Howard County Biological Monitoring and Assessment

Dorsey Run, Hammond Branch, and Rocky Gorge Watersheds - 2009

Howard County, Maryland

Howard County MARYLAND

KCI Technologies, Inc.
October 2009

KCI TECHNOLOGIES

Howard County Biological Monitoring and Assessment
Dorsey Run, Hammond Branch, and
Rocky Gorge Watersheds – 2009

October 2009 - FINAL

NPDES Permit No. 00-DP-3318 MD0068322

Prepared for:

Department of Public Works
Bureau of Environmental Services
Stormwater Management Division
NPDES Watershed Management Programs

Howard County
MARYLAND

Prepared by:

KCI Technologies, Inc.
936 Ridgebrook Road
Sparks, Maryland 21152
KCI Job Order No. 01054139.25

KCI
TECHNOLOGIES

CONTENTS

Acknowledgements iii

Background and Objectives 3

1 Methodologies 5

1.1 Selection of Sampling Sites 5
1.2 Impervious Surface Analysis 7
1.3 Water Quality Sampling 7
1.4 Biological Sampling 8
1.4.1 Benthic Macroinvertebrate Sampling 8
1.4.2 Sample Processing and Laboratory Identification 8
1.4.3 Biological Data Analysis 10
1.5 Physical Habitat Assessment 12
1.6 Geomorphic Analysis 13
1.6.1 Cross Section Analysis 13
1.6.2 Particle Size Analysis 14
1.6.3 Rosgen Classification 14

2 Results 15

2.1 Index Selection 15
2.2 Subwatershed Summaries 16
2.2.1 Rocky Gorge 16
2.2.2 Hammond Branch 22
2.2.3 Dorsey Run 28

3 Discussion and Comparison 34

3.1 Discussion 34
3.1.1 2009 Assessment Results 34
3.1.2 Comparison of 2003 and 2009 Bioassessment data 37

4 Conclusion and Recommendations 40

5 References 41

FIGURES

Figure 1 - Howard County Bioassessment....4
Figure 2 - Location Map of Dorsey Run, Hammond Branch and Rocky Gorge Watersheds....6
Figure 3 – Dorsey Run, Hammond Branch and Rocky Gorge Bioassessment Sampling Locations....9
Figure 4 – BIBI Regression....16
Figure 5 – Rocky Gorge PSU Sampling Results....18
Figure 6 - Hammond Branch PSU Sampling Results....26
Figure 7 - Dorsey Run PSU Sampling Results....29
Figure 8 - Scatterplot Matrix for several 2009 Data Parameters....36
Figure 9 - Comparison of 2003 and 2009 BIBI scores....38
Figure 10 - Comparison of 2003 and 2009 RBP Physical Habitat Assessment scores....39

TABLES

Table 1 – Summary of Bioassessment Progress....3
Table 2 - Water Quality Sampling and COMAR Standards, Use I-P and IV-P Waters....7
Table 3 – Biological Index Scoring for Piedmont Benthic Macroinvertebrates....11
Table 4 – Biological Index Scoring for Coastal Plain Benthic Macroinvertebrates....12
Table 5 – BIBI Scoring and Rating....12
Table 6 – RBP Habitat Parameters - High Gradient Streams....13
Table 7 – RBP Habitat Parameters - Low Gradient Streams....13
Table 8 – RBP Habitat Score and Ratings....13
Table 9 – Rosgen Level II Channel Type Description....15
Table 10 - Rocky Gorge Summary....19
Table 11 - Hammond Branch Summary....27
Table 12 - Dorsey Run Summary....30
Table 13 - Pearson Correlations....36
Table 14 - Comparison of 2003 and 2009 BIBI Data....37
Table 15 - Comparison of 2003 and 2009 RBP Physical Habitat Assessment Data....39

APPENDICES

Appendix A: Land Use and Imperviousness
Appendix B: Water Quality Data
Appendix C: Benthic Macroinvertebrate Data
Appendix D: Habitat Assessment Data
Appendix E: Geomorphologic Data
Appendix F: Quality Assurance/Quality Control

Acknowledgements

The principal authors for this report are Colin Hill and Megan Crunkleton of KCI Technologies.

