	EW & DV	15	12	13	15	12	80	90	16	15	6
MP39-REP	-76.6508080000	38.7840080000	Cabin Branch 5	547.47	3/31/2016	EW & DV	15	14	16	16	9	80	85	6	17	8
MP42	-76.6201369125	38.7803678166	Lyons Creek 4	656.90	4/11/2016	CR & JT	11	10	12	11	10	60	80	1	16	7
MP43	-76.6196545046	38.7694249523	Lyons Creek 9	357.05	4/19/2016	JS & DV	12	13	13	10	14	80	85	14	15	9
MP44	-76.6102020286	38.7770370282	Lyons Creek 9	357.05	4/11/2016	CR & JT	11	11	10	10	10	50	75	10	16	7
MP48	-76.5984305738	38.7594666261	Lyons Creek 7	396.09	4/20/2016	EW & CR	6	5	6	5	12	90	80	2	6	7
MP50	-76.6106733940	38.7609378941	Lyons Creek 8	315.02	4/18/2016	JS & CR	7	7	7	7	12	40	70	2	14	6
MP51	-76.6179662845	38.7672193481	Lyons Creek 2	388.41	4/20/2016	EW & CR	13	11	9	9	15	80	20	9	18	8
MP53	-76.6383941554	38.7689890836	Lyons Creek 10	1078.58	4/16/2016	CR & JT	6	5	6	7	12	75	75	20	15	5
MP57	-76.6645116000	38.7654610000	Cabin Branch 1	902.12	4/21/2016	MWT/JP	13	13	7	11	6	100	90	6	5	37
MP60	-76.6697537000	38.7794964000	Deep Creek	964.91	4/6/2016	MWT/JCR	4	4	6	6	5	25	80	3	17	6
MP61	-76.6912386000	38.7751811000	Pindell Branch	648.26	3/25/2016	MKT/MWT	11	11	12	7	15	70	90	10	18	18
MP62	-76.6891356000	38.7795740000	Pindell Branch	648.26	3/25/2016	MKT/MWT	14	14	10	7	14	70	100	6	17	10
MP64	-76.7005768000	38.7823277000	Two Run Branch 1	732.35	4/6/2016	MWT/JCR	10	3	7	7	20	25	60	17	17	11
MP64-REP	-76.7005768000	38.7823277000	Two Run Branch 1	732.35	4/4/2016	MWT/JCR	10	3	7	7	20	25	60	17	17	11
MP71A	-76.6211975611	38.8448078844	Rock Branch 3	1664.90	4/6/2016	KB & JT	7	5	6	6	10	50	75	10	12	4
MP71A-REP	-76.6195229685	38.8446866010	Rock Branch 3	1664.90	4/6/2016	KB & JT	9	5	11	7	6	75	75	16	13	5
MP79A	-76.6679218012	38.8417570504	Ferry Branch 1	919.52	4/22/2016	KB & JT	11	13	13	10	2	50	80	5	10	5
MP80A	-76.6739095000	38.8279864000	Wilson Owens Branch 3	707.66	4/13/2016	MKT/MWT	11	6	12	7	12	90	80	2	13	16
MP86A	-76.6234728766	38.8308363056	Ferry Branch 3	857.43	4/14/2016	JS & JA	11	5	6	7	8	75	80	8	14	1
MP88A	-76.6343984107	38.8388054800	Ferry Branch 3	857.43	4/15/2016	JS & JA	4	5	5	4	4	40	50	3	8	7
MP92A	-76.5975985768	38.8070898821	Lyons Creek 6	465.91	4/14/2016	JS & CR	11	8	6	6	8	60	80	5	15	2
MP97A	-76.6403920000	38.8041042000	Cabin Branch 4	827.29	4/25/2016	JCR/JP	12	12	10	10	10	70	65	8	12	6
MP98A	-76.6580006000	38.8157613000	Wilson Owens Branch 2	645.31	4/14/2016	GZ/JCR	10	8	11	8	2	40	80	10	17	10

APPENDIX E

Contract Name: AA County Middle and Lower Patuxent Watersheds Biological Monitoring Open End Agreement #8551
Project Name: Middle and Lower Patuxent Watersheds - Spring 2016 Bioassessment
Project Number: 111075.28
Data Entered by: CLR
Data QC by:

	PREPARED METRICS					SCALED METRICS							
Site ID	**Instream Habitat**	**Epifaunal Substrate**	**Bank Stability**	**Shading**	**Remoteness**	**# Woody Debris & Rootwads**	**Instream Habitat**	**Epifaunal Substrate**	**Bank Stability**	**Shading**	**Remoteness**	**# Woody Debris & Rootwads**	**PHI**	**Rating**
LP02	-4.01	-6.71	3.16	1.05	15.00	-5.68	61.50	37.73	70.71	73.32	80.78	68.69	65.46	Degraded
LP04	-3.17	-8.20	2.83	0.46	18.00	11.05	66.13	29.06	63.25	21.22	96.93	118.19	65.80	Degraded
LP06	-5.91	-9.03	2.83	1.05	6.00	-6.39	50.98	24.19	63.25	73.32	32.31	66.59	51.77	Degraded
LP09A	-9.01	-8.71	3.46	0.68	9.00	-9.68	33.76	26.11	77.46	40.96	48.47	56.86	47.27	Severely Degraded
LP11A	-4.91	-8.03	2.00	1.05	11.00	-10.39	56.53	30.00	44.72	73.32	59.24	54.76	53.09	Degraded
MP01	2.16	4.01	4.12	1.11	14.00	-8.25	95.74	99.96	92.20	78.67	75.39	61.09	83.84	Minimally Degraded
MP02	-1.84	1.01	3.32	1.11	6.00	-10.25	73.55	82.53	74.16	78.67	32.31	55.18	66.07	Partially Degraded
MP03	-0.13	1.83	3.16	0.79	5.00	-11.86	83.02	87.30	70.71	49.95	26.93	50.42	61.39	Degraded
MP04	-2.13	-0.17	2.83	1.25	16.00	-10.86	71.92	75.69	63.25	91.34	86.16	53.38	73.62	Partially Degraded
MP05	-6.40	-4.34	3.16	0.79	20.00	-12.42	48.23	51.50	70.71	49.95	107.70	48.76	62.81	Degraded
MP06	-4.40	-6.34	3.16	1.11	13.00	-8.42	59.33	39.88	70.71	78.67	70.01	60.60	63.20	Degraded
MP07	-3.80	-1.58	3.74	0.63	8.00	-14.25	62.67	67.52	83.67	36.34	43.08	43.36	56.11	Degraded
MP08	-2.80	-1.58	1.41	1.11	11.00	-6.25	68.22	67.52	31.62	78.67	59.24	67.03	62.05	Degraded
MP09	-8.23	-6.84	2.45	1.05	2.00	-15.15	38.07	36.94	54.77	73.32	10.77	40.69	42.43	Severely Degraded
MP103A	1.28	3.08	1.41	1.17	6.00	-6.00	90.86	94.57	31.62	84.56	32.31	67.74	66.95	Partially Degraded
MP109A	1.82	2.41	3.32	0.94	18.00	-2.89	93.84	90.66	74.16	63.55	96.93	76.95	82.68	Minimally Degraded
MP11	1.86	-6.18	3.46	1.25	20.00	-8.87	94.08	40.80	77.46	91.34	107.70	59.25	78.44	Partially Degraded
MP112A	-5.72	-5.92	4.24	0.89	20.00	-8.01	52.00	42.28	94.87	58.94	107.70	61.81	69.60	Partially Degraded
MP113A	-5.52	1.20	3.46	1.11	10.00	-10.59	53.13	83.66	77.46	78.67	53.85	54.18	66.83	Partially Degraded
MP117A	-8.83	-9.99	2.24	0.89	13.00	-8.23	34.76	18.66	50.00	58.94	70.01	61.15	48.92	Severely Degraded
MP117A-REP	-10.83	-8.99	2.45	0.79	15.00	-8.23	23.66	24.47	54.77	49.95	80.78	61.15	49.13	Severely Degraded
MP118A	3.17	1.01	3.46	0.89	7.00	3.77	101.34	82.56	77.46	58.94	37.70	96.65	75.77	Partially Degraded
MP119A	-9.58	-7.23	2.83	1.11	6.00	-9.65	30.57	34.67	63.25	78.67	32.31	56.95	49.40	Severely Degraded
MP121A	-7.16	-5.97	2.00	0.89	5.00	-8.78	44.01	41.97	44.72	58.94	26.93	59.54	46.02	Severely Degraded
MP124A	3.45	2.79	4.00	0.00	11.00	-0.58	102.90	92.89	89.45	-20.18	59.24	83.80	68.02	Partially Degraded
MP126A	-2.43	-0.35	3.16	1.05	8.00	-12.49	70.25	74.62	70.71	73.32	43.08	48.57	63.43	Degraded
MP128A	0.51	1.22	3.87	1.11	18.00	-2.52	86.61	83.78	86.61	78.67	96.93	78.05	85.11	Minimally Degraded
MP129A	-4.49	-5.78	3.74	1.11	12.00	9.48	58.86	43.11	83.67	78.67	64.62	113.55	73.75	Partially Degraded
MP13	3.34	0.12	4.47	1.17	12.00	-6.87	102.31	77.37	100.00	84.56	64.62	65.17	82.34	Minimally Degraded
MP132A	-12.10	-10.15	4.00	1.25	5.00	2.20	16.60	17.69	89.45	91.34	26.93	92.01	55.67	Degraded
MP134A	-2.23	-1.23	3.32	0.99	20.00	-2.06	71.39	69.54	74.16	68.32	107.70	79.41	78.42	Partially Degraded
MP139A	-4.58	-8.44	3.61	1.05	10.00	3.21	58.34	27.63	80.63	73.32	53.85	95.00	64.79	Degraded
MP139A-REP	-4.58	-8.44	3.61	1.05	10.00	3.21	58.34	27.63	80.63	73.32	53.85	95.00	64.79	Degraded
MP15	-8.42	-8.35	1.73	0.89	8.00	-5.46	37.02	28.18	38.73	58.94	43.08	69.34	45.88	Severely Degraded
MP16	-5.42	-8.35	3.16	1.05	5.00	-14.46	53.66	28.18	70.71	73.32	26.93	42.72	49.25	Severely Degraded
MP16-REP	-6.42	-8.35	3.46	1.11	5.00	-13.46	48.12	28.18	77.46	78.67	26.93	45.67	50.84	Severely Degraded
MP19	-2.58	-8.44	3.87	1.25	6.00	-0.79	69.44	27.63	86.61	91.34	32.31	83.17	65.08	Degraded
MP22	1.52	1.22	3.16	1.11	20.00	-4.52	92.15	83.78	70.71	78.67	107.70	72.13	84.19	Minimally Degraded
MP23	-2.11	-5.55	2.83	0.89	15.00	-11.75	72.03	44.43	63.25	58.94	80.78	50.75	61.69	Degraded
MP24	-6.11	-7.55	2.83	1.11	13.00	-2.75	49.83	32.81	63.25	78.67	70.01	77.38	61.99	Degraded
MP25	-11.41	-9.34	3.16	1.05	18.00	-10.44	20.45	22.42	70.71	73.32	96.93	54.63	56.41	Degraded
MP26	-3.41	-3.34	3.16	1.05	6.00	-10.44	64.84	57.28	70.71	73.32	32.31	54.63	58.85	Degraded
MP31	-6.94	-6.06	2.45	1.05	11.00	-2.47	45.22	41.49	54.77	73.32	59.24	78.20	58.71	Severely Degraded
MP31-REP	-6.94	-6.06	2.45	1.05	6.00	-7.47	45.22	41.49	54.77	73.32	32.31	63.40	51.75	Degraded
MP33	-5.79	-0.57	3.46	0.89	2.00	-3.23	51.62	73.36	77.46	58.94	10.77	75.95	58.02	Degraded
MP34	-6.79	-3.57	3.74	0.99	15.00	-12.23	46.07	55.93	83.67	68.32	80.78	49.33	64.01	Degraded
MP35	-1.91	-1.04	2.83	1.11	10.00	-3.41	73.13	70.64	63.25	78.67	53.85	75.42	69.16	Partially Degraded
MP36	-0.91	-2.04	4.24	0.99	14.00	-8.41	78.68	64.83	94.87	68.32	75.39	60.63	73.79	Partially Degraded
MP37	-6.97	-5.47	2.00	1.05	16.00	-10.45	45.08	44.93	44.72	73.32	86.16	54.59	58.13	Degraded
MP38	-7.97	-6.47	2.83	0.99	7.00	-11.45	39.53	39.12	63.25	68.32	37.70	51.63	49.92	Severely Degraded
MP39	2.82	1.41	3.46	1.25	16.00	-5.89	99.39	84.85	77.46	91.34	86.16	68.08	84.55	Minimally Degraded
MP39-REP	2.82	3.41	3.00	1.17	6.00	-3.89	99.39	96.47	67.08	84.56	32.31	74.00	75.63	Partially Degraded
MP42	-1.52	-0.80	3.16	1.11	1.00	-5.59	75.33	72.04	70.71	78.67	5.39	68.97	61.85	Degraded
MP43	0.61	2.89	3.74	1.17	14.00	-1.25	87.12	93.44	83.67	84.56	75.39	81.79	84.33	Minimally Degraded
MP44	-0.39	0.89	3.16	1.05	10.00	-3.25	81.57	81.82	70.71	73.32	53.85	75.88	72.86	Partially Degraded
MP48	-5.58	-5.23	3.46	1.11	2.00	-3.65	52.76	46.29	77.46	78.67	10.77	74.70	56.78	Degraded
MP50	-4.16	-2.97	3.46	0.99	2.00	-3.78	60.65	59.40	77.46	68.32	10.77	74.34	58.49	Degraded
MP51	1.45	0.79	3.87	0.46	9.00	-2.58	91.80	81.28	86.61	21.22	48.47	77.88	67.87	Partially Degraded
MP53	-7.43	-6.35	3.46	1.05	20.00	-9.49	42.51	39.76	77.46	73.32	107.70	57.44	66.37	Partially Degraded
MP57	-0.10	1.85	2.45	1.25	6.00	23.20	83.18	87.40	54.77	91.34	32.31	154.13	83.86	Minimally Degraded
MP60	-9.23	-7.23	2.24	1.11	3.00	-8.06	32.55	34.68	50.00	78.67	16.16	61.66	45.62	Severely Degraded
MP61	-1.49	0.22	3.87	1.25	10.00	5.46	75.46	77.94	86.61	91.34	53.85	101.67	81.14	Partially Degraded
MP62	1.51	3.22	3.74	1.57	6.00	-2.54	92.11	95.37	83.67	120.07	32.31	78.00	83.59	Partially Degraded
MP64	-2.72	-7.92	4.47	0.89	17.00	-2.00	68.67	30.67	100.00	58.94	91.55	79.58	71.57	Partially Degraded
MP64-REP	-2.72	-7.92	4.47	0.89	17.00	-2.00	68.67	30.67	100.00	58.94	91.55	79.58	71.57	Partially Degraded
MP71A	-7.23	-6.84	3.16	1.05	10.00	-12.15	43.61	36.94	70.71	73.32	53.85	49.57	54.67	Degraded
MP71A-REP	-5.23	-6.84	2.45	1.05	16.00	-11.15	54.71	36.94	54.77	73.32	86.16	52.53	59.74	Degraded
MP79A	-2.14	1.82	1.41	1.11	5.00	-8.87	71.88	87.28	31.62	78.67	26.93	59.25	59.27	Degraded
MP80A	-1.66	-4.88	3.46	1.11	2.00	3.13	74.57	48.32	77.46	78.67	10.77	94.76	64.09	Degraded
MP86A	-2.01	-6.10	2.83	1.11	8.00	-12.61	72.60	41.26	63.25	78.67	43.08	48.21	57.84	Degraded
MP88A	-9.01	-6.10	2.00	0.79	3.00	-6.61	33.76	41.26	44.72	49.95	16.16	65.96	41.97	Severely Degraded
MP92A	-0.88	-2.41	2.83	1.11	5.00	-9.27	78.84	62.66	63.25	78.67	26.93	58.07	61.40	Degraded
MP97A	-0.94	0.94	3.16	0.94	8.00	-7.47	78.51	82.16	70.71	63.55	43.08	63.40	66.90	Partially Degraded
MP98A	-2.48	-2.78	1.41	1.11	10.00	-2.52	69.96	60.54	31.62	78.67	53.85	78.05	62.12	Degraded

APPENDIX F –
WATER QUALITY TABLE

Contract Name: AA County Middle and Lower Patuxent Watersheds Biological Monitoring Open End Agreement #8551
Project Name: Middle and Lower Patuxent Watersheds - Spring 2016 Bioassessment
Project Number: 111075.28
Data Entered by: CLR
Data QC by: ETW