Fieldwork was conducted primarily by Colin Hill and Megan Crunkleton of KCI. They were assisted by Dave Ivey from Chesapeake Environmental Management (CEM). Biological sample processing was conducted by Jennifer Nein and Grant Neely of KCI and Eric Freidly and Michelle Mullen of CEM. Megan Crunkleton provided laboratory QC oversight and record keeping. Taxonomic identification was conducted by Environmental Services and Consulting (ESC). ESC's lab manager is Nicole Martin. Andrea Poling and Austin Byers of KCI provided additional support with GIS analysis.

Michael Pieper assisted with report editing and review and also performed project management duties with contract management oversight from Peter Mattejat and Kerry Rexroad. The project accountant was Jen Pizarro.

KCI would like to thank Howard County staff for support and review of the draft report including:

Brenda Belensky, Natural Resource Manager

Lindsay DeMarzo, Environmental Planner

Angela Morales, Environmental Planner

Susan Overstreet, Environmental Planning Supervisor

Howard Saltzman, Chief Stormwater Management Division

For more information on this report or Howard County's Watershed Management efforts contact:

Howard Saltzman, Chief Stormwater Management Division

or

Angela Morales, Environmental Planner

Stormwater Management Division
Howard County Department of Public Works
6751 Columbia Gateway Drive
Columbia, Maryland 21046
410-313-6416

Or visit us on the web at http://www.co.ho.md.us/DPW/watershed_management.htm

The appropriate citation for this report is:

C. R. Hill and M. C. Crunkleton. 2009. Howard County Biological Monitoring and Assessment, Dorsey Run, Hammond Branch, and Rocky Gorge Watersheds – 2009. Prepared by KCI Technologies, Inc., Sparks, MD for Howard County, Department of Public Works. Stormwater Management Division. Columbia, MD. October 2009.

This Page Intentionally Left Blank

Executive Summary

The Howard County Department of Public Works Stormwater Management Division initiated the Howard County Biological Monitoring and Assessment Program in the spring of 2001. The County initiated the monitoring program to establish a baseline ecological stream condition for all of the County's watersheds. The program involves monitoring the biological health and physical condition of the County's water resources and is designed on a five year rotating basis such that each of the County's 15 watersheds, or primary sampling units (PSU) will be sampled once every five years.

The 2009 sampling effort continued the second round of countywide sampling. The Dorsey Run, Hammond Branch, and Rocky Gorge watersheds were re-sampled at 30 newly selected sites to fulfill the 2009 sampling requirements. These watersheds were previously sampled and assessed by Tetra Tech, Inc. in 2003 during the first round of the county-wide assessment (Pavlik and Stribling, 2005). Stream monitoring was conducted again in 2009 at 10 sites within each of the three PSUs (Dorsey Run, Hammond Branch, and Rocky Gorge). The monitoring involved sampling instream water quality, collection and analysis of the biological community (benthic macroinvertebrates) using Maryland Biological Stream Survey (MBSS) protocols, cross section analysis, particle size distribution, and assessment of the physical habitat using the United States Environmental Protection Agency's (EPA) Rapid Bioassessment Protocols (RBP). The sampling methods used are compatible with those used in the first round (2001-2003) with updates where applicable.

The MBSS benthic metrics, scoring criteria, and individual species tolerance were updated by Maryland Department of Natural Resources (DNR) in 2005 (Southerland et al., 2005). The biological data collected in the first round of sampling of the Dorsey Run, Hammond Branch, and Rocky Gorge watersheds was analyzed using the old metrics (Stribling et. al 1998), and as such, the results are not directly comparable to the current sampling data. Therefore, all data from the 2003 sampling effort were recalculated using the updated metrics to allow for direct comparison to the current data. For this report any mention of 2003 BIBI scores refer to these recalculated values.

All data collection occurred between March 1st and May 1st of 2009, as required by the MBSS protocols. Sampling sites were marked in the field using tree tags (when possible) at the midpoint of the reach. The positions of the sites were collected using a GPS unit accurate to within 2 meters.

Biological and physical habitat assessment results for 2009 in Rocky Gorge, Hammond Branch, and Dorsey Run indicate subwatersheds that are moderately to severely impaired. Only one out of thirty benthic macroinvertebrate samples received a rating of 'Good' and five received a 'Fair' rating. The remaining sites (80 percent) were rated as either 'Poor' or 'Very Poor.'

Overall, the average subwatershed physical habitat conditions were 'Partially Supporting' (Rocky Gorge, Hammond Branch) and 'Non-supporting'(Dorsey Run). The geomorphic assessment reveals a variable system. Using the Rosgen classification system for natural rivers (Rosgen, 1996), many of the channels sampled throughout the watersheds were classified as stable type B or C channels. However, a good portion of channels were classified as unstable, incised F channels. Gravel was the dominant substrate type in the majority of sampling reaches, however sand, silt/clay and cobble dominate streams were also present.