Site ID	Longitude	Latitude	Stream Name	Description- Subshed	Drainage Area (acres)	Impervious Area (acres)	Impervious Percentage	Forested Cover	Forested %	Date Sampled	Completed by	Ph Average	Temperature °C Average	DO (mg/L) Average	Conductivity (uS/cm) Average	TDS (mg/L) Average	Turbidity (NTU) Average*
LP02	-76.6210032487	38.7358258783	Hall Creek	Hall Creek 1	1471.38	76.59	5.21%	620.77	42.19%	3/29/2016	KB & JT	7.26	14.10	10.96	171.87	141.05	8.85
LP04	-76.5852373915	38.7313517257	Hall Creek	Hall Creek 2	144.58	9.64	6.67%	17.68	12.23%	3/29/2016	KB & JT	6.88	10.33	10.61	139.23	125.45	16.83
LP06	-76.6090045764	38.7245846469	Hall Creek	Hall Creek 3	412.63	12.33	2.99%	156.41	37.90%	4/19/2016	KB & JT	7.42	16.67	10.30	155.03	119.82	17.73
LP09A	-76.6132786263	38.7403841145	Hall Creek	Hall Creek 1	1093.61	65.31	5.97%	422.51	38.63%	4/19/2016	KB & JT	7.20	19.07	10.12	207.83	152.32	17.87
LP11A	-76.6000008110	38.7292581471	Hall Creek	Hall Creek 3	80.53	3.72	4.62%	21.58	26.80%	4/22/2016	KB & JT	7.25	15.10	9.96	164.10	131.52	36.03
MP01	-76.6752930853	38.8726662756	Unnamed Tributary	Unnamed Tributary 2	1262.52	50.93	4.03%	528.09	41.83%	4/4/2016	JS & JT	6.19	9.29	12.28	144.33	134.00	0.33
MP02	-76.6607555390	38.8736513178	Unnamed Tributary	Unnamed Tributary 2	114.28	0.65	0.57%	53.02	46.39%	4/6/2016	EW & CR	5.86	11.22	13.94	59.00	51.67	1.57
MP03	-76.6856112182	38.8540283870	Rock Branch	Rock Branch 1	3846.78	135.04	3.51%	1600.19	41.60%	4/19/2016	KB & JT	7.46	13.70	12.26	148.43	123.07	7.80
MP04	-76.6693015459	38.8596894564	Rock Branch	Rock Branch 1	168.25	3.42	2.04%	63.42	37.69%	4/4/2016	JT & JS	6.44	11.42	10.56	82.00	71.67	0.77
MP05	-76.6574360092	38.8675974083	Unnamed Tributary	Unnamed Tributary 3	1024.36	44.10	4.30%	388.99	37.97%	4/15/2016	CR & JT	8.40	15.17	13.35	154.87	124.15	9.30
MP06	-76.6302148023	38.8664992988	Unnamed Tributary	Unnamed Tributary 3	150.66	12.73	8.45%	38.84	25.78%	3/30/2016	KB & JT	7.20	13.20	12.06	184.40	154.70	6.03
MP07	-76.6653062384	38.8532468188	Rock Branch	Rock Branch 2	2530.53	92.19	3.64%	1064.57	42.07%	4/4/2016	JS & JT	6.85	14.56	11.42	157.33	128.00	3.57
MP08	-76.6414362404	38.8489458607	Rock Branch	Rock Branch 2	115.00	6.49	5.64%	34.19	29.73%	4/6/2016	EW & CR	5.78	6.71	12.16	195.67	144.67	2.67
MP09	-76.6300955872	38.8475566514	Rock Branch	Rock Branch 3	996.01	41.84	4.20%	405.54	40.72%	4/6/2016	KB & JT	6.78	5.77	13.09	134.70	138.45	10.40
MP103A	-76.6880027000	38.7922534000	Two Run Branch	Two Run Branch 1	136.75	9.16	6.70%	44.45	32.50%	4/25/2016	JCR/JP	5.99	12.13	7.61	164.67	80.67	2.53
MP109A	-76.6499147472	38.7937694993	Cabin Branch	Cabin Branch 5	157.30	1.98	1.26%	86.58	55.04%	4/19/2016	JS & DV	6.13	14.30	10.62	64.67	64.00	6.07
MP11	-76.6910585640	38.8416271177	Ferry Branch	Ferry Branch 1	2738.55	103.93	3.80%	1063.64	38.84%	3/31/2016	KB & JT	6.99	13.77	11.04	146.43	121.33	10.19
MP112A	-76.6148656370	38.7988712944	Lyons Creek	Lyons Creek 1	106.30	4.61	4.34%	24.84	23.37%	4/14/2016	JS & CR	6.35	15.04	10.98	197.00	158.00	12.00
MP113A	-76.6177431514	38.7885766644	Lyons Creek	Lyons Creek 4	123.53	6.04	4.89%	28.20	22.83%	4/15/2016	JS & CR	6.55	12.71	11.97	156.67	133.00	5.77
MP117A	-76.6009251993	38.7872536637	Lyons Creek	Lyons Creek 3	2473.53	107.59	4.35%	714.49	28.89%	3/29/2016	JS & CR	6.35	16.52	12.54	134.67	144.67	40.60
MP117A-REP	-76.6015182459	38.7884996973	Lyons Creek	Lyons Creek 3	2456.06	105.52	4.30%			3/29/2016	JS & CR	6.75	18.26	12.08	126.67	105.23	33.77
MP118A	-76.6002589174	38.7797293042	Lyons Creek	Lyons Creek 3	2750.22	131.48	4.78%	795.45	28.92%	4/15/2016	JS & JA	6.23	10.17	11.65	169.33	153.00	5.47
MP119A	-76.5979925418	38.7607286055	Lyons Creek	Lyons Creek 7	226.54	14.39	6.35%	74.73	32.99%	4/18/2016	JS & CR	6.17	11.16	11.59	231.00	203.67	14.90
MP121A	-76.6195504531	38.7654773946	Lyons Creek	Lyons Creek 8	245.18	22.27	9.08%	50.51	20.60%	4/18/2016	JS & CR	7.65	18.51	12.29	287.33	213.00	4.53
MP124A	-76.6124565267	38.7679217483	Lyons Creek	Lyons Creek 2	3678.68	187.81	5.11%	1201.78	32.67%	4/20/2016	EW & CR	7.22	18.19	12.81	210.67	157.33	8.37
MP126A	-76.6336469872	38.7836962551	Lyons Creek	Lyons Creek 10	289.68	8.19	2.83%	83.78	28.92%	4/15/2016	CR & JT	6.91	9.33	12.46	96.83	89.48	31.03
MP128A	-76.6526570000	38.7798720000	Cabin Branch	Cabin Branch 2	1975.08	68.66	3.48%	758.66	38.41%	3/31/2016	EW & DV	6.16	10.83	11.25	125.00	112.00	2.70
MP129A	-76.6483818000	38.7746081000	Cabin Branch	Cabin Branch 2	194.80	9.42	4.84%	71.51	36.71%	4/21/2016	MWT/JP	6.08	10.77	11.46	135.67	67.33	8.96
MP13	-76.6790416445	38.8320349065	Wilson Owens Branch	Wilson Owens Branch 3	214.17	19.12	8.93%	45.02	21.02%	3/31/2016	KB & JT	7.06	12.27	10.85	189.63	163.15	3.83
MP132A	-76.6560683000	38.7647921000	Lyons Creek	Cabin Branch 1	9462.08	409.37	4.33%	3184.86	33.66%	4/21/2016	MWT/JP	6.78	12.50	11.63	194.33	97.00	8.61
MP134A	-76.6662257000	38.7851949000	Deep Creek	Deep Creek	72.06	12.55	17.42%	38.15	52.95%	4/14/2016	GZ/JCR	6.13	16.33	2.36	931.00	465.33	4.11
MP139A	-76.6879070000	38.8214737000	Wilson Owens Branch	Wilson Owens Branch	1433.46	63.10	4.40%	529.62	36.95%	4/13/2016	MKT/MWT	6.73	9.60	11.34	191.67	96.00	2.71
MP139A-REP	-76.6879070000	38.8214737000	Wilson Owens Branch	Wilson Owens Branch	1433.46	63.10	4.40%			4/13/2016	MKT/MWT	6.73	9.60	11.34	192.00	96.00	2.71
MP15	-76.6637483727	38.8291373462	Ferry Branch	Ferry Branch 2	1897.75	78.24	4.12%	608.09	32.04%	3/25/2016	KB & CR	6.91	14.63	10.44	161.90	131.08	7.08
MP16	-76.6448853467	38.8227748589	Ferry Branch	Ferry Branch 2	88.31	5.42	6.14%	32.87	37.23%	4/11/2016	JS & KB	6.11	13.64	10.24	160.00	132.67	19.63
MP16-REP	-76.6441791874	38.8223774124	Ferry Branch	Ferry Branch 2	83.77	4.67	5.57%			4/11/2016	JS & KB	5.66	10.43	10.66	163.67	147.00	9.73
MP19	-76.6958574000	38.8143952000	Unnamed Patuxent Trib	Wilson Owens Branch 3	187.99	25.72	13.68%	47.68	25.36%	4/13/2016	MKT/MWT	6.81	15.70	5.70	344.00	171.33	5.08
MP22	-76.6672743000	38.8126660000	Wilson Owens Branch	Wilson Owens Branch 2	184.15	3.41	1.85%	92.82	50.41%	4/14/2016	GZ/JCR	6.88	16.07	3.26	137.33	68.00	8.97
MP23	-76.6518280182	38.8131951811	Wilson Owens Branch	Wilson Owens Branch 1	273.52	10.46	3.83%	81.97	29.97%	4/14/2016	KB & JA	7.22	10.53	14.20	169.10	151.88	6.42
MP24	-76.6401237243	38.8138783419	Wilson Owens Branch	Wilson Owens Branch 1	85.49	5.05	5.91%	22.70	26.56%	3/30/2016	KB & JT	6.87	9.60	11.49	224.13	206.27	7.22
MP25	-76.6237856431	38.8103464073	Lyons Creek	Lyons Creek 5	128.91	7.09	5.50%	20.13	15.61%	4/22/2016	KB & JT	6.91	16.33	9.73	194.00	151.02	23.60
MP26	-76.6178211389	38.8183585170	Lyons Creek	Lyons Creek 5	394.88	22.23	5.63%	83.76	21.21%	4/14/2016	JS & CR	6.19	11.59	10.87	180.33	157.33	11.13
MP31	-76.6426054696	38.7992428540	Cabin Branch	Cabin Branch 4	633.21	30.42	4.80%	148.74	23.49%	4/4/2016	KB & CR	6.83	11.33	11.45	128.97	113.32	9.50
MP31-REP	-76.6414549416	38.7999815319	Cabin Branch	Cabin Branch 4	609.96	28.57	4.68%			4/4/2016	KB & CR	6.89	14.90	10.77	130.33	104.43	8.69
MP33	-76.7003565000	38.8084556000	Galloway Creek	Galloway Creek	974.70	86.88	8.91%	518.57	53.20%	3/25/2016	MKT/MWT	6.49	15.10	8.62	347.33	173.33	7.96
MP34	-76.6766793000	38.8013447000	Galloway Creek	Galloway Creek	112.07	1.41	1.26%	70.52	62.93%	3/31/2016	JP/GZ	6.57	15.27	10.68	80.33	40.00	8.59
MP35	-76.6961104000	38.7950552000	Unnamed Tributary	Two Run Branch 2	90.04	3.40	3.78%	62.84	69.79%	3/31/2016	JP/GZ	6.28	11.57	10.39	78.67	39.00	6.48
MP36	-76.7034369000	38.7953443000	Unnamed Tributary	Two Run Branch 2	155.19	3.63	2.34%	127.71	82.29%	3/31/2016	JP/GZ	6.45	14.27	8.24	61.00	31.00	5.81
MP37	-76.6593869901	38.7989851083	Cabin Branch	Cabin Branch 3	47.49	0.38	0.80%	15.90	33.49%	4/4/2016	KB & CR	6.67	13.97	9.50	102.30	84.28	20.80
MP38	-76.6593496000	38.7900549000	Cabin Branch	Cabin Branch 3	331.85	8.69	2.62%	173.93	52.41%	4/25/2016	JCR/JP	6.63	15.50	11.87	212.33	105.33	3.68
MP39	-76.6510020000	38.7850080000	Cabin Branch	Cabin Branch 5	1352.98	51.85	3.83%	447.98	33.11%	3/31/2016	EW & DV	6.68	13.74	11.51	135.00	112.00	9.00
MP39-REP	-76.6508080000	38.7840080000	Cabin Branch	Cabin Branch 5	1360.67	52.33	3.85%			3/31/2016	EW & DV	6.79	15.80	11.13	140.00	110.00	11.20
MP42	-76.6201369125	38.7803678166	Lyons Creek	Lyons Creek 4	431.02	19.32	4.48%	120.11	27.87%	4/11/2016	CR & JT	7.02	15.80	11.13	140.00	110.00	11.20
MP43	-76.6196545046	38.7694249523	Lyons Creek	Lyons Creek 9	346.95	15.65	4.51%	162.93	46.96%	4/19/2016	JS & DV	6.56	19.19	9.83	158.67	116.00	6.67
MP44	-76.6102020286	38.7770370282	Lyons Creek	Lyons Creek 9	38.31	2.00	5.23%	16.86	44.01%	4/11/2016	CR & JT	6.11	12.63	9.52	110.80	94.25	12.66
MP48	-76.5984305738	38.7594666261	Lyons Creek	Lyons Creek 7	220.85	13.99	6.33%	71.66	32.45%	4/20/2016	EW & CR	7.10	17.64	10.24	259.00	196.00	31.90
MP50	-76.6106733940	38.7609378941	Lyons Creek	Lyons Creek 8	42.15	2.06	4.88%	12.42	29.46%	4/18/2016	JS & CR	7.50	14.52	13.13	266.00	223.00	4.50
MP51	-76.6179662845	38.7672193481	Lyons Creek	Lyons Creek 2	3790.27	192.51	5.08%	1267.15	33.43%	4/20/2016	EW & CR	6.59	14.26	10.60	197.67	161.33	6.50
MP53	-76.6383941554	38.7689890836	Lyons Creek	Lyons Creek 10	862.22	42.58	4.94%	291.23	33.78%	4/16/2016	CR & JT	7.13	12.07	12.95	125.83	138.33	6.22
MP57	-76.6645116000	38.7654610000	Lyons Creek	Cabin Branch 1	294.40	22.63	7.69%	129.52	43.99%	4/21/2016	MWT/JP	6.43	14.67	9.85	142.00	70.67	5.77
MP60	-76.6697537000	38.7794964000	Deep Creek	Deep Creek	289.66	21.06	7.27%	148.33	51.21%	4/6/2016	MWT/JCR	6.46	12.63	11.13	412.33	206.00	8.46
MP61	-76.6912386000	38.7751811000	Pindell Branch	Pindell Branch	234.07	5.07	2.17%	145.39	62.11%	3/25/2016	MKT/MWT	6.32	15.50	10.06	118.00	58.67	1.83
MP62	-76.6891356000	38.7795740000	Pindell Branch	Pindell Branch	93.28	1.84	1.98%	35.95	38.54%	3/25/2016	MKT/MWT	6.41	15.67	10.27	137.33	67.33	1.93
MP64	-76.7005768000	38.7823277000	Two Run Branch	Two Run Branch 1	614.82	21.48	3.49%	334.58	54.42%	4/6/2016	MWT/JCR	6.63	10.00	13.35	118.67	59.00	1.79
MP64-REP	-76.7005768000	38.7823277000	Two Run Branch	Two Run Branch 1	614.82	21.48	3.49%			4/6/2016	MWT/JCR	6.63	10.00	13.35	118.67	59.00	1.79
MP71	-76.6211975611	38.8448078844	Rock Branch	Rock Branch 3	229.06	8.63	3.77%	87.21	38.07%	4/6/2016	KB & JT	6.77	10.77	12.18	127.00	113.10	10.67
MP71A-REP	-76.6195229685	38.8446866010	Rock Branch	Rock Branch 3	222.21	8.51	3.83%			4/6/2016	KB & JT	6.45	11.53	11.47	130.83	114.62	11.67
MP79A	-76.6679218012	38.8417570504	Ferry Branch	Ferry Branch 1	144.63	6.74	4.66%	41.50	28.69%	4/22/2016	KB & JT	7.02	16.07	10.26	150.80	118.30	7.24
MP80A	-76.6739095000	38.8279864000	Wilson Owens Branch	Wilson Owens Branch 3	167.91	16.01	9.54%	27.36	16.30%	4/13/2016	MKT/MWT	6.67	12.40	5.78	264.67	131.33	10.02
MP86A	-76.6234728766	38.8308363056	Ferry Branch	Ferry Branch 3	91.15	6.68	7.33%	11.64	12.77%	4/14/2016	JS & JA	6.91	14.60	10.26	252.83	204.97	31.45
MP88A	-76.6343984107	38.8388054800	Ferry Branch	Ferry Branch 3	36.88	1.90	5.15%	9.75	26.45%	4/15/2016	JS & JA	5.76	12.50	8.83	353.33	303.33	8.07
MP92A	-76.5975985768	38.8070898821	Lyons Creek	Lyons Creek 6	78.52	6.98	8.89%	5.76	7.33%	4/14/2016	JS & CR	6.50	14.23	12.45	170.33	139.33	15.33
MP97A	-76.6403920000	38.8041042000	Cabin Branch	Cabin Branch 4	237.91	5.16	2.17%	66.55	27.97%	4/25/2016	JCR/JP	6.86	18.33	9.98	163.67	81.00	8.91
MP98A	-76.6580006000	38.8157613000	Wilson Owens Branch	Wilson Owens Branch 2	563.63	24.70	4.38%	155.27	27.55%	4/14/2016	GZ/JCR	6.82	10.03	4.27	224.67	111.00	8.17

APPENDIX G –
LAB DATA FROM ECOANALYSTS & DNR

Century Engineering MD MBSS Benthos 2016
MBSS Coastal Plain IBI

EcoAnalysts, Inc.
LIFE IN WATER

	CEI	CEI	CEI	CEI	CEI	CEI	CEI	CEI	CEI	CEI	BIO	BIO	BIO	CEI	CEI	BIO	CEI	CEI	CEI	CEI	CEI	CEI	BIO	BIO	CEI
Site Id	**LP02**	**LP11A**	**MP01**	**MP03**	**MP06**	**MP07**	**MP09**	**MP121A**	**MP128A**	**MP132A**	**MP139A**	**MP19**	**MP23**	**MP31**	**MP35**	**MP39**	**MP42**	**MP71A-REP**	**LP04**	**MP11**	**MP15**	**MP34**	**MP37**	**MP39-REP**
Time	**14:21**	**10:15**	**10:00**	**10:45**	**13:45**	**13:30**	**10:45**	**12:47**	**10:15**	**11:42**	**10:00**	**14:43**	**11:45**	**10:10**	**9:15**	**13:20**	**15:36**	**13:30**	**11:50**	**14:00**	**12:15**	**3:15**	**16:10**	**14:30**
Collected By	**KB / JT**	**KB / JT**	**JS / JT**	**KB / JT**	**KB / JT**	**JS / JT**	**KB / JT**	**JS / CR**	**EW / DV**	**MWT / KT**	**MWT / KT**	**MWT / KT**	**KB / JA**	**KB / CR**	**GZ / JP**	**EW / DV**	**CR / JT**	**KB / JT**	**KB / JT**	**KB / JT**	**KB / CR**	**GZ / JP**	**GZ / JP**	**EW / DV**
Date Received	**5/19/2016**	**5/19/2016**	**5/20/2016**	**5/19/2016**	**5/20/2016**	**5/19/2016**	**5/20/2016**	**5/20/2016**	**5/20/2016**	**5/19/2016**	**5/19/2016**	**5/19/2016**	**5/20/2016**	**5/19/2016**	**5/20/2016**	**5/19/2016**	**5/20/2016**	**5/20/2016**	**5/23/2016**	**5/23/2016**	**5/23/2016**	**5/20/2016**	**5/19/2016**	**5/23/2016**
Box	**1**	**1**	**2**	**1**	**2**	**1**	**2**	**2**	**4**	**1**	**3**	**3**	**4**	**3**	**4**	**3**	**4**	**4**	**5**	**5**	**5**	**2**	**3**	**5**
Collection Date	**03-29-2016**	**04-22-2016**	**04-04-2016**	**04-19-2016**	**03-30-2016**	**04-04-2016**	**04-06-2016**	**04-18-2016**	**03-31-2016**	**04-21-2016**	**04-13-2016**	**04-13-2016**	**04-14-2016**	**04-04-2016**	**03-31-2016**	**03-31-2016**	**04-11-2016**	**04-06-2016**	**03-29-2016**	**03-31-2016**	**03-25-2016**	**03-31-2016**	**04-04-2016**	**03-31-2016**
Percent Subsampled	**32.00**	**2.50**	**18.00**	**41.00**	**13.00**	**25.00**	**55.00**	**2.00**	**31.00**	**1.50**	**1.50**	**2.00**	**11.00**	**50.00**	**2.00**	**12.00**	**27.00**	**26.00**	**6.00**	**18.00**	**35.00**	**2.00**	**14.00**	**21.00**
EcoAnalysts Sample ID	**7445.01-1**	**7445.01-2**	**7445.01-3**	**7445.01-4**	**7445.01-5**	**7445.01-6**	**7445.01-7**	**7445.01-8**	**7445.01-9**	**7445.01-10**	**7445.01-11**	**7445.01-12**	**7445.01-13**	**7445.01-14**	**7445.01-15**	**7445.01-16**	**7445.01-17**	**7445.01-18**	**7445.01-19**	**7445.01-20**	**7445.01-21**	**7445.01-22**	**7445.01-23**	**7445.01-24**
Metric Values																								
Number of Taxa	29	20	15	18	23	16	18	21	19	32	36	34	21	20	26	25	19	21	7	23	17	16	24	26
Number of EPT Taxa	6	2	5	5	3	4	5	1	5	5	9	1	2	3	7	4	2	5	0	3	2	4	1	7
Number of Ephemeroptera Taxa	0	0	3	1	0	2	0	0	0	3	3	0	0	1	0	2	0	0	0	2	0	0	0	1
Percent Intolerant Urban	12.8205128	3.14465409	36.7924528	3.38983051	5.3030303	16.4835165	33.9285714	5	28.9719626	21.2903226	17.9310345	7.02702703	49.0196078	5.88235294	24.1666667	9.01639344	8.47457627	52.1367521	0	5.44217687	5.66037736	59.2334495	8.79120879	6.03448276
Percent Ephemeroptera Individuals	0	0	21.8487395	46.8468468	0	18.8679245	0	0	0	9.52380952	2.7027027	0	0	1.96078431	0	3.27868852	0	0	0	1.35135135	0	0	0	0.86206897
Number of Scraper Taxa	5	0	0	0	1	2	1	0	2	3	2	1	2	4	1	5	3	2	0	3	5	0	0	6
Percent Climbers	11.8644068	2.5	9.24369748	5.40540541	21.969697	4.71698113	1.78571429	0.625	18.6915888	16.6666667	8.10810811	6.98924731	4.90196078	13.7254902	3.33333333	26.2295082	16.9491525	1.70940171	0	8.78378378	6.54205607	1.39372822	1.0989011	13.7931034
Metric Scores																								
Number of Taxa	5	3	3	3	5	3	3	3	3	5	5	5	3	3	5	5	3	3	1	5	3	3	5	5
Number of EPT Taxa	5	3	5	5	3	3	5	1	5	5	5	1	3	3	5	3	3	5	1	3	3	3	1	5
Number of Ephemeroptera Taxa	1	1	5	3	1	5	1	1	1	5	5	1	1	3	1	5	1	1	1	5	1	1	1	3
Percent Intolerant Urban	3	1	5	1	1	3	5	1	5	3	3	1	5	1	3	1	1	5	1	1	1	5	1	1
Percent Ephemeroptera	1	1	5	5	1	5	1	1	1	3	3	1	1	3	1	3	1	1	1	3	1	1	1	3
									5	5	5	3	5	5	3	5	5	5	1	5	5	1	1	5
									5	5	5	3	3	5	3	5	5	3	1	5	3	3	3	5
Average MBSS Coastal Plain IBI Score	**3.6**	**1.9**	**4.1**	**3.0**	**2.7**	**3.9**	**3.0**	**1.3**	**3.6**	**4.4**	**4.4**	**2.1**	**3.0**	**3.3**	**3.0**	**3.9**	**2.7**	**3.3**	**1.0**	**3.9**	**2.4**	**2.4**	**1.9**	**3.9**
MBSS Coastal Plain B-IBI Rating	**Fair**	**Very Poor**	**Good**	**Fair**	**Poor**	**Fair**	**Fair**	**Very Poor**	**Fair**	**Good**	**Good**	**Poor**	**Fair**	**Fair**	**Fair**	**Fair**	**Poor**	**Fair**	**Very Poor**	**Fair**	**Poor**	**Poor**	**Very Poor**	**Fair**

Century Engineering MD MBSS Benthos 2016
MBSS Coastal Plain IBI

EcoAnalysts, Inc.
LIFE IN WATER

		CEI	CEI	CEI	CEI	CEI	CEI	BIO	CEI	CEI	CEI	CEI	CEI	CEI	CEI	CEI	CEI	CEI	BIO	CEI	BIO	BIO	BIO	CEI	CEI	CEI	CEI	BIO
Site Id		MP71A	LP06	LP09A	MP04	MP05	MP08	MP103A	MP109A	MP112A	MP113A	MP117A	MP117A-REP	MP118A	MP119A	MP124A	MP126A	MP129A	MP13	MP134A	MP139A-REP	MP22	MP24	MP25	MP26	MP31-REP	MP33
Time		13:00	12:05	13:55	12:00	14:00	9:45	10:58	11:00	13:30	13:00	12:30	14:50	10:45	10:08	11:54	10:30	10:05	11:21	16:30	9:54	14:00	11:30	12:18	11:06	12:00	10:18
Collected By		KB / JT		KB / JT	JS / JT	CR / JT	EW / CR	JCR / JP	JS / DV	JS / CR	JS / JA	JS / CR	JS / CR	JS / JA	JS / CR	EW / CR	CR / JT	MWT / JP	KB / JT	GZ / JCR	MWT / KT	GZ / JCR	KB / JT	KB / JT	JS / CR	KB / CR	MWT / KT
Date Received		5/23/2016	5/27/2016	5/27/2016	5/27/2016	5/27/2016	5/27/2016	5/27/2016	5/27/2016	5/27/2016	5/27/2016	5/27/2016	5/27/2016	5/27/2016	5/27/2016	5/27/2016	5/27/2016	5/25/2016	5/25/2016	5/27/2016	5/25/2016	5/27/2016	5/27/2016	5/27/2016	5/27/2016	5/27/2016	5/27/2016
Box		5	21	22	17	20	16	18	11	19	17	11	18	15	15	9	16	8	7	14	6	9	15	22	13	22	20
Collection Date		04-06-2016	04-19-2016	04-19-2016	04-04-2016	04-15-2016	04-06-2016	04-25-2016	04-19-2016	04-13-2016	04-15-2016	03-29-2016	03-29-2016	04-15-2016	04-18-2016	04-20-2016	04-15-2016	04-21-2016	03-31-2016	04-14-2016	04-13-2016	04-14-2016	03-30-2016	04-22-2016	04-14-2016	04-04-2016	03-25-2016
Percent Subsampled		22.00	9.00	14.00	30.00	6.00	6.00	18.00	9.00	19.00	12.00	30.00	33.00	14.00	9.00	24.00	10.00	2.00	43.00	12.00	6.00	5.00	17.00	30.00	12.00	60.00	17.00
EcoAnalysts Sample ID		7445.01-25	7445.01-26	7445.01-27	7445.01-28	7445.01-29	7445.01-30	7445.01-31	7445.01-32	7445.01-33	7445.01-34	7445.01-35	7445.01-36	7445.01-37	7445.01-38	7445.01-39	7445.01-40	7445.01-41	7445.01-42	7445.01-43	7445.01-44	7445.01-45	7445.01-46	7445.01-47	7445.01-48	7445.01-49	7445.01-50
Metric Values																											
Number of Taxa		14	18	15	23	18	21	29	20	26	20	17	20	36	15	23	20	18	24	10	39	18	14	27	20	31	22
Number of EPT Taxa		5	3	2	5	5	3	3	2	1	3	1	4	4	3	6	6	5	7	2	8	2	3	3	1	5	3
Number of Ephemeroptera Taxa		0	0	1	1	1	0	0	1	0	0	0	0	1	0	3	1	3	2	0	2	0	0	0	0	1	1
Percent Intolerant Urban		59.0909091	7.80141844	15.2542373	27.1028037	13.7096774	6.97674419	17.7966102	1.01010101	2.15827338	21.4285714	7.47663551	18.3486239	13.5338346	3.03030303	48.2758621	5.29411765	13.3928571	11.0169492	2.75229358	20.1298701	10.0775194	3.63636364	4.29447853	2.7027027	5.95238095	0.84745763
Percent Ephemeroptera Individuals		0	0	2.47933884	0.93457944	1.57480315	0	0	0.99009901	0	0	0	0	5.59440559	0	24.7524752	0.58823529	6.03448276	1.68067227	0	4.54545455	0	0	0	0	0.5952381	0.84745763
Number of Scraper Taxa		0	0	0	3	1	1	1	1	0	3	1	3	4	0	4	1	2	4	0	4	2	2	2	1	3	4	4
Percent Climbers		0	52.1126761	0	6.54205607	5.51181102	1.1627907	0.84745763	14.8514851	27.1428571	25.8928571	6.54205607	4.58715596	23.0769231	13.6363636	12.8712871	37.0588235	6.89655172	10.0840336	0.91743119	12.987013	21.7054264	5.40540541	17.1779141	24.7787611	22.6190476	4.23728814
Metric Scores																											
Number of Taxa		3	3	3	5	3	3	5	3	5	3	3	3	5	3	5	3	3	5	1	5	3	3	5	3	5	5
Number of EPT Taxa		5	3	3	5	5	3	3	3	1	3	1	3	3	3	5	5	5	5	3	5	3	3	3	1	5	3
Number of Ephemeroptera Taxa		1	1	3	3	3	1	1	3	1	1	1	1	3	1	5	3	5	5	1	5	1	1	1	1	3	3
Percent Intolerant Urban		5	1	3	3	3	1	3	1	1	3	1	3	3	1	5	1	3	3	1	3	3	1	1	1	1	1
Percent Ephemeroptera		1	1	3	3	3	1	1	3	1	1	1	1	3	1	5	1	3	3	1	3	1	1	1	1	1	3
		1	1	1	5	3	3	3	3	1	5	3	5	5	1	5	3	5	5	1	5	5	5	3	5	5	5
		1	5	1	3	3	3	1	5	5	5	3	3	5	5	5	5	3	5	3	5	5	3	5	5	5	3
Average MBSS Coastal Plain IBI Score		2.4	2.1	2.4	3.9	3.3	2.1	2.4	3.0	2.1	3.0	1.9	2.7	3.9	2.1	5.0	3.0	3.9	4.4	1.6	4.4	3.0	2.4	2.7	2.4	3.6	3.3
MBSS Coastal Plain B-IBI Rating	**Fair**	**Poor**	**Poor**	**Poor**	**Fair**	**Fair**	**Poor**	**Poor**	**Fair**	**Poor**	**Fair**	**Very Poor**	**Poor**	**Fair**	**Poor**	**Good**	**Fair**	**Fair**	**Good**	**Very Poor**	**Good**	**Fair**	**Poor**	**Poor**	**Poor**	**Fair**	**Fair**

Century Engineering MD MBSS Benthos 2016
MBSS Coastal Plain IBI

EcoAnalysts, Inc.
LIFE IN WATER

		BIO	BIO	CEI	CEI	CEI	CEI	CEI	CEI	BIO	BIO	BIO	BIO	BIO	BIO	CEI	BIO	CEI	CEI	CEI	CEI	BIO	BIO	CEI	CEI	CEI	CEI
Site Id		MP36	MP38	MP43	MP44	MP48	MP50	MP51	MP53	MP57	MP60	MP61	MP62	MP64	MP64-REP	MP79A	MP80A	MP86A	MP88A	MP92A	MP97A	MP98A	MP31	MP109A	MP50	MP86A
Time		12:30	13:18	14:45	13:00	14:54	11:10	10:23	12:00	13:50	14:02	14:01	12:16	11:11	11:11	13:45	12:27	14:00	14:00	15:50	13:44	11:50	10:10	11:00	11:10	14:00
Collected By		GZ / JP	JCR / JP	JS / DV	CR / JT	EW / CR	JS / CR	EW / CR	CR / JT	MWT / JP	MWT / JCR	MWT / KT	MWT / KT	MWT / JCR	MWT / JCR	KB / JT	MWT / KT	KB / JA	JS / JA	JS / CR	JCR / JP	GZ / JCR	KB / CR	JS / DV	JS / CR	KB / JA
Date Received		5/27/2016	5/25/2016	5/27/2016	5/27/2016	5/27/2016	5/27/2016	5/27/2016	5/27/2016	5/27/2016	5/25/2016	5/27/2016	5/27/2016	5/27/2016	5/25/2016	5/25/2016	5/27/2016	5/25/2016	5/27/2016	5/27/2016	5/27/2016	5/25/2016	5/19/2016	5/27/2016	5/27/2016	5/25/2016
Box		21	7	14	13	18	20	22	19	12	6	19	11	10	8	8	10	7	16	12	17	6	3	11	20	7
Collection Date		03-31-2016	04-25-2016	04-19-2016	04-11-2016	04-20-2016	04-18-2016	04-20-2016	04-15-2016	04-21-2016	04-06-2016	03-25-2016	03-25-2016	04-06-2016	04-06-2016	04-22-2016	04-13-2016	04-14-2016	04-15-2016	04-14-2016	04-25-2016	04-14-2016	04-04-2016	04-19-2016	04-18-2016	04-14-2016
Percent Subsampled		6.00	4.00	7.00	13.00	10.00	5.00	3.00	13.00	49.00	12.00	9.00	22.00	10.00	17.00	56.00	10.00	100.00	62.00	9.00	7.00	8.00	77.00	5.00	6.00	100.00
EcoAnalysts Sample ID		7445.01-51	7445.01-52	7445.01-53	7445.01-54	7445.01-55	7445.01-56	7445.01-57	7445.01-58	7445.01-59	7445.01-60	7445.01-61	7445.01-62	7445.01-63	7445.01-64	7445.01-65	7445.01-66	7445.01-67	7445.01-68	7445.01-69	7445.01-70	7445.01-71	7445.01-72	7445.01-73	7445.01-74	7445.01-75
Metric Values																										
Number of Taxa		25	18	24	17	25	16	27	27	31	26	40	29	38	29	32	35	24	22	8	15	19	24	20	17	25
Number of EPT Taxa		6	3	4	4	5	0	6	3	3	4	8	7	7	8	7	9	1	1	1	3	2	6	0	0	2
Number of Ephemeroptera Taxa		1	1	1	1	1	0	2	1	0	1	1	1	2	2	0	2	0	0	0	0	0	1	0	0	0
Percent Intolerant Urban		36.0759494	9.90990991	29.1666667	4.38596491	4.84848485	0.74074074	12.3966942	5.81395349	15.2	13.4502924	27.5167785	53.0434783	17.2043011	31.0344828	27.0676692	12.195122	25.2173913	9.93377483	2.96296296	6.55737705	1.42857143	8.33333333	1.27388535	0.94339623	26
Percent Ephemeroptera Individuals		0.63291139	3.47826087	0.82644628	0.87719298	0.60606061	0	16.5517241	1.71428571	0	0.58479532	5.36912752	4.34782609	5.37634409	12.0689655	0	1.2195122	0	0	0	0	0	1.5037594	0	0	0
Number of Scraper Taxa		1	0	1	1	0	0	5	2	1	4	3	2	3	6	2	3	0	1	1	1	1	5	1	0	1
Percent Climbers		16.4556962	4.34782609	4.1322314	2.63157895	27.2727273	0.74074074	8.27586207	12	10.4	1.75438596	8.72483221	3.47826087	15.5913978	12.0689655	14.0740741	9.75609756	4.34782609	0.66225166	10.3703704	4.09836066	8.57142857	21.8045113	7.59493671	2.83018868	4
Metric Scores																										
Number of Taxa		5	3	5	3	5	3	5	5	5	5	5	5	5	5	5	5	5	5	1	3	3	5	3	3	5
Number of EPT Taxa		5	3	3	3	5	1	5	3	3	3	5	5	5	5	5	5	1	1	1	3	3	5	1	1	3
Number of Ephemeroptera Taxa		3	3	3	3	3	1	5	3	1	3	3	3	5	5	1	5	1	1	1	1	1	3	1	1	1
Percent Intolerant Urban		5	1	5	1	1	1	3	1	3	3	3	5	3	5	3	3	3	1	1	1	1	1	1	1	3
Percent Ephemeroptera		1	3	3	3	1	1	5	3	1	1	3	3	3	5	1	3	1	1	1	1	1	3	1	1	1
		3	1	3	3	1	1	5	5	3	5	5	5	5	5	5	5	1	3	3	3	3	5	3	1	3
		5	3	3	3	5	1	5	5	5	3	5	3	5	5	5	5	3	1	5	3	5	5	3	3	3
Average MBSS Coastal Plain IBI Score		3.9	2.4	3.6	2.7	3.0	1.3	4.7	3.6	3.0	3.3	4.1	4.1	4.4	5.0	3.6	4.4	2.1	1.9	1.9	2.1	2.4	3.9	1.9	1.6	2.7
MBSS Coastal Plain B-IBI Rating	Fair	Fair	Poor	Fair	Poor	Fair	Very Poor	Good	Fair	Fair	Fair	Good	Good	Good	Good	Fair	Good	Poor	Very Poor	Very Poor	Poor	Poor	Fair	Very Poor	Very Poor	Poor

APPENDIX G - Maryland Department of Natural Resources Audit Lab Data

Original N	SITE	Collector	ntaxa	nept	nephem	totind	totephem	nscrape	totclimb	totchiron	totcling	tottany	totscrape	totswim	totdipt	totintol_ur	pephem	pclimb	pchiron	pcling	ptany	pscrape	pswim	pdipt	pintol_urb	strata_r	sc_ntaxa	sc_nept	sc_nepher	sc_pintol_	sc_pepher	sc_nscrap	sc_pclimb	bibi_05
Database	SITE	Collector	No_taxa	No_EPT_t	No_Ephen	totind	totephem	nscrape	totclimb	totchiron	totcling	tottany	totscrape	totswim	totdipt	totintol_ur	Per_Epher	Per_climb	pchiron	pcling	ptany	pscrape	pswim	pdipt	Per_Intol	strata_r	No_Taxa_	No_EPT_t	No_Ephen	Per_Intol_	Per_Epher	No_Sscpr	Per_climb	BIBI
MP16	0915-01-D	Joe Smith	14	2	0	118	0	0	1	13	9	0	0	0	20	86	0	0.847458	11.01695	7.627119	0	0	0	16.94915	72.88136	COASTAL	3	3	1	5	1	1	1	2.142857
MP16-REP	0915-02-D	Karen Bow	19	3	0	118	0	0	0	24	27	0	0	0	26	76	0	0	20.33898	22.88136	0	0	0	22.0339	64.40678	COASTAL	3	3	1	5	1	1	1	2.142857
MP02	0917-01-D		31	5	1	129	1	1	20	99	33	3	4	1	110	13	0.775194	15.50388	76.74419	25.5814	2.325581	3.100775	0.775194	85.27132	10.07752	COASTAL	5	5	3	3	1	3	5	3.571429