The average percentage of impervious area in the Rocky Gorge, Hammond Branch, and Dorsey Run subwatersheds is 10, 13, and 32 percent, respectively. Imperviousness for the areas draining to each sampling site range from five (5) percent to 37 percent.

Pearson correlations between the BIBI scores and three parameters (RBP score, percent imperviousness, and specific conductivity) all showed significant relationships. The percentage of imperviousness to each sampling site indicates a strong negative relationship (correlation of -0.605 with a significance level of <0.001) to BIBI scores, implying biological condition decreases with increased watershed imperviousness. Specific conductivity and BIBI scores also showed a strong

negative correlation (correlation of -0.507 with a significance level of 0.004). These results support the notion that overall water quality and biological health are likely being affected by the amount of development, and hence imperviousness, in the watershed.

A strong correlation was also observed between impervious percent and specific conductivity (correlation of 0.718 with a significance level of <0.001), suggesting that increased conductivity is due in large part to urban runoff. In addition, a strong negative correlation was found between RBP scores and imperviousness (-0.444, with a significance level of 0.014), inferring that altered hydrologic regimes are degrading the physical habitat through more intense discharges and higher peak flows in more developed watersheds.

Results of the 2009 assessment indicate degraded biological conditions in all three watersheds, and statistically significant decreases in mean BIBI scores were observed in Dorsey Run and Hammond Branch since Round One. While physical habitat scores resulted in slight changes, there were no statistically significant changes between Round One and Round Two results.

Background and Objectives

The Howard County Biological Monitoring and Assessment Program was initiated in the spring of 2001 by the Howard County Department of Public Works Stormwater Management Division. The program involves monitoring the biological health and physical condition of the County's water resources to detect the status and trends at the stream level, the watershed level and ultimately at the County level.

The County initiated the program to establish a baseline ecological stream condition for all of the County's watersheds. The program is designed on a five year rotating basis such that each of the County's 15 watersheds or primary sampling units (PSU) will be sampled once every five years. In general three PSUs would be sampled each year with 10 sites sampled in each PSU.

The first sampling rotation was completed in only three years (2001 to 2003; Table 1). Requirements of the Patuxent Reservoir Watershed Group were addressed in 2001 with sampling conducted in PSUs 2, 5 and 3. This was in addition to sampling conducted in the Little Patuxent watersheds (PSUs 11, 12, and 13) under a Watershed Restoration Action Strategy (WRAS) grant. In 2002, only the Middle

Table 1 – Summary of Bioassessment Progress

Year	Number of Sites	Primary Sampling Unit (code and name)
Round One		
1 (2001)	60	11 – Upper Little Patuxent 12 – Middle Little Patuxent 13 – Lower Little Patuxent 2 – Upper Brighton Dam 5 – Lower Brighton Dam 3 – Cattail Creek
2 (2002)	30	6 – Upper Middle Patuxent 7 – Middle Middle Patuxent 8 – Lower Middle Patuxent
3 (2003)	60	9 – Rocky Gorge Dam 14 – Hammond Branch 15 – Dorsey Run 10 – S Branch Patapsco River Tributaries 1 – Patapsco River L Branch A 4 – Patapsco River L Branch B
Round Two		
5 (2005)	30	2 – Upper Brighton Dam 5 – Lower Brighton Dam 3 – Cattail Creek
6 (2006)	30	11 – Upper Little Patuxent 12 – Middle Little Patuxent 13 – Lower Little Patuxent
7 (2007)	30	6 – Upper Middle Patuxent 7 – Middle Middle Patuxent 8 – Lower Middle Patuxent
8 (2008)	30	10 – S Branch Patapsco River Tributaries 1 – Patapsco River L Branch A 4 – Patapsco River L Branch B
9 (2009)	30	9 – Rocky Gorge Dam 14 – Hammond Branch 15 – Dorsey Run

Patuxent sites (PSUs 6, 7 and 8) were sampled. Additional WRAS funding in 2003 allowed sampling to be completed in the Patapsco River Tributaries (PSUs 1, 4, and 10) in addition to Rocky Gorge, Hammond Branch, and Dorsey Run, which were sampled to supplement the data collected in 2001 for the Little Patuxent.