APPENDIX H –
SITE PHOTOGRAPHS

APPENDIX I –
CHAIN OF CUSTODY SHEETS

CEI - Box 1 of 6
AA Co. DPW
SPRING 2016 BIO ASSESSMENT

Benthic Sample Log-in

In Field				In Lab					
Date Collected	Site ID	Number of Containers	Collected by (Initials)	Date Received	Site ID	Number of Containers	Internal and External Labels Match?	Received By (Initials)	Sample Condition/Notes
3/25/16	MP15	1	KB/CR						
3/29/16	LP02	1	KB/JT						
3/30/16	MP06	1	KB/JT						
4/4/16	MP37	1	KB/CR						
4/6/16	MP71A	1	KB/JT						
4/6/16	MP71A-REP	1	KB/JT						
4/11/16	MP44	3	CR/JT						
4/11/16	MP42	1	CR/JT						
4/14/16	MP86A	2	KB/JA						
	TOTAL:	12 CONTAINERS							

Relinquished By: Ella [illegible]	Date & Time: 5/9/16 10:15AM	Received By: K Merrill	Date & Time: 5/9/16 10:15 am
Relinquished By:	Date & Time:	Received By:	Date & Time:

AA Co. DPW
SPRING 2016
BIO ASSESSMENT

CE1 - Box 2 of 6

Benthic Sample Log-in									
In Field				In Lab					
Date Collected	Site ID	Number of Containers	Collected by (Initials)	Date Received	Site ID	Number of Containers	Internal and External Labels Match?	Received By (Initials)	Sample Condition/Notes
3/31/16	MP13	1	KB/JT						
3/31/16	MP39	1	EW/DV						
4/4/16	MP04	2	JS/JT						
4/14/16	MP23	1	KB/JA						
3/29/16	LP02	1	KB/JT						
3/31/16	MP128A	1	EW/DV						
4/4/16	MP01	1	JS/JT						
4/6/16	MP09	1	KB/JT						
4/6/16	MP08	2	EW/CR						
4/22/16	MP79A	1	KB/JT						
	TOTAL:	12 CONTAINERS							

Relinquished By: [signature]	Date & Time: 5/9/16 10:15AM	Received By: [signature]	Date & Time: 5/9/10 10:15am
Relinquished By:	Date & Time:	Received By:	Date & Time:

AA Co. DPW
SPRING 2016
BIO ASSESSMENT

CE1 - Box 3 of 6

Benthic Sample Log-in									
In Field				In Lab					
Date Collected	Site ID	Number of Containers	Collected by (Initials)	Date Received	Site ID	Number of Containers	Internal and External Labels Match?	Received By (Initials)	Sample Condition/Notes
3/31/16	MP11	1	KB/JT						
4/19/16	LP06	2	KB/JT						
3/30/16	MP24	2	KB/JT						
4/4/16	MP07	1	JS/JT						
4/28/16	LP11A	1	KB/JT						
4/19/16	MP03	1	KB/JT						
4/18/16	MP19A	1	JS/CR						
4/20/16	MP48	2	EW/CR						
4/19/16	MP43	2	JS/DV						
4/15/16	MP88A	1	JS/JA						
4/15/16	MP113A	1	JS/JA						
4/18/16	MP121A	1	JS/CR						
	TOTAL:	16 CONTAINERS							

Relinquished By: [signature]	Date & Time: 5/9/16 10:15 AM	Received By: [signature]	Date & Time: 10:15 am
Relinquished By:	Date & Time:	Received By:	Date & Time:

AA Co. DPW
SPRING 2016
BIO ASSESSMENT

CEI - Box 4 of 6

Benthic Sample Log-in									
In Field				In Lab					
Date Collected	Site ID	Number of Containers	Collected by (Initials)	Date Received	Site ID	Number of Containers	Internal and External Labels Match?	Received By (Initials)	Sample Condition/Notes
4/4/16	MP31	1	KB/CR						
4/4/16	MP31-REP	1	KB/CR						
4/20/16	MP124A	2	EW/CR						
4/20/16	MP51	1	EW/CR						
4/19/16	MP109A	2	JS/OV						
4/22/16	MP25	1	KB/JT						
4/14/16	MP112A	2	JS/CR						
4/18/16	MP50	2	JS/CR						
3/29/16	MP117A	2	JS/CR						
3/29/16	MP117A-REP	1	JS/CR						
4/19/16	LP09A	1	KB/JT						
	TOTAL:	16 CONTAINERS							

Relinquished By: [signature]	Date & Time: 5/9/16 10:15AM	Received By: [signature]	Date & Time: 5/9/16 10:15am
Relinquished By:	Date & Time:	Received By:	Date & Time:

AA Co. DPW
SPRING 2016
BIO ASSESSMENT

CEI - Box 5 of 6

Benthic Sample Log-in									
In Field				In Lab					
Date Collected	Site ID	Number of Containers	Collected by (Initials)	Date Received	Site ID	Number of Containers	Internal and External Labels Match?	Received By (Initials)	Sample Condition/Notes
4/15/16	MP118A	2	JS/JA						
4/15/16	MP126A	2	CR/JT						
3/31/16	MP39-REP	1	EW/OV						
4/15/16	MP05	1	CR/JT						
	TOTAL:	6 CONTAINERS							

Relinquished By:	Date & Time: 5/9/16 10:15 AM	Received By:	Date & Time: 5/9/16 10:15 am
Relinquished By:	Date & Time:	Received By:	Date & Time:

AA Co. DPW
SPRING 2016
BIO ASSESSMENT

CE1 - Box 6 of 6

Benthic Sample Log-in									
In Field				In Lab					
Date Collected	Site ID	Number of Containers	Collected by (Initials)	Date Received	Site ID	Number of Containers	Internal and External Labels Match?	Received By (Initials)	Sample Condition/Notes
4/14/16	MP26	2	JS/CR						
4/14/16	MP92A	2	JS/CR						
4/15/16	MP53	1	CR/JT						
	TOTAL:	5 CONTAINERS							

Relinquished By: Ellen Wain	Date & Time: 5/9/16 10:15 AM	Received By: K Merrill	Date & Time: 5/9/16 10:15 am
Relinquished By: K Merrill	Date & Time: 5/9/16 10:	Received By:	Date & Time:

BIOHABITATS CHAIN OF CUSTODY

Biohabitats, Inc.
2081 Clipper Park Road
Baltimore, MD 21211
410-554-0156

Biohabitats

Client: AA CO DPW	Project Manager: Mike Thompson	Contact Name: Melissa Harlinski
Project: 2016 Biological Monitoring		Contact Information:

Site ID Code	Crew	Date	Time	# of Sample Containers	Notes/Sample Type:
[redacted]					
MP 36	GZ/JP	3/31/16	12:30	2	
MP 34	GZ/JP	3/31/16	3:15	1	
MP 35	GZ/JP	3/31/16	9:15	1	

Comments:

Relinquished By:	Date & Time:	Received By:	Date & Time
	4/26/16 4:40 PM		4/26/16 4:40 pm
	4/28/16 4:29pm		4/28/16 4:29PM
	5/9/16 10:15 AM	K Merriel	5/9/16 10:15 am

BIOHABITATS CHAIN OF CUSTODY

Biohabitats, Inc.
2081 Clipper Park Road
Baltimore, MD 21211
410-554-0156

Biohabitats

Client: AA Co DPW	Project Manager: Mike Thompson	Contact Name: Melissa Harlinski
Project: 2016 Bioassessment		Contact Information:

Site ID Code	Crew	Date	Time	# of Sample Containers	Notes/Sample Type:
MP 64	MWT/JCR	4/6/16	11:11	3	
MP 57	MWT/JP	4/21/16	1:50	3	
MP 19	MWT/KT	4/13/16	2:43	1	
MP 132 A	MWT/JP	4/21/16	11:42	1	
MP 80 A	MWT/KT	4/13/16	12:27	2	
MP 139 A	MWT/KT	4/13/16	10:00	1	
MP 139 A Rep	MWT/KT	4/13/16	9:58	2	
MP 129 A	MWT/JP	4/21/16	10:05	2	
MP 64 Rep	MWT/JCR	4/6/16	11:11	2	
MP 60	MWT/JCR	4/6/16	14:02	1	
MP 62	MWT/KT	3/25/16	12:16	1	
MP 61	MWT/KT	3/25/16	14:01	2	
MP 33	MWT/KT	3/25/16	10:18	2	

Comments:

Relinquished By:	Date & Time:	Received By:	Date & Time
	4/28/16 4:29pm		4/28/16 4:29PM
	5/9/16 10:15 AM		
			5/9/16 10:15 am

BIOHABITATS CHAIN OF CUSTODY
Biohabitats, Inc.
2081 Clipper Park Road
Baltimore, MD 21211
410-554-0156

Biohabitats

Client: AACO DPW	Project Manager: M.K. Thompson	Contact Name: Melissa Havlinski
Project: 2016 Biological Monitoring		Contact Information:

Site ID Code	Crew	Date	Time	# of Sample Containers	Notes/Sample Type:
MP134 A	JCR/GZ	4/14/16	4:30	3	
MP 38	JCR/JP	4/25/16	13:18	2	
MP97A	JCR/JP	4/25/16	15:44	2	
MP22	GZ/JCR	4/14/16	2:00	3	
~~MP89A~~ MP98A	GZ/JCR	4/14/16	11:50	2	
MP103A	~~GZ~~ JCR/JP	4/25/16	10:58	2	

Comments:

Relinquished By:	Date & Time:	Received By:	Date & Time
	4/26/16 16:40		4/26/16 4:40pm
	4/28/16 4:29 PM		4/28/16 4:29 PM
	5/9/16 10:15 AM		5/9/16 10:15 AM

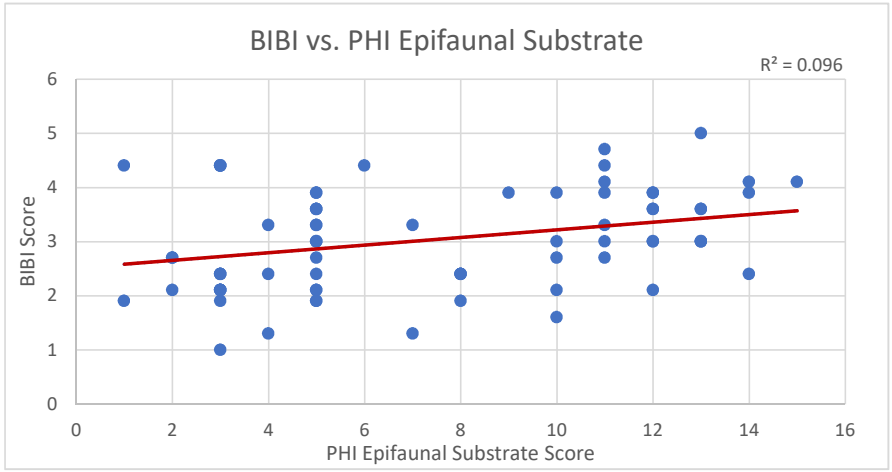
APPENDIX J –
INTEGRATED ASSESSMENT

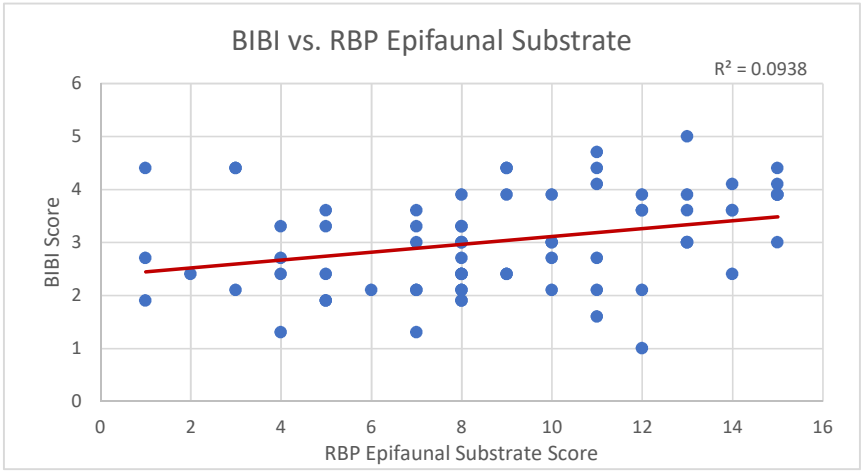
Pearson Correlation Coeffecient	*BIBI*	*PHI*	*RBP*	*Instream Habitat*	*Epifaunal Substrate*	*Velocity/Depth Diversity*	*Pool/ Glide/Eddy Quality*	*Bank Stability*	*Embeddedness (%)*	*Shading (%)*	*Remoteness Score*	*Aesthetic Rating (Trash)*	*# Woody Debris & Rootwads*	*Drainage Area (acres)*	*Impervious Area (acres)*	*Impervious Percentage*	*pH Average*	*Temperature °C Average*	*DO (mg/L) Average*	*Conductivity (uS/cm) Average*	*TDS (mg/L) Average*	*Turbidity (NTU) Average**	*Number of Taxa Score*	*Number of EPT Taxa Score*	*Number of Ephemeroptera Taxa Score*	*Percent Intolerant to Urban Stressors Score*	*Percent Ephemeroptera Taxa Score*	*Number of Scraper Taxa Score*	*Percent Climbers Score*	*Epifaunal Substrate/Available Cover*	*Pool Substrate Characterization*	*Pool Variability*	*Sediment Deposition*	*Channel Flow Status*	*Channel Alteration*	*Channel Sinuosity*	*Bank Stability - Left Bank*	*Bank Stability - Right Bank*	*Vegetative Protection - Left Bank*	*Vegetative Protection - Right Bank*	*Riparian Vegetative Zone Width - Left Bank*	*Riparian Vegetative Zone Width - Right Bank*
BIBI	**1.000**																																								
PHI	**0.427**	**1.000**																																								
RBP	**0.507**	**0.635**	**1.000**																																						
Instream Habitat	**0.403**	**0.752**	**0.697**	**1.000**																																					
Epifaunal Substrate	**0.310**	**0.630**	**0.562**	**0.761**	**1.000**																																				
Velocity/Depth Diversity	**0.460**	**0.534**	**0.671**	**0.650**	**0.565**	**1.000**																																			
Pool/ Glide/Eddy Quality	**0.461**	**0.412**	**0.587**	**0.611**	**0.539**	**0.681**	**1.000**																																		
Bank Stability	**0.546**	**0.508**	**0.559**	**0.308**	0.128	**0.312**	0.123	**1.000**																																	
Embeddedness (%)	-0.016	-0.131	0.010	-0.099	-0.174	0.038	0.144	-0.077	**1.000**																																	
Shading (%)	0.024	0.202	-0.001	0.073	0.086	-0.011	-0.054	-0.089	0.027	**1.000**																																
Remoteness Score	0.107	**0.440**	0.223	0.138	-0.036	0.120	0.069	0.245	-0.170	-0.112	**1.000**																															
Aesthetic Rating (Trash)	0.277	0.101	0.216	0.016	-0.022	0.148	0.154	0.128	-0.097	-0.167	0.202	**1.000**																														
# Woody Debris & Rootwads	0.252	**0.394**	0.111	0.223	0.067	0.205	0.188	0.157	0.214	0.029	0.009	0.036	**1.000**																													
Drainage Area (acres)	**0.408**	-0.049	0.145	-0.051	-0.055	0.284	**0.408**	0.222	0.286	-0.272	-0.043	0.204	0.135	**1.000**																												
Impervious Area (acres)	**0.407**	-0.063	0.138	-0.061	-0.064	0.249	**0.375**	0.225	**0.323**	**-0.312**	-0.077	0.190	0.174	**0.986**	**1.000**																												
Impervious Percentage	-0.264	-0.062	-0.091	-0.030	-0.146	-0.072	-0.147	-0.036	0.154	0.014	-0.171	-0.209	0.214	-0.108	-0.020	**1.000**																											
pH Average	0.000	-0.185	-0.049	-0.128	-0.209	0.037	0.015	-0.030	-0.045	-0.244	0.066	-0.010	-0.154	0.159	0.158	0.012	**1.000**																										
Temperature °C Average	-0.159	-0.038	-0.112	-0.078	0.070	-0.028	-0.083	0.010	0.146	-0.186	-0.033	-0.098	-0.104	0.039	0.068	0.109	**0.355**	**1.000**																									
DO (mg/L) Average	0.180	-0.205	0.117	-0.169	-0.139	-0.145	0.031	0.113	0.018	-0.187	-0.021	0.232	-0.238	0.200	0.166	**-0.404**	0.186	-0.245	**1.000**																							
Conductivity (uS/cm) Average	-0.270	-0.103	-0.154	-0.131	-0.106	-0.019	-0.104	-0.059	0.013	-0.061	-0.105	-0.102	0.091	-0.049	0.014	**0.783**	-0.037	0.180	**-0.487**	**1.000**																					
TDS (mg/L) Average	**-0.390**	-0.259	-0.152	-0.217	-0.182	-0.158	-0.169	-0.147	0.057	-0.174	-0.115	-0.096	-0.120	-0.048	0.009	**0.718**	0.039	0.126	-0.240	**0.876**	**1.000**																				
Turbidity (NTU) Average*	**-0.393**	**-0.411**	**-0.379**	**-0.366**	**-0.398**	**-0.418**	**-0.334**	**-0.304**	0.239	-0.102	-0.032	-0.216	-0.244	-0.005	-0.001	0.010	0.171	0.288	0.016	-0.053	0.101	**1.000**																			
Number of Taxa Score	**0.581**	0.185	0.159	0.164	0.102	0.076	0.165	0.263	0.142	0.208	-0.071	-0.054	0.191	0.146	0.178	-0.116	-0.027	0.066	0.003	-0.148	-0.223	-0.192	**1.000**																		
Number of EPT Taxa Score	**0.762**	**0.300**	**0.393**	0.264	0.262	**0.383**	**0.330**	**0.336**	-0.130	0.098	0.023	0.166	0.136	0.241	0.217	-0.289	0.051	-0.239	0.159	-0.249	**-0.385**	-0.290	**0.305**	**1.000**																	
Number of Ephemeroptera Taxa Score	**0.797**	0.279	**0.431**	0.285	0.124	**0.425**	**0.405**	**0.594**	-0.025	-0.137	0.081	0.283	0.237	**0.428**	**0.428**	-0.108	0.069	-0.104	0.164	-0.093	-0.209	-0.276	**0.382**	**0.508**	**1.000**																
Percent Intolerant to Urban Stressors Score	**0.445**	0.247	0.287	0.207	0.149	0.147	0.132	**0.368**	-0.101	-0.022	0.094	0.073	0.002	0.080	0.074	-0.230	-0.174	-0.183	0.152	-0.239	-0.298	-0.257	0.135	**0.488**	0.173	**1.000**															
Percent Ephemeroptera Taxa Score	**0.681**	**0.308**	**0.504**	**0.350**	0.286	**0.501**	**0.471**	**0.530**	-0.010	**-0.324**	0.106	**0.300**	0.143	**0.453**	**0.448**	-0.154	0.092	-0.017	0.203	-0.120	-0.175	**-0.344**	0.235	**0.410**	**0.847**	0.192	**1.000**														
Number of Scraper Taxa Score	**0.685**	0.228	0.165	0.209	0.156	0.229	0.296	0.155	0.015	0.078	0.111	0.224	0.265	0.270	0.282	-0.125	-0.013	-0.145	0.079	-0.174	-0.242	**-0.304**	**0.381**	**0.372**	**0.396**	0.124	0.278	**1.000**													
Percent Climbers Score	**0.580**	**0.384**	**0.330**	0.290	0.217	0.282	0.220	**0.337**	0.052	0.207	0.173	0.166	0.190	0.202	0.194	-0.150	0.046	-0.072	0.036	-0.191	-0.249	-0.101	**0.342**	**0.363**	**0.355**	-0.096	0.221	**0.477**	**1.000**												
Epifaunal Substrate/Available Cover	**0.306**	**0.651**	**0.686**	**0.855**	**0.804**	**0.684**	**0.572**	0.193	-0.034	0.103	0.054	-0.051	0.185	-0.090	-0.106	-0.013	-0.083	-0.018	-0.220	-0.081	-0.136	**-0.387**	0.104	0.275	0.155	0.174	0.277	0.122	0.166	**1.000**											
Pool Substrate Characterization	**0.438**	**0.489**	**0.730**	**0.663**	**0.579**	**0.604**	**0.508**	**0.338**	-0.143	-0.078	0.173	0.030	0.000	0.046	0.040	-0.149	0.113	-0.066	0.114	-0.181	-0.172	**-0.352**	0.227	**0.379**	**0.342**	0.260	**0.464**	0.155	0.181	**0.664**	**1.000**									
Pool Variability	**0.360**	0.265	**0.608**	**0.455**	**0.376**	**0.594**	**0.763**	0.115	0.075	-0.091	0.087	0.199	-0.054	**0.392**	**0.360**	-0.130	0.086	-0.145	0.215	-0.105	-0.008	-0.245	0.045	0.260	**0.308**	0.125	**0.408**	0.210	0.174	**0.436**	**0.533**	**1.000**								
Sediment Deposition	0.298	**0.504**	**0.719**	**0.559**	**0.606**	**0.599**	**0.491**	0.209	-0.234	0.008	0.177	0.122	-0.058	-0.001	-0.025	-0.125	0.101	-0.088	0.080	-0.119	-0.067	-0.299	0.011	**0.302**	0.198	0.147	**0.346**	0.110	0.200	**0.617**	**0.658**	**0.590**	**1.000**							
Channel Flow Status	0.250	0.174	**0.375**	0.161	0.154	0.287	0.297	0.229	0.257	-0.159	0.081	0.064	0.158	**0.437**	**0.458**	-0.055	-0.109	-0.020	0.012	-0.109	-0.088	0.145	0.094	0.167	0.129	0.268	0.163	0.039	0.222	0.221	0.154	0.232	0.139	**1.000**						
Channel Alteration	0.221	0.293	**0.490**	0.274	0.155	0.180	0.175	**0.352**	0.184	0.044	0.090	0.175	0.101	0.066	0.072	-0.019	0.174	-0.011	**0.351**	-0.288	-0.254	-0.172	-0.091	0.258	0.156	0.040	0.213	0.139	0.285	0.192	0.218	0.148	0.266	0.058	**1.000**					
Channel Sinuosity	0.122	**0.398**	**0.605**	**0.454**	**0.326**	0.190	0.261	0.177	-0.123	0.161	0.169	0.072	-0.014	-0.281	-0.299	-0.009	-0.184	-0.143	-0.006	-0.100	-0.069	-0.131	-0.007	0.235	0.066	0.183	0.090	-0.130	0.100	**0.417**	**0.403**	0.207	**0.438**	0.083	0.284	**1.000**				
Bank Stability - Left Bank	**0.426**	**0.364**	**0.565**	0.237	0.057	0.241	0.155	**0.787**	-0.016	-0.055	0.094	0.245	0.148	0.164	0.165	-0.082	-0.120	-0.097	0.114	-0.039	-0.141	**-0.330**	0.190	0.271	**0.483**	**0.304**	**0.435**	0.094	0.264	0.143	0.254	0.104	0.190	0.211	**0.390**	0.289	**1.000**			
Bank Stability - Right Bank	**0.403**	**0.364**	**0.586**	0.241	0.109	0.251	0.089	**0.817**	-0.025	-0.064	0.101	0.172	0.127	0.170	0.174	-0.027	-0.128	-0.095	0.198	-0.020	-0.076	-0.254	0.169	0.273	**0.449**	0.287	**0.414**	0.076	0.270	0.126	0.299	0.072	0.194	0.197	**0.443**	0.257	**0.838**	**1.000**		
Vegetative Protection - Left Bank	**0.319**	0.295	**0.663**	**0.353**	**0.341**	**0.353**	0.286	**0.401**	0.051	0.005	0.038	0.244	0.043	-0.011	-0.004	-0.014	-0.192	-0.106	-0.004	0.033	0.025	**-0.325**	0.151	0.123	**0.302**	0.061	0.275	0.226	0.257	**0.393**	**0.335**	**0.310**	**0.370**	0.100	0.213	0.288	**0.484**	**0.463**	**1.000**	
Vegetative Protection - Right Bank	0.265	0.249	**0.605**	0.284	**0.327**	**0.319**	0.236	**0.386**	0.033	-0.050	-0.002	0.172	0.037	0.014	0.025	0.031	-0.208	-0.055	-0.018	0.141	0.152	**-0.315**	0.155	0.095	0.260	0.051	0.261	0.163	0.165	**0.342**	0.300	0.238	**0.327**	0.062	0.144	0.271	**0.415**	**0.518**	**0.929**	**1.000**	
Riparian Vegetative Zone Width - Left Bank	0.169	0.208	**0.346**	0.073	-0.010	0.202	0.049	0.294	0.145	-0.003	0.184	0.107	0.219	0.160	0.179	0.015	0.026	0.005	0.092	-0.140	-0.220	-0.107	0.068	0.073	0.232	0.197	0.260	0.014	0.024	0.030	0.083	0.071	0.086	0.224	0.244	0.068	0.179	0.257	0.156	0.086	**1.000**	
Riparian Vegetative Zone Width - Right Bank	0.162	0.267	0.226	0.010	-0.128	0.001	-0.126	0.278	0.029	0.105	**0.324**	0.255	0.240	-0.004	0.025	0.044	0.033	0.084	0.014	0.007	-0.074	-0.064	0.145	0.085	0.228	0.090	0.125	-0.059	0.179	-0.096	0.025	-0.136	-0.132	0.023	0.200	0.167	0.183	0.238	0.145	0.154	**0.549**	**1.000**

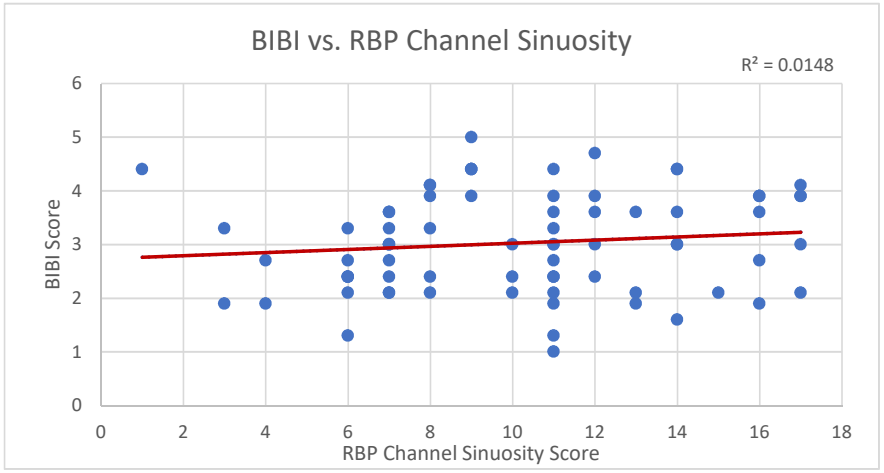
R^2 Values	BIBI	PHI	RBP	Instream Habitat	Epifaunal Substrate	Velocity/Depth Diversity	Pool/ Glide/Eddy Quality	Bank Stability	Embeddedness (%)	Shading (%)	Remoteness Score	Aesthetic Rating (Trash)	# Woody Debris & Rootwads	Drainage Area (acres)	Impervious Area (acres)	Impervious Percentage	Ph Average	Temperature °C Average	DO (mg/L) Average	Conductivity (uS/cm) Average	TDS (mg/L) Average	Turbidity (NTU) Average*	Number of Taxa Score	Number of EPT Taxa Score	Number of Ephemeroptera Taxa Score	Percent Intolerant to Urban Stressors Score	Percent Ephemeroptera Taxa Score	Number of Scraper Taxa Score	Percent Climbers Score	Epifaunal Substrate/Available Cover	Pool Substrate Characterization	Pool Variability	Sediment Deposition	Channel Flow Status	Channel Alteration	Channel Sinuosity	Bank Stability - Left Bank	Bank Stability - Right Bank	Vegetative Protection - Left Bank	Vegetative Protection - Right Bank	Riparian Vegetative Zone Width - Left Bank	Riparian Vegetative Zone Width - Right Bank
BIBI	**1.000**																																									
PHI	0.182	**1.000**																																									
RBP	0.257	0.403	**1.000**																																							
Instream Habitat	0.162	0.566	0.486	**1.000**																																							
Epifaunal Substrate	0.096	0.397	0.316	0.579	**1.000**																																						
Velocity/Depth Diversity	0.212	0.285	0.451	0.422	0.319	**1.000**																																					
Pool/ Glide/Eddy Quality	0.213	0.169	0.345	0.373	0.291	0.464	**1.000**																																				
Bank Stability	0.298	0.258	0.312	0.095	0.016	0.097	0.015	**1.000**																																			
Embeddedness (%)	0.000	0.017	0.000	0.010	0.030	0.001	0.021	0.006	**1.000**																																		
Shading (%)	0.001	0.041	0.000	0.005	0.007	0.000	0.003	0.008	0.001	**1.000**																																	
Remoteness Score	0.011	0.194	0.050	0.019	0.001	0.014	0.005	0.060	0.029	0.013	**1.000**																																
Aesthetic Rating (Trash)	0.077	0.010	0.047	0.000	0.000	0.022	0.024	0.016	0.009	0.028	0.041	**1.000**																															
# Woody Debris & Rootwads	0.064	0.155	0.012	0.050	0.004	0.042	0.035	0.025	0.046	0.001	0.000	0.001	**1.000**																														
Drainage Area (acres)	0.166	0.002	0.021	0.003	0.003	0.081	0.166	0.049	0.082	0.074	0.002	0.041	0.018	**1.000**																													
Impervious Area (acres)	0.166	0.004	0.019	0.004	0.004	0.062	0.141	0.051	0.104	0.097	0.006	0.036	0.030	**0.973**	**1.000**																												
Impervious Percentage	0.070	0.004	0.008	0.001	0.021	0.005	0.022	0.001	0.024	0.000	0.029	0.044	0.046	0.012	0.000	**1.000**																											
Ph Average	0.000	0.034	0.002	0.016	0.044	0.001	0.000	0.001	0.002	0.059	0.004	0.000	0.024	0.025	0.025	0.000	**1.000**																										
Temperature °C Average	0.025	0.001	0.012	0.006	0.005	0.001	0.007	0.000	0.021	0.034	0.001	0.010	0.011	0.002	0.005	0.012	0.126	**1.000**																									
DO (mg/L) Average	0.032	0.042	0.014	0.029	0.019	0.021	0.001	0.013	0.000	0.035	0.000	0.054	0.057	0.040	0.027	0.163	0.035	0.060	**1.000**																								
Conductivity (uS/cm) Average	0.073	0.011	0.024	0.017	0.011	0.000	0.011	0.004	0.000	0.004	0.011	0.010	0.008	0.002	0.000	0.612	0.001	0.032	0.237	**1.000**																					
TDS (mg/L) Average	0.152	0.067	0.023	0.047	0.033	0.025	0.029	0.022	0.003	0.030	0.013	0.009	0.015	0.002	0.000	0.516	0.002	0.016	0.058	**0.767**	**1.000**																				
Turbidity (NTU) Average*	0.155	0.169	0.144	0.134	0.159	0.175	0.111	0.092	0.057	0.010	0.001	0.047	0.060	0.000	0.000	0.000	0.029	0.083	0.000	0.003	0.010	**1.000**																			
Number of Taxa Score	0.338	0.034	0.025	0.027	0.010	0.006	0.027	0.069	0.020	0.043	0.005	0.003	0.036	0.021	0.032	0.013	0.001	0.004	0.000	0.022	0.050	0.037	**1.000**																		
Number of EPT Taxa Score	0.581	0.090	0.155	0.070	0.069	0.147	0.109	0.113	0.017	0.010	0.001	0.027	0.019	0.058	0.047	0.083	0.003	0.057	0.025	0.062	0.148	0.084	0.093	**1.000**																	
Number of Ephemeroptera Taxa Score	0.635	0.078	0.186	0.081	0.015	0.180	0.164	0.353	0.001	0.019	0.007	0.080	0.056	0.183	0.183	0.012	0.005	0.011	0.027	0.009	0.044	0.076	0.146	0.258	**1.000**																
Percent Intolerant to Urban Stressors Score	0.198	0.061	0.082	0.043	0.022	0.022	0.017	0.135	0.010	0.001	0.009	0.005	0.000	0.006	0.006	0.053	0.030	0.033	0.023	0.057	0.089	0.066	0.018	0.238	0.030	**1.000**															
Percent Ephemeroptera Taxa Score	0.463	0.095	0.254	0.122	0.082	0.251	0.222	0.281	0.000	0.105	0.011	0.090	0.020	0.205	0.200	0.024	0.008	0.000	0.041	0.014	0.030	0.118	0.055	0.168	0.717	0.037	**1.000**													
Number of Scraper Taxa Score	0.469	0.052	0.027	0.044	0.024	0.052	0.087	0.024	0.000	0.006	0.012	0.050	0.070	0.073	0.079	0.016	0.000	0.021	0.006	0.030	0.059	0.092	0.145	0.138	0.157	0.015	0.077	**1.000**												
Percent Climbers Score	0.337	0.148	0.109	0.084	0.047	0.080	0.049	0.114	0.003	0.043	0.030	0.027	0.036	0.041	0.038	0.022	0.002	0.005	0.001	0.036	0.062	0.010	0.117	0.132	0.126	0.009	0.049	0.227	**1.000**											
Epifaunal Substrate/Available Cover	0.094	0.424	0.471	0.732	0.647	0.468	0.327	0.037	0.001	0.011	0.003	0.003	0.034	0.008	0.011	0.000	0.007	0.000	0.048	0.007	0.018	0.150	0.011	0.076	0.024	0.030	0.077	0.015	0.028	**1.000**									
Pool Substrate Characterization	0.192	0.239	0.533	0.440	0.336	0.365	0.258	0.114	0.020	0.006	0.030	0.001	0.000	0.002	0.002	0.022	0.013	0.004	0.013	0.033	0.030	0.124	0.052	0.144	0.117	0.068	0.216	0.024	0.033	0.441	**1.000**								
Pool Variability	0.129	0.070	0.370	0.207	0.142	0.353	0.582	0.013	0.006	0.008	0.008	0.039	0.003	0.153	0.130	0.017	0.007	0.021	0.046	0.011	0.000	0.060	0.002	0.068	0.095	0.016	0.166	0.044	0.030	0.190	0.284	**1.000**							
Sediment Deposition	0.089	0.254	0.517	0.312	0.368	0.358	0.241	0.044	0.055	0.000	0.031	0.015	0.003	0.000	0.001	0.016	0.010	0.008	0.006	0.014	0.004	0.089	0.000	0.091	0.039	0.022	0.120	0.012	0.040	0.381	0.433	0.348	**1.000**						
Channel Flow Status	0.062	0.030	0.141	0.026	0.024	0.082	0.088	0.052	0.066	0.025	0.007	0.004	0.025	0.191	0.210	0.003	0.012	0.000	0.000	0.012	0.008	0.021	0.009	0.028	0.017	0.072	0.026	0.002	0.049	0.049	0.024	0.054	0.019	**1.000**					
Channel Alteration	0.049	0.086	0.240	0.075	0.024	0.032	0.031	0.124	0.034	0.002	0.008	0.031	0.010	0.004	0.005	0.000	0.030	0.000	0.123	0.083	0.064	0.030	0.008	0.066	0.024	0.002	0.046	0.019	0.081	0.037	0.047	0.022	0.070	0.003	**1.000**				
Channel Sinuosity	0.015	0.159	0.366	0.206	0.107	0.036	0.068	0.031	0.015	0.026	0.029	0.005	0.000	0.079	0.090	0.000	0.034	0.021	0.000	0.010	0.005	0.017	0.000	0.055	0.004	0.033	0.008	0.017	0.010	0.174	0.163	0.043	0.192	0.007	0.081	**1.000**			
Bank Stability - Left Bank	0.181	0.133	0.320	0.056	0.003	0.058	0.024	0.619	0.000	0.003	0.009	0.060	0.022	0.027	0.027	0.007	0.014	0.009	0.013	0.002	0.020	0.109	0.036	0.074	0.233	0.092	0.189	0.009	0.070	0.021	0.064	0.011	0.036	0.045	0.152	0.084	**1.000**		
Bank Stability - Right Bank	0.163	0.133	0.344	0.058	0.012	0.063	0.008	0.668	0.001	0.004	0.010	0.029	0.016	0.029	0.030	0.001	0.017	0.009	0.039	0.000	0.006	0.065	0.029	0.074	0.201	0.082	0.171	0.006	0.073	0.016	0.090	0.005	0.038	0.039	0.196	0.066	0.703	**1.000**	
Vegetative Protection - Left Bank	0.102	0.087	0.440	0.125	0.116	0.124	0.082	0.161	0.003	0.000	0.001	0.060	0.002	0.000	0.000	0.000	0.037	0.011	0.000	0.001	0.001	0.106	0.023	0.015	0.091	0.004	0.076	0.051	0.066	0.154	0.113	0.096	0.137	0.010	0.045	0.083	0.234	0.215	**1.000**	
Vegetative Protection - Right Bank	0.070	0.062	0.365	0.081	0.107	0.102	0.056	0.149	0.001	0.002	0.000	0.030	0.001	0.000	0.001	0.001	0.043	0.003	0.000	0.020	0.023	0.099	0.024	0.009	0.068	0.003	0.068	0.027	0.027	0.117	0.090	0.057	0.107	0.004	0.021	0.074	0.172	0.268	**0.862**	**1.000**
Riparian Vegetative Zone Width - Left Bank	0.029	0.043	0.120	0.005	0.000	0.041	0.002	0.086	0.021	0.000	0.034	0.011	0.048	0.025	0.032	0.000	0.001	0.000	0.008	0.020	0.048	0.011	0.005	0.005	0.054	0.039	0.067	0.000	0.001	0.001	0.007	0.005	0.007	0.050	0.059	0.005	0.032	0.066	0.024	0.007	**1.000**
Riparian Vegetative Zone Width - Right Bank	0.026	0.071	0.051	0.000	0.016	0.000	0.016	0.077	0.001	0.011	0.105	0.065	0.057	0.000	0.001	0.002	0.001	0.007	0.000	0.000	0.006	0.004	0.021	0.007	0.052	0.008	0.016	0.003	0.032	0.009	0.001	0.018	0.017	0.001	0.040	0.028	0.033	0.056	0.021	0.024	0.301	**1.000**

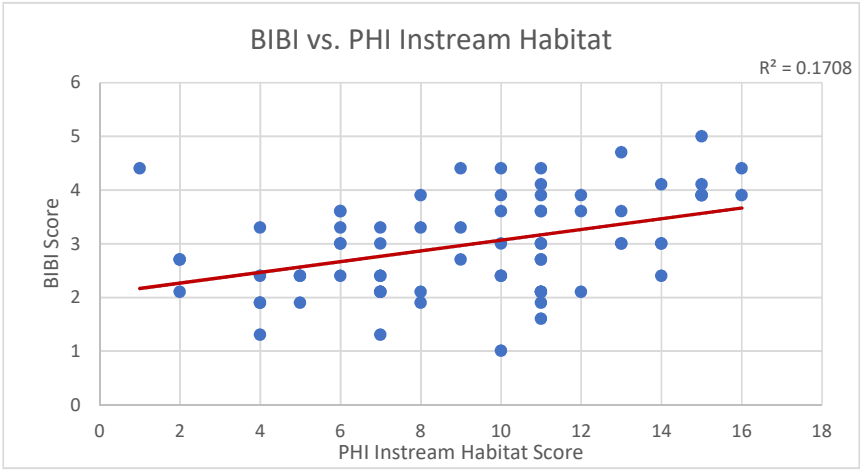
APPENDIX K –
SUPPLEMENTAL GRAPHING ANALYSIS

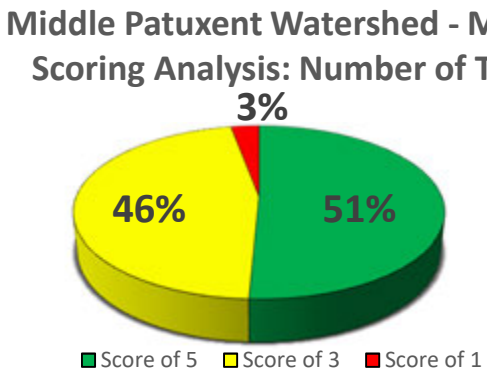
APPENDIX K: SUPPLEMENTAL GRAPHING ANALYSIS

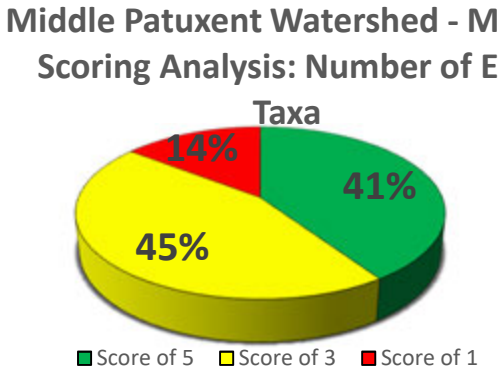


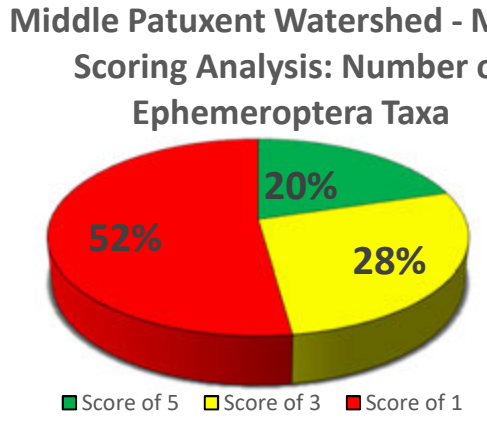


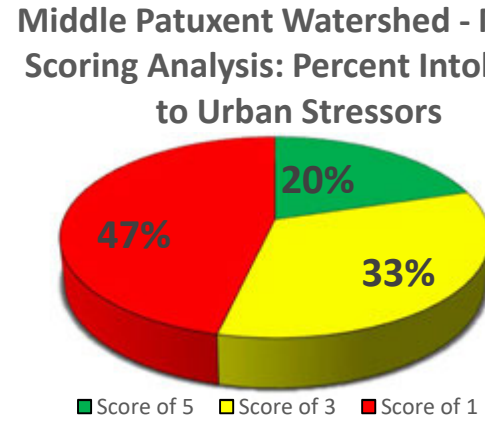


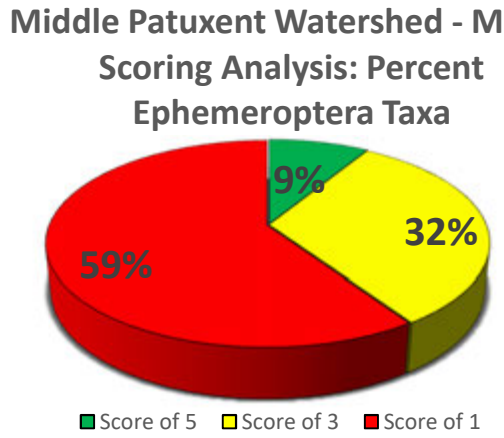


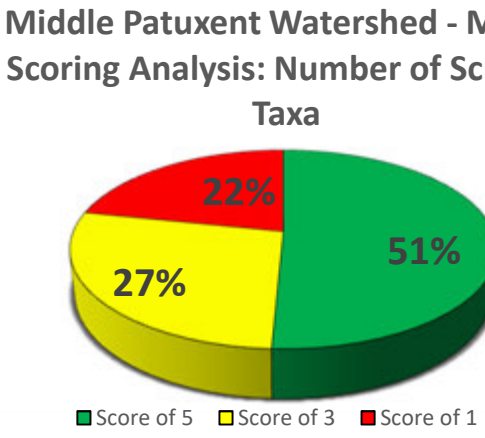

Middle Patuxent Watershed - Metric Scoring Analysis: Number of Taxa
3%
46%
51%
Score of 5
Score of 3
Score of 1

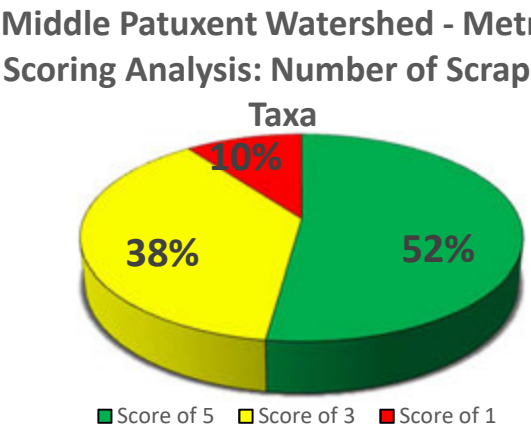

Middle Patuxent Watershed - Metric Scoring Analysis: Number of EPT Taxa
14%
41%
45%
Score of 5
Score of 3
Score of 1


Middle Patuxent Watershed - Metric Scoring Analysis: Number of Ephemeroptera Taxa
20%
52%
28%
Score of 5
Score of 3
Score of 1

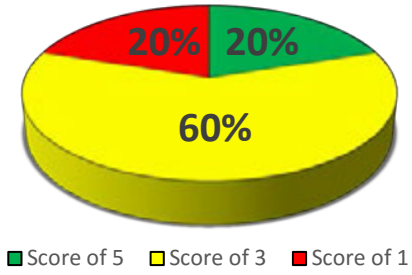

Middle Patuxent Watershed - Metric Scoring Analysis: Percent Intolerant to Urban Stressors
20%
47%
33%
Score of 5
Score of 3
Score of 1


Middle Patuxent Watershed - Metric Scoring Analysis: Percent Ephemeroptera Taxa
9%
32%
59%
Score of 5
Score of 3
Score of 1

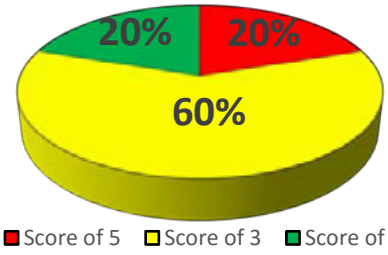

Middle Patuxent Watershed - Metric Scoring Analysis: Number of Scraper Taxa
22%
51%
27%
Score of 5
Score of 3
Score of 1


Middle Patuxent Watershed - Metric Scoring Analysis: Number of Scraper Taxa
10%
38%
52%
Score of 5
Score of 3
Score of 1

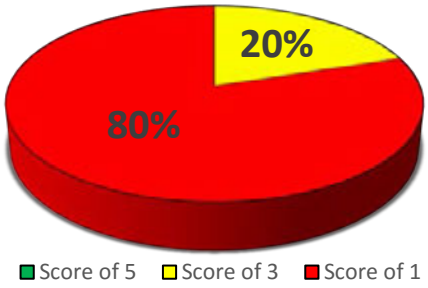
Lower Patuxent Watershed - Metric Scoring Analysis: Number of Taxa



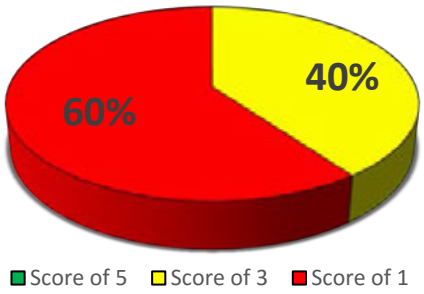
Lower Patuxent Watershed - Metric Scoring Analysis: Number of EPT Taxa



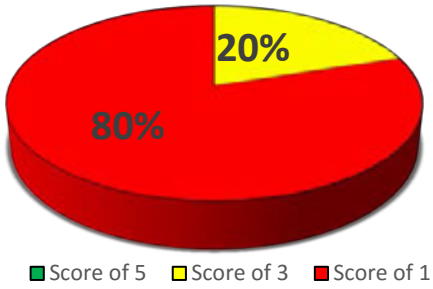
Lower Patuxent Watershed - Metric Scoring Analysis: Number of Ephemeroptera Taxa



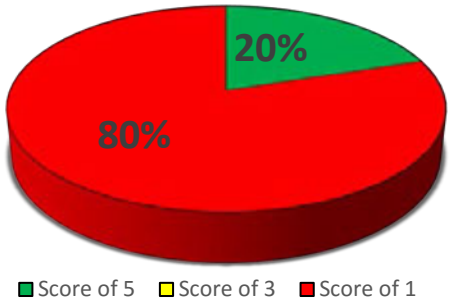
Lower Patuxent Watershed - Metric Scoring Analysis: Percent Intolerant to Urban Stressors



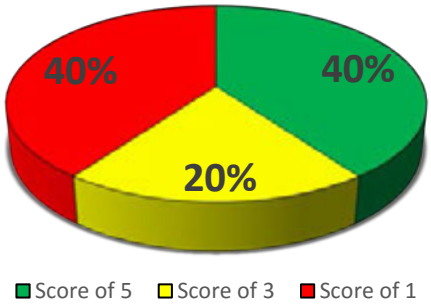
Lower Patuxent Watershed - Metric Scoring Analysis: Percent Ephemeroptera Taxa



Lower Patuxent Watershed - Metric Scoring Analysis: Number of Scraper Taxa



Lower Patuxent Watershed - Metric Scoring Analysis: Number of Scraper Taxa



APPENDIX C – PARCEL SCALE ASSESSMENT AND RATING TECHNICAL MEMORANDUM

KCI TECHNOLOGIES

TECHNICAL MEMORANDUM

TO:	Raghavenderrao Badami, Anne Arundel County
FROM:	Susanna Brellis, KCI Technologies, Inc. Mike Pieper, KCI Technologies, Inc.
DATE:	May 21, 2018
SUBJECT:	Herring Bay, Middle, and Lower Patuxent Watershed Assessment Parcel Scale Assessment and Rating

INTRODUCTION

Beginning with the Severn River Watershed Study, Anne Arundel County has included watershed protection and preservation as a key item into each of the completed watershed studies and management plans. Currently, the County is completing its final watershed study, which covers the Herring Bay, Middle Patuxent, and Lower Patuxent watersheds. The County understands that while watershed restoration, treatment of impervious surfaces, and reducing pollutant loads are extremely important objectives, just as important is managing land use effectively and preserving the County's natural resources including wetlands, high quality streams, forests, and estuaries. Each watershed study has utilized a quantitative method to prioritize areas for preservation using a series of indicators of watershed health incorporated into a scoring system such that each County subwatershed is prioritized and ranked relative to all of the other subwatersheds.

General land use conditions in the southern portions of Anne Arundel County differ from the northern and central portions of the County in that southern areas are less developed and overall there is more agricultural use and more forest present (see section 1.4.5 of the watershed assessment report for details). As a result, the amount of impervious surface in the southern areas is considerably less than in other parts of the County. Herring Bay's overall impervious surface coverage is 6.5% and the Middle Patuxent is 4.8% of the total watershed area. Because of these factors, the County recognizes that preservation is a critical factor in the Herring Bay, Middle and Lower Patuxent watersheds and has therefore emphasized those elements.

To supplement the subwatershed based preservation ranking used in all of the previous studies and the current study, KCI worked with the County to develop three separate but related prioritization models that identify areas at the parcel level. The prioritization models are being piloted in the current assessment for the study watersheds, with a future goal of potentially applying the methods across other watersheds across the County.

Three related prioritization models were identified for development:

1. Parcel Preservation: The goal of this model is to identify parcels with high ecological value that should be, but are not already preserved or protected.
2. Pervious to Forest: The goal of this model is to identify parcels that are good candidates for tree planting, including stream buffers, and areas of general reforestation.
3. Impervious to Pervious: The goal of this model is to identify impervious areas that are good candidates for impervious surface treatment either by removal or through stormwater management practices.

This memo includes the methods used to develop the models, and describes each indicator, including how the data were processed and used, and provides a summary of the results. Because the models are applied at the parcel scale there are thousands of results. It is impractical to include a list ranking all or even a meaningful portion of the outcome; therefore the results are summarized by watershed and by ranking category (High, Medium High, Medium, Low) and are presented in several maps. Mapping at a larger scale will also be included in the final watershed assessment report. GIS results files are delivered to the County for their use.

GENERAL METHOD

The prioritization models were developed with a procedure consisting of the following steps:

- Indicators: Choose three sets of indicators (one for each model), that characterize conditions for the specific model with a minimum of duplication within each set,
- Scoring: Quantify or score each indicator, preferably in a normalized fashion so that one parcel's score is directly compared with that of another, A 0-10 scale was used for each indicator where 0 indicates low priority for selection and 10 indicates high priority for selection.
- Weights: Weight the indicators against each other so that the ones that are most important in establishing the model outcome would have the highest consideration.

Indicator Selection

Indicators are specific measures of environmental, watershed, or parcel based features that have a relationship to the condition that the model is prioritizing for. These can include biological community data, forest resources, or wetland presence. Indicators are derived either from GIS analysis, modeling, or from field investigations.

The best data would fit the following criteria:

- Data has a predictable response or relationship to the model,
- Data is available watershed wide and applicable at the parcel scale,
- Data is developed following a standard method or protocol,
- Data is spatially variable and has a known watershed condition response,
- Data are not duplicative,
- Data is relatively current, and
- Data allows scoring either as an absolute value or as a normalized quantity with known or developable category breakpoints.

The indicator selection was initiated by reviewing several existing data sources including the County's available GIS resources, data developed during the watershed assessment including field data and model results, existing County planning products, and state GIS resources including data generated by the Maryland Department of Natural Resources.

An initial list of potential indicators was developed and qualitatively tested against the criteria listed above. A final list was derived that met the criteria and each selected indicator moved into the scoring phase.

Indicator Scoring

A prioritization ranking system can either be conducted using absolute values, with scoring against known category breakpoints, or it can be developed as a relative ranking system. The absolute version has the ability to determine which areas are in good condition or poor condition as compared to known values. A relative ranking compares the parcels against themselves and determines which ones have the greatest relative potential for the specific model.

As the prioritization was being developed it became clear that with a low development area such as the Herring Bay and Middle Patuxent, with generally homogeneous land use, and low imperviousness that a relative ranking would be the best method to discriminate between parcels. An absolute system would preclude many of the indicators from being used since the majority would fall in good ranges. In addition, a relative system would be consistent with existing County prioritization models (Subwatershed Restoration, Stream Restoration, and Subwatershed Preservation).

A relative system needs only a high end and low end of the indicator range to determine condition. The raw values are translated by either a natural breaks function, by established break points, or using a simple presence / absence approach to a score from 0-10. Specifics for each indicator are described below. Once the raw values for each indicator were scored the weight could be applied.

Indicator Weighting

The next step in developing the prioritization of each subwatershed is to determine weights for each of the indicators. By weighting the indicators against each other, the ones that are deemed the most important in establishing watershed condition or vulnerability are given the highest consideration. The weights were derived using a *Paired Comparison* technique which allows for a side by side comparisons of each indicator and is useful when trying to rank items that are numerous and complex. KCI's environmental scientists that have been working with the County on the project for the past year were given the opportunity to 'vote' using matrices of restoration indicators and protection indicators. The total number of selections was tabulated and a final weight was calculated by figuring the percentage that each indicator was selected out of all of the possible selections.

Final Ranking

Once the weighting factor was applied to the scores for each indicator for each parcel the total scope for each parcel was summed and the parcels ranked. At this point, select groups of parcels needed to be excluded from each of the models to eliminate including parcels that would not fit with the goal of the model (preservation, tree planting, impervious treatment). For example parcels that are already fully or partially preserved were eliminated from the parcel preservation model. More detail is provided in the following sections on parcels eliminated from the final ranking.

Finally, natural breaks were used to group the parcels into four categories labeled High, Medium High, Medium, and Low to be consistent with previous County prioritization models.

PARCEL PRESERVATION

Indicator Selection

The Parcel Preservation model used a series of indicators that describe various conditions of a parcel. The indicators are grouped into one of three categories: stream ecology, landscape, and aquatic living resources. Each indicator score is weighed and combined to obtain a single preservation rating for each parcel. Indicators evaluated and corresponding weights are listed in Table 1.

Table 1: Parcel Preservation Indicators and Weights

Category	Indicator	Weight
Stream Ecology	Bioassessment Score	8%
	Instream and Epifaunal Habitat Scores	11%
Aquatic Living Resources	Targeted Ecological Areas	10%
	Within Natural Heritage Area	5%
	Within Green Infrastructure Network	8%
Landscape	Forest within the 100 ft stream buffer (%)	17%
	Presence of Forest	9%
	Presence of Wetland	15%
	Proximity to Wetland	3%
	Presence of Headwater Streams	13%

Bioassessment Score

The Herring Bay watershed was sampled in 2005 as part of the County's Round 1 random sampling efforts, in 2010 as part of the County's Round 2 random sampling efforts, and in 2013 as part of the County's targeted sampling efforts. The Middle Patuxent watershed was sampled from 2004 to 2013 as part of the County's Round 1 and Round 2 random sampling efforts and targeted Middle Patuxent sites were also sampled by the County in 2016. Parcels that fell within drainage areas of sites that received a Benthic Index of Biotic Integrity (BIBI) score of "Good" received a score of 10. All parcels not within those drainage areas received a score of 0.

Instream and Epifaunal Habitat Scores

Instream habitat for the fish and benthic macroinvertebrate communities were scored during the Physical Habitat Condition Assessment conducted throughout the Herring Bay and Middle Patuxent watersheds during the winter of 2017/2018. Parcels containing a stream reach that was assigned instream and epifaunal habitat scores received prioritization scores according to Table 2.

Table 2: Instream and Epifaunal Habitat Scores

		In-Stream Habitat		
		Optimal	**Suboptimal**	**Marginal/Poor**
Epifaunal Habitat	**Optimal**	10	7.5	5
	Suboptimal	7.5	5	2.5
	Marginal/Poor	5	2.5	0

Targeted Ecological Areas

Targeted ecological areas (TEAs) are lands identified by the Maryland Department of Natural Resources (DNR) as having high ecological value and are conservation priorities for natural resource protection. Many components were considered to identify TEAs, including:

- Large, contiguous blocks of forests and wetlands and their connecting corridors, areas that support rare, threatened, and endangered species, rare plant and animal communities, species of Greatest Conservation Need, and wildlife concentrations,
- Areas of high aquatic biodiversity, Tier II regulated streams, and brook trout streams,
- Sensitive lands such as forests, wetlands, and steep slopes,
- Blue Infrastructure shoreline and areas important for sustaining spawning and nursery areas for important commercial and recreational fisheries, and
- Areas important for sustaining wetland ecosystems that are changing and moving landward in response to sea level rise.

Parcels within a TEA received a score of 10. All parcels not within a TEA received a score of 0.

Natural Heritage Area

Natural Areas (NA) are tracts of land and water that represent the best remaining examples of Maryland's natural landscapes. The Natural Heritage Program evaluated proposed Natural Areas for several criteria:

- Rare natural communities,
- Habitats for species of conservation concern, for example habitats essential to rare species especially those listed as Endangered, Threatened, or In Need or Conservation, or to species of Greatest Conservation Need,
- Exemplary common natural communities, and
- Exemplary geological sites.

Parcels within a NA received a score of 10. All parcels not within a NA received a score of 0.

Green Infrastructure Network

The County's Green Infrastructure Network is an interconnected network of important ecological habitat areas, protected lands, agricultural areas, vacant unprotected lands, FEMA floodplains, Open Space zoning, and trails that meet the minimum criteria for size, protection status, and land use characteristic. The Green Infrastructure Network is maintained to help facilitate development in a manner than protects the County's most valuable environmental resources. Parcels within the Green Infrastructure Network received a score of 10. All parcels not within the Network received a score of 0.

Percent Forest Cover within the 100 foot Stream Buffer

To determine the percent forest cover within the 100 foot stream buffer on each parcel, first the County's buffer management area GIS data (buffer_mgmt_area.shp) was used to determine the area of 100 foot stream buffer on each parcel. Then the County's tree line GIS data (treeline.shp) was used to determine the percent forest cover within that 100 foot stream buffer on each parcel. Natural breaks were used to assign a score to each parcel. If a parcel had no or very little forest within the stream buffer it received a score of 0. If the stream buffer was entirely or mostly forested it received a score of 10.

Presence of Forest

The County's tree line GIS data (treeline.shp) was used to determine which parcels contained forested areas. Parcels with forested areas received a score of 10, parcels without forests received a score of 0.

Presence of Wetland

National Wetlands Inventory (NWI) GIS data was used to determine which parcels contained wetlands. Parcels with wetlands received a score of 10, parcels without wetlands received a score of 0.

Proximity to Wetland

National Wetlands Inventory (NWI) GIS data was used to determine which parcels have wetlands within 25 feet of them. Parcels with wetlands with 25 feet received a score of 10, parcels without proximate wetlands received a score of 0.

Presence of Headwater Streams

The County's stream layer GIS data, updated in 2017/2018 as part of the Herring Bay, Middle Patuxent, and Lower Patuxent Watershed Assessment, was used to determine which parcels have any 0 or 1st order streams located on them. Parcels with headwater streams received a score of 10, parcels without headwater streams received a score of 0.

Protected Parcels

Parcels that already have some type of protection were removed from the list of candidate parcels. The criterion for exclusion was that the parcel needed to have greater than 50% of the parcel area under one of the listed protection types. Types of protection considered include:

- Green Infrastructure Network (2017 draft) - protected parcels
- Maryland Agricultural Designations
- County protected lands
- DNR owned properties and conservation easements
- Maryland Agriculture Land Preservation Foundation Easements
- Maryland Environmental Trust Easements
- Private Conservation Lands
- Protected Federal Lands
- Rural Legacy Properties
- Local Protected Lands

Parcel Elimination

A total of 12,402 parcels within the Herring Bay, Middle Patuxent and Lower Patuxent watersheds were evaluated against the selection criteria. A total of 409 road and utility parcels were eliminated under the assumption that parcel preservation would not be feasible on the property. These include State and County roadways, County utility, and Baltimore Gas and Electric Company utility properties. A total of 778 parcels are already fully or partially (greater than 50% of the parcel) preserved and were removed from the analysis.

Selection Results

Figure 1 present the preservation prioritization rating of the 9,165 parcels not already preserved. The high priority parcels are evenly distributed throughout the watersheds. Larger parcels tended to be rated higher priority than smaller parcels, which are generally clustered around the coast of Herring Bay.

Table 3: Parcel Preservation Prioritization Results

	Preservation Prioritization Rating				Already Protected	Excluded Roads/Utility Parcels	Total
	High	Medium High	Medium	Low			
Herring Bay							
Number of Parcels	166	718	2,458	5,087	375	178	8,982
Parcel Acres	3,786	2,642	2,409	1,404	4,625	1,532	16,398
Middle and Lower Patuxent							
Number of Parcels	626	1,015	834	311	403	231	3,420
Parcel Acres	10,085	4,407	2,117	525	11,529	1,260	29,923

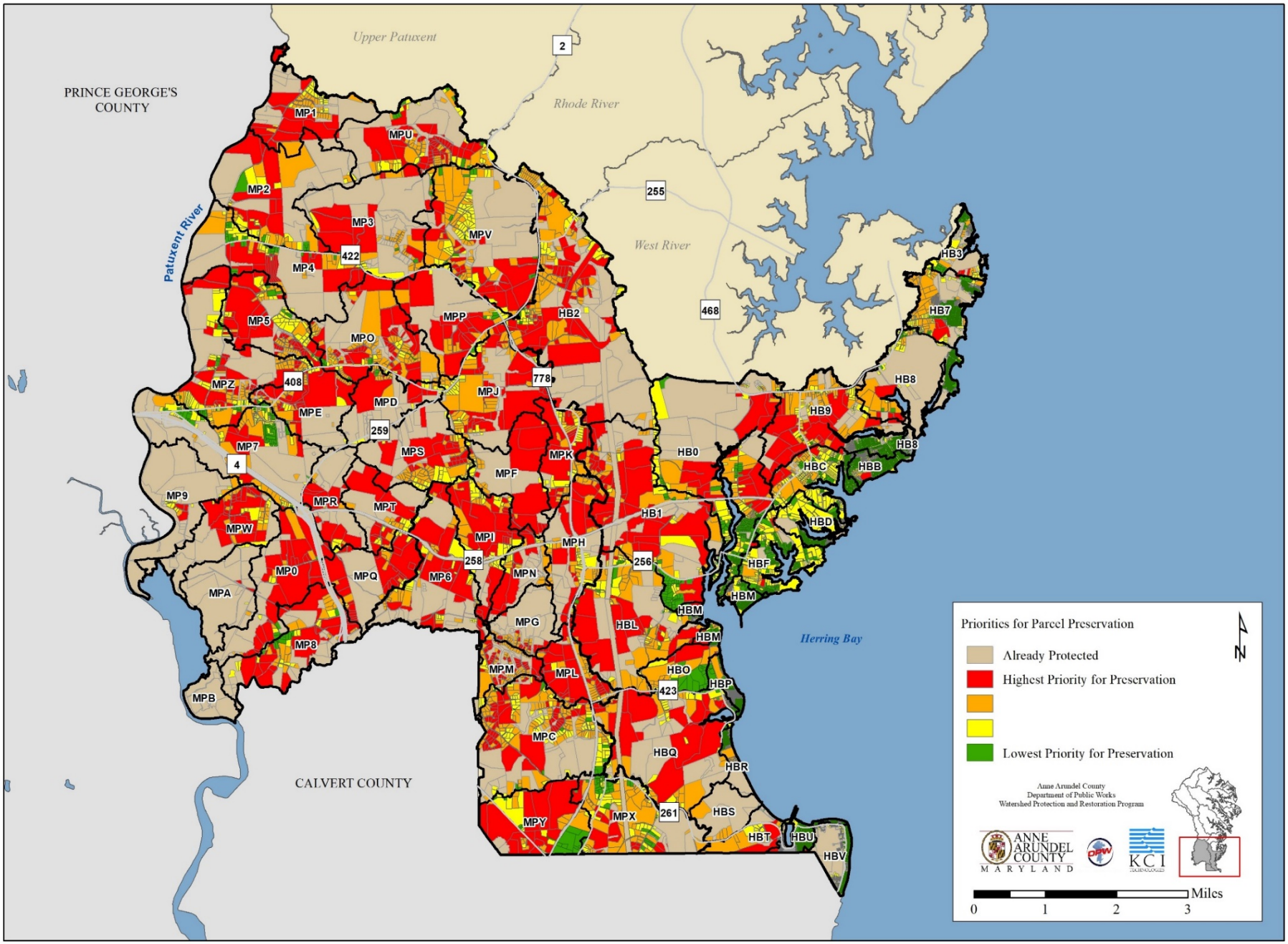


Figure 1: Parcel Preservation Prioritization Results

PERVIOUS TO FOREST

Indicator Selection

The pervious to forest conversion prioritization used a series of indicators that aided in the identification of areas that could be reforested with a particular focus on stream buffers. The indicators fell into three categories: stream buffers, steep slopes, and open space. Each indicator score is weighed and combined to obtain a single priority rating for each parcel. Indicators evaluated and corresponding weights are listed in Table 4.

Table 4: Pervious to Forest Indicators and Weights

Category	Indicator	Weight
Stream Buffers	Unforested Areas within 100ft Stream Buffer	35%
	Buffer Impacts and Restoration Potential	28%
Steep Slopes	Unforested Areas on Slopes 15 to 24%	8%
	Unforested Areas on Slopes >25%	10%
Open Space	Unforested 'Open Space' Land Cover	20%

Unforested Areas within 100ft Stream Buffer

To determine the area in need of reforestation within the 100 foot stream buffer on each parcel, first the County's buffer management area GIS data (buffer_mgmt_area.shp) was used to determine the area of 100 foot stream buffer on each parcel. Then the County's tree line GIS data (treeline.shp) was used to determine the area of forest cover within that 100 foot stream buffer on each parcel. The difference between the total area and forested area was used to estimate the area in need of reforestation. Natural breaks were used to assign a score to each parcel. If a parcel had a large area within the stream buffer in need of reforestation, it received a score of 10. If the stream buffer was entirely or mostly forested it received a score of 0.

Buffer Impacts and Restoration Potential

Points of impact to the riparian buffer were collected during the stream assessment conducted throughout the Herring Bay and Middle Patuxent watersheds during the winter of 2017/2018. Buffer impacts were assigned an impact score and restoration potential rating. Parcels containing a buffer impact point received prioritization scores according to Table 5.

Table 5: Buffer Impacts and Restoration Potential Scores

		Impact Score	
		Severe	**Moderate**
Restoration Potential	**High**	10	7.5
	Moderate	7.5	5
	Low	5	2.5

Unforested Areas on Steep Slopes

Steep slopes are generally unused or underutilized areas that property owners may be willing to reforest due to difficulties and added cost in developing land on steep slopes. Additionally steep slopes are important areas for maintaining forest cover to reduce stormwater runoff and erosion that results from unforested, or un-vegetated slopes. Possible areas available for planting were identified by first using the County's steep slopes GIS data (SteepSlopes.shp) to determine the area of 15 to 24% and greater than 25% slopes within each parcel. Then the County's tree line GIS data (treeline.shp) was used to determine the area of forest cover within those steep slope areas. The difference between the total area and forested area was used to estimate the areas potentially available for planting. Natural breaks were used to assign a score to each parcel. If a parcel had a large area within the steep slope areas, it received a score of 10. If the steep slopes were entirely or mostly forested it received a score of 0.

Unforested Open Space

The "Open Space" classification within the County's 2014 Land Cover GIS data (CountywideLandCover2014.shp) was used to locate currently unused open green space, however in some cases these areas have already naturally revegetated or the land cover has changed since 2014. This layer was analyzed against the most recent aerial imagery to remove areas that would not be suitable for planting. Some common reasons open space areas were removed from the selection include:

- Forested
- Naturally re-vegetated
- Parking lot/ roads
- Lawn space not suitable for planting
- Recreation areas (sports fields/baseball diamonds/golf course)
- House development/new house construction

The total area of open space present in each parcel was determined. Natural breaks were used to assign a score to each parcel. If a parcel had no or very little open space, it received a score of 0. If the parcel had a large open space area, it received a score of 10.

Parcel Elimination

A total of 409 road and utility parcels were eliminated under the assumption that tree planting would not be feasible on the property. These include State and County roadways, County utility, and Baltimore Gas and Electric Company utility properties.

In an effort to eliminate parcels consisting primarily of wetland habitat, parcels with greater than 50% of the parcel area consisting of wetland were eliminated from the selection. This was done to avoid disturbance of the wetlands and because establishment of forest would likely be unsuccessful in these wetland areas with high soil saturations. A total of 463 parcels were eliminated. While the majority of these parcels were initially rated Low priority for reforestation before they were excluded, a total of 15 parcels had overall priority ratings of High, Medium High, or Medium. To ensure the removal of these properties did not eliminate good potential planting sites, the aerial photography of all 15 parcels were reviewed visually. None of these sites were determined to be good potential planting sites.

Selection Results

Table 6 and Figure 2 present the number of parcels receiving each preservation rating by watershed. Similar to the parcel preservation, the high priority parcels are evenly distributed throughout the watersheds and larger parcels tended to be rated higher priority than smaller parcels.

Table 6: Pervious to Forest Conversion Prioritization Results

Watershed	Number of Parcels with Priority Rating				Excluded Roads/Utility Parcels	Excluded Wetland Parcels	Total
	High	Medium High	Medium	Low			
Herring Bay	9	34	111	8,233	178	417	8,982
Middle and Lower Patuxent	17	74	158	2,893	231	47	3,420

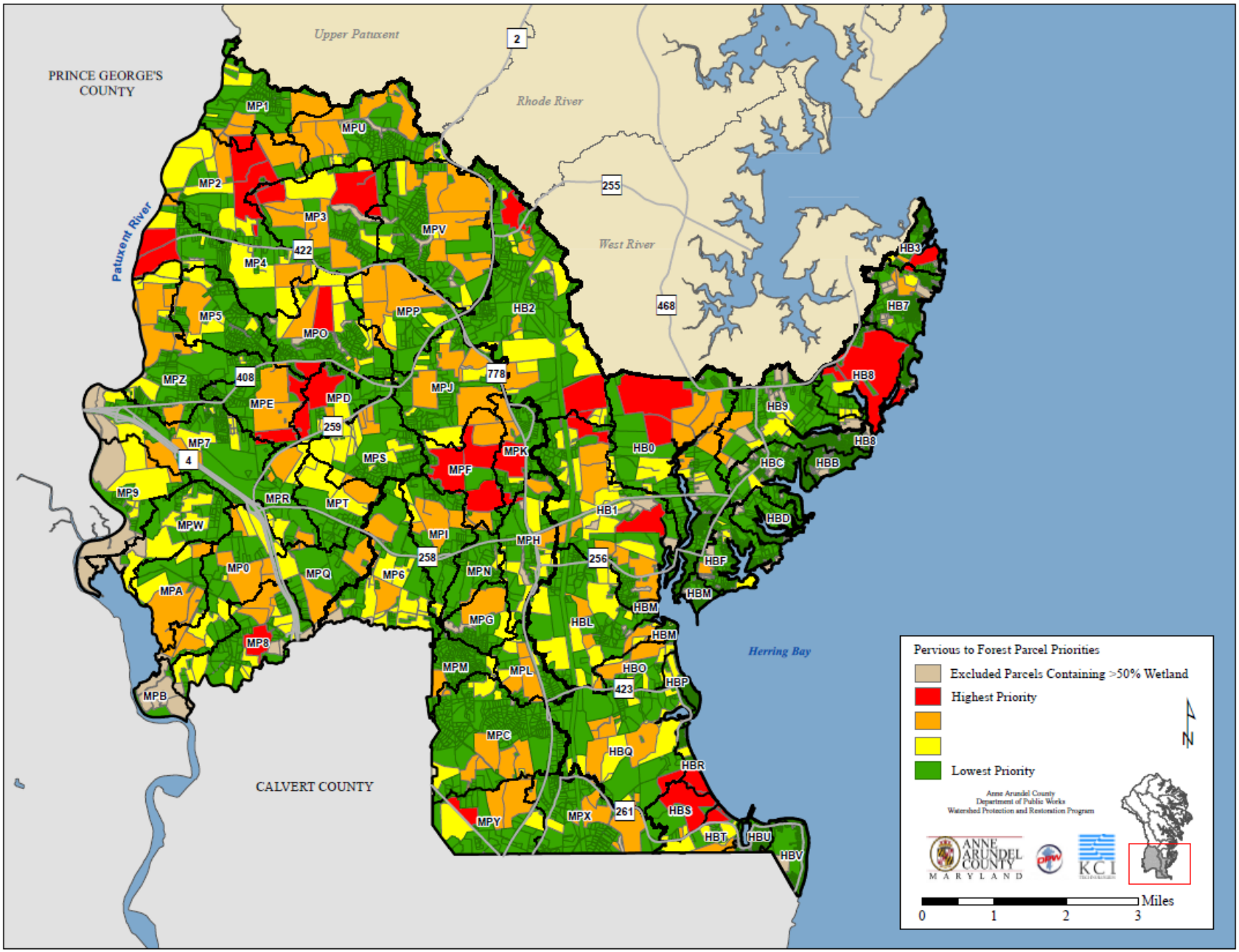


Figure 2: Priority Parcels for Pervious to Forest Conversion

IMPERVIOUS TO PERVIOUS

Indicator Selection

The impervious to pervious conversion prioritization used a series of indicators to identify areas of impervious that could be good candidates for impervious treatment, either by removal or through application of stormwater management practices such as pervious pavers, pervious concrete, or stormwater treatment BMPs. Each indicator score is weighed and combined to obtain a single priority rating for each parcel. Indicators evaluated and corresponding weights are listed in Table 7.

Table 7: Impervious to Pervious Indicators and Weights

Indicator	Weight
Total Impervious Area	13%
Percent Impervious Area	9%
Presence of Gravel Parking Lot	16%
Presence of Paved Parking Lot	27%
Presence of BMP Treatment	13%
Within Critical Area	22%

Total Impervious Area

The County's impervious GIS data (impervious.shp) was used to determine the total area of impervious surfaces on each parcel. Natural breaks were used to assign a score to each parcel. If a parcel had a large amount of impervious surfaces, it received a score of 10. If the parcel was entirely or mostly pervious it received a score of 0.

Percent Impervious Area

The percent of impervious area on each parcel was calculated using the County's impervious GIS data (impervious.shp). Natural breaks were used to assign a score to each parcel. If a parcel had a large percentage of impervious surfaces, it received a score of 10. If the parcel was entirely or mostly pervious it received a score of 0.

Presence of Parking Lot

The feature type and surface type fields in the County's impervious GIS data (impervious.shp) were used to identify the area of gravel and paved parking lots on each parcel. Two indicators were used, one for paved lots, and one for gravel lots. Parcels containing a gravel or paved parking lot received a score of 10, while parcels not containing a parking lot received a 0.

Presence of BMP Treatment

The County's BMP Drainage Area GIS data (BMP_DrainageArea_BMPType.shp) was used to determine parcels with stormwater BMP treatment. If a parcel currently has any BMP treatment it received a score of 0, if the parcel does not have existing treatment, it received a score of 10.

Within Critical Area

The County's Critical Area GIS data (AACo_Critical Area.shp) was used to determine if a parcel was within the Chesapeake Bay Critical Area. If any part of a parcel fell within the Critical Area, it received a score of 10, if the parcel was not within the Critical Area, it received a score of 0.

Parcel Elimination

A total of 409 road and utility parcels were eliminated under the assumption that impervious removal would not be feasible on the property. These include State and County roadways, County utility, and Baltimore Gas and Electric Company utility properties.

Selection Results

Table 8 and Figure 3 present the number of parcels receiving each preservation rating by watershed. The high priority parcels are generally clustered around the coasts of the Herring Bay and Patuxent River. This is partially due to the fact that these areas have a higher density of impervious surfaces than the central areas of the watersheds, but also because these parcels are within the Critical Area, which are rated higher priority in the model.

Table 8: Impervious to Pervious Conversion Prioritization Results

Watershed	Number of Parcels with Priority Rating				Excluded Roads/Utility Parcels	Total
	High	Medium High	Medium	Low		
Herring Bay	37	146	7,146	1,475	178	8,982
Middle and Lower Patuxent	4	50	207	2,928	231	3,420

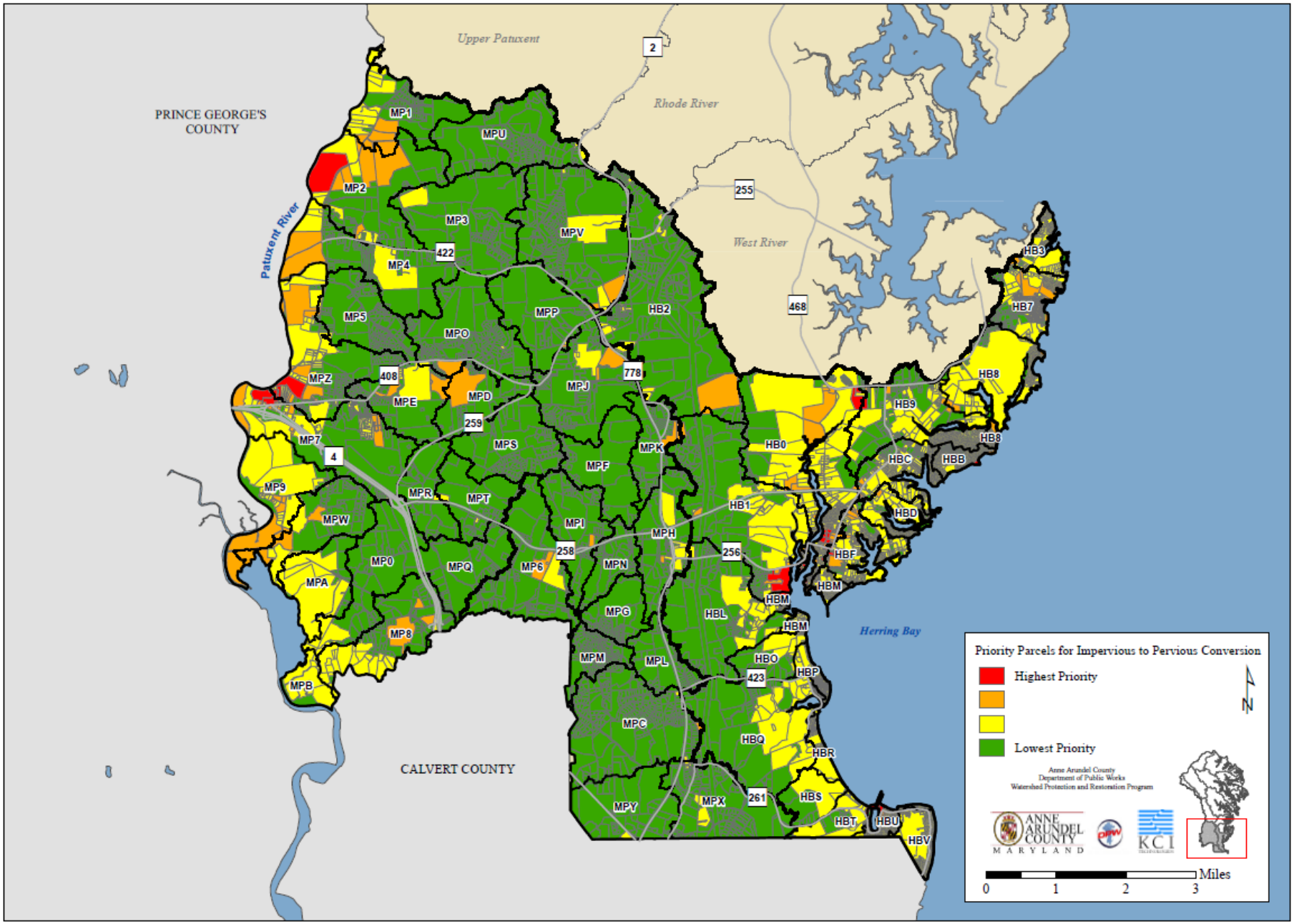


Figure 3: Priority Parcels for Impervious to Pervious Conversion

FEASIBILITY ANALYSES

Identification of the parcels shown in the results mapping is just the first phase of implementation. All parcels identified in the three models for preservation, planting, and impervious area conversion and treatment will need to undergo additional feasibility analyses to determine their specific suitability for the management measures proposed and to determine the willingness of the property owner.

County staff from both the Watershed Protection and Restoration Program and the County's Planning and Zoning department will work collaboratively on implementation. The County may look to engage with partners such as the Maryland Environmental Trust or the Advocates for Herring Bay for land conservation projects, or with local watershed groups such as the Alliance for the Chesapeake Bay or the Patuxent Riverkeeper for tree planting projects.

Parcels will require additional desktop assessment and records research to confirm items such as ownership, existing easement location and type, zoning, and property value. Field visits will be necessary to document suitable conditions on the ground and to meet with private property owners. County staff and their representatives will obtain permission from property owners before field assessments on private property are conducted. Desktop and field assessments should include the following items:

For preservation areas the following items will be useful for determining the current conditions and the type of preservation mechanism that will be appropriate:

- Acreage,
- Property improvements,
- Current land use – forest, agriculture, open space,
- Presence of historic resources,
- Presence of natural resources including forest, wetland, shoreline, streams
- Presence of natural habitats,
- Lands contiguous to other open space or conservation areas,
- Adjacent to or including unique designation including Chesapeake Bay Critical Area, Scenic Roads, Natural Heritage, or Endangered Species,
- Protection of the area from development, and
- Potential public benefit including outdoor recreation and education.

For tree planting areas the following should be reviewed when selecting a site and identifying the types of vegetation to plant:

- Acres of available planting area,
- Access to the site for planting and maintenance,
- Soil conditions,
- Susceptibility to animal browse,
- Surrounding vegetation including invasive species and noxious weeds, and
- Maintenance requirements.

For impervious removal or treatment a field assessment should be conducted by a water resources engineer. The site assessment will determine the best method of treatment, which could include impervious surface removal or impervious treatment through application of stormwater management practices such as pervious pavers, pervious concrete, or stormwater treatment BMPs. Site visits will document:

- Current use and pavement type,
- Future use,
- Acres of pervious and impervious surface,
- Access considerations for construction and maintenance,
- Existing utilities,
- Analysis of runoff volume and available treatment/storage areas,
- Maintenance considerations, and
- BMP siting and site Hydraulic and Hydrologic conditions.

APPENDIX D – PUBLIC REVIEW AND COMMENT

Advocates for Herring Bay

To: Raghavenderrao Badami, Watershed Protection and Restoration Program
From: Kathy Gramp, on behalf of the Advocates for Herring Bay
Date: June 26, 2018
Re: Comments on May 2018 draft assessment of the Herring Bay watershed

The May 2018 draft of the *Herring Bay, Middle Patuxent, and Lower Patuxent Watershed Assessment* is a valuable resource for those working to promote the health of Herring Bay. It provides a comprehensive review of recent ecological conditions and applies a logical weighting of those factors in developing policy recommendations. The Advocates for Herring Bay concur with the report's emphasis on the long-term benefits of preserving and restoring natural features that filter pollutants and sustain ecologically important habitats.

As noted in the report, the nature of the investments needed in Herring Bay will differ from those in more urban parts of the county. Instead of relying on government-sponsored engineering projects, we will need to rely on the efforts of hundreds of individuals and community organizations. Marshaling support at that grassroots level calls for new and creative solutions. We have outlined a few possible options below.

Use the report for public outreach

1. ***Increase accessibility.*** As partners in this effort, local citizens need a guide to *their* investments in the watersheds. Jargon that makes sense to planners—such as TMDLs, MS4s, and peak flows, etc.—may be confusing to nonprofessionals and thus discourage individual action. Adding sidebars or graphics for context might make the report more accessible to the public.

2. ***Harmonize the rankings across watersheds.*** Because the ranges used in the color-coded maps vary across watersheds, we can't tell how the priorities in our areas compare to similarly color-coded watersheds in the rest of the county. Using consistent metrics would help citizens understand why the county is spending money in one area and not another.

3. ***Highlight the key characteristics of each subwatershed.*** Adding tables that show the relative importance of each factor by subwatershed would make it easier for citizens to identify their local issues and solutions. For example, some areas warrant preservation because of their forests, others because they are in a wellhead protection zone; some need restoration because of pollutant loads, others because they lack stream buffers, etc.

Provide incentives for individuals and communities to preserve and restore areas

1. ***Compensate easement holders for the public value of preservation***. The real estate appraisals used by land trusts will underestimate the value of priority parcels because they omit the benefits accruing to taxpayers from preserving forests and wetlands. Paying a premium would better reflect the value of an easement and create incentives for more people to adopt them. Such premiums could be calculated using data in the watershed assessment,

such as estimates of benefits of avoiding the higher nitrogen, phosphorus, or sediment loads that would result from development.

2. ***Facilitate preservation of parcels smaller than 10 acres***. Most land trusts will manage only large parcels. While a 10-acre minimum makes sense from their perspective, it has the effect of leaving key parcels unprotected, even when landowners are willing to execute an agreement. We urge you to find ways to preserve smaller sites, particularly wetlands and forests that serve as buffers against storm surges, filters for runoff, and incubators for many species. Options could include defraying the higher costs associated with small parcels or creating a new easement program administered directly by the county.

3. ***Use income from fees paid-in-lieu to plant trees on priority parcels.*** This report gives the county and state a parcel-by-parcel guide for planting native trees in the most environmentally and cost-effective places. At a minimum, any planting done with taxpayer dollars should be done in areas identified as a priority by the watershed assessment.

4. ***Encourage communities to consider using local financial or legal tools***. There may be instances where a community would be willing to defray the costs or provide legal enhancements for a preservation or mitigation project. The county should ensure that communities are aware of options available under current law for such participation, such as Special Community Benefit Districts and neighborhood conservation overlay districts.

5. ***Take a holistic approach to sewer connections.*** The report recommends that some existing septic systems in the Herring Bay watershed be connected to sewers as a way to reduce nitrogen and bacteria loads. While we recognize the merits of this within existing sewer service areas (SSAs), we are concerned about the potential environmental impacts of expanding the SSAs. Doing so would most likely trigger more intense development in areas with wetlands, forests, and other pervious land uses. This risk is especially pronounced in neighborhoods in the Critical Area that were platted in the 1920s, where antiquated lots of one-eighth of an acre are common.

   Alternative methods to reduce nitrogen loads are needed in such areas. We urge you to continue your ongoing outreach and financial incentives for installing advanced septic system technologies. It also may be appropriate to pursue indirect methods of reducing those pollutants, such as rebuilding oyster reefs in Herring Bay.

6. ***Incorporate watershed metrics into the GDP, zoning, and other land-use laws.*** Efforts by citizens will be futile if the county's land-use laws promote the loss of the forests and wetlands that this plan recommends be preserved. We urge the county to use the upcoming GDP and rezoning process to strengthen protections for these assets. Options could include new zoning overlay districts, stronger forestry protections, and procedures making the approval of rezoning requests contingent on a determination that they would be consistent with the results of the watershed assessments.

We look forward to a continuing collaboration with the Department of Public Works to achieve our shared goals. Thank you for considering our views.

Advocates for Herring Bay

To: Raghavenderrao Badami, Watershed Protection and Restoration Program
From: Kathy Gramp, on behalf of the Advocates for Herring Bay
Date: June 26, 2018
Re: Comments on May 2018 draft assessment of the Herring Bay watershed

The May 2018 draft of the *Herring Bay, Middle Patuxent, and Lower Patuxent Watershed Assessment* is a valuable resource for those working to promote the health of Herring Bay. It provides a comprehensive review of recent ecological conditions and applies a logical weighting of those factors in developing policy recommendations. The Advocates for Herring Bay concur with the report's emphasis on the long-term benefits of preserving and restoring natural features that filter pollutants and sustain ecologically important habitats.

As noted in the report, the nature of the investments needed in Herring Bay will differ from those in more urban parts of the county. Instead of relying on government-sponsored engineering projects, we will need to rely on the efforts of hundreds of individuals and community organizations. Marshaling support at that grassroots level calls for new and creative solutions. We have outlined a few possible options below.

County Response: *Thank you for your comments. Your comments and the County's responses are included as an appendix to the report. The County appreciates your concurrence with the report's emphasis on the long term benefits of preserving and restoring natural features that filter pollutants and sustain ecologically important habitats. The County agrees that stakeholder participation and partnerships are key to new and creative solutions.*

For comments under the heading "Use the report for public outreach" – see below responses to each comments and changes to the report as noted.

For comments under the heading ***"Provide incentives for individuals and communities to preserve and restore areas"*** *– The County acknowledges the comments and will review them for possible actions with the understanding that this could include strategies such as public private partnerships, coordination and collaboration between multiple County departments, policy changes, County Council actions, and other legislative changes.*

Use the report for public outreach

1. ***Increase accessibility.*** As partners in this effort, local citizens need a guide to *their* investments in the watersheds. Jargon that makes sense to planners—such as TMDLs, MS4s, and peak flows, etc.—may be confusing to nonprofessionals and thus discourage individual action. Adding sidebars or graphics for context might make the report more accessible to the public.

County Response: *The report is written to simultaneously meet the needs of MDE, County planners and engineers, and the public; therefore much of the technical information is necessary and unavoidable. However, the County agrees that the topic can be quite technical and not easily understood by individuals new to the subject matter. The County did provide two public meeting on September 27, 2016 and April 24, 2018 to introduce the study, the methods, and report findings to the public. A major goal of the meetings was to provide some background, context, and basic understanding of the subject to facilitate public review of the material.*

The County is taking several additional steps to make the information more accessible: 1. A list of acronyms has been added to the report, 2. A glossary of frequently used technical terms has been added to provide clear definitions, 3. The County is developing a shorter (approx.. 2-3 page) synopsis of the report findings to clearly and concisely deliver the message to the public. This summary will be published on the County's WPRP website in the summer of 2018 in the 'Watershed Studies' section.

2. ***Harmonize the rankings across watersheds.*** Because the ranges used in the color-coded maps vary across watersheds, we can't tell how the priorities in our areas compare to similarly color-coded watersheds in the rest of the county. Using consistent metrics would help citizens understand why the county is spending money in one area and not another.

County Response: *All of the County's stream reaches and subwatersheds, in each study, are ranked using the same metrics or "Indicators" as they are called in the report. These indicators are presented in tables 4-1, 4-4, and 4-8. However, the break points for each indicator and for the final ranking do change by watershed since the ranking system uses the relative condition, that is, how they compare to one another rather than how they compare to some absolute value. These floating breakpoints are what the comment refers to.*

The County maintains two separate ranking systems at the reach and subwatershed levels. The first is the ranking unique to each watershed which allows the County to determine in each watershed where the highest priorities for restoration and preservation exist. These results are included in tables 4-2, 4-5, and 4-9 and in Maps 4.1, 4.2, and 4.3. The second is a Countywide ranking that ranks every subwatershed in the County using the same indicators and using a relative scale that allows all of the subwatersheds to be compared. As each watershed study was completed and added to the ranking the breakpoints changed to account for the conditions of the newly added data. The results of this Countywide ranking are included in tables 4-3, 4-7, and 4-11 indicating how many subwatersheds are included in each ranking category.

Now that the final watershed study is complete, the County is preparing mapping for the entire County displaying the subwatershed rankings. This mapping will be complete in the summer of 2018 and posted to the County's WPRP website in the 'Watershed Studies' section and added to the Watershed Mapping Application.

3. ***Highlight the key characteristics of each subwatershed.*** Adding tables that show the relative importance of each factor by subwatershed would make it easier for citizens to identify their local issues and solutions. For example, some areas warrant preservation because of their forests, others because they are in a wellhead protection zone; some need restoration because of pollutant loads, others because they lack stream buffers, etc.

County Response: *Each indicator is displayed on the Maps included at the end of the report. Describing by subwatershed a singular indicator that is critical to each is problematic and could be misleading as it is generally a combination of factors that results in the particular ranking. Additionally the indicator weights make it difficult to determine which indicator is the prime factor, versus which is simply weighted higher.*

In response to your comment, a graphic has been added to the report for the subwatershed restoration and subwatershed preservation results sections that show the relative importance of each indicator to each of the subwatersheds.

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We look forward to a continuing collaboration with the Department of Public Works to achieve our shared goals. Thank you for considering our views.

County Response: *Thanks for taking the time to review the report and providing comments. We look forward to working with you to meet the goals outlined in the report.*