Upper and Lower Brighton Dam (PSUs 2 and 5, respectively) and Cattail Creek (PSU 3) were all sampled as part of the first year of the second round of sampling in 2005. The Little Patuxent River subwatersheds (PSUs 11, 12, and 13) were sampled in 2006 during year two of the second round of sampling. The Middle Patuxent subwatersheds (PSUs 6, 7, and 8) and the Patapsco River subwatersheds (PSUs 1, 4, and10) were re-sampled in 2007 and 2008, respectively.

In 2009, 30 newly selected sites were sampled in the Rocky Gorge Dam (PSU 9), Hammond Branch (PSU 14), and Dorsey Run (PSU 15) subwatersheds to fulfill the 2009 sampling requirements. With the completion of Rocky Gorge Dam, Hammond Branch, and Dorsey Run subwatersheds, the current sampling period marked the conclusion of round two of county-wide sampling. These watersheds were previously sampled and assessed by Tetra Tech, Inc. in 2003 during the first round of the county-wide assessment (Pavlik and Stribling, 2005). Figure 1 illustrates the progress made to date on the county-wide biological monitoring program.

Assessment methods follow those developed by Maryland Department of Natural Resources' (DNR) Maryland Biological Stream Survey (MBSS) and the Standard Operating Procedures (SOPs) found in the Quality Assurance Project Plan (QAPP) for the Howard County Biological Monitoring and Assessment Program (Howard County, 2001). The sampling methods used in 2009 are compatible with those used in the first round (2001-2003) with updates where applicable.

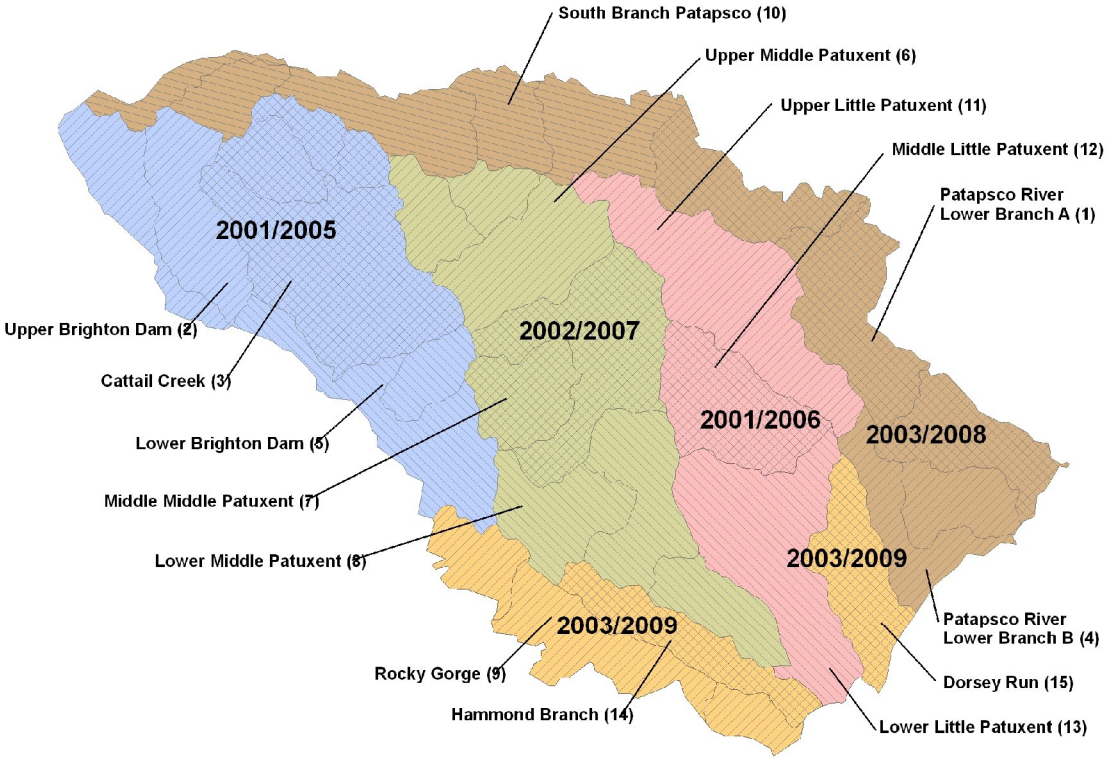


Figure 1 - Howard County Bioassessment

All three subwatersheds sampled in 2009 are located in the southeastern portion of the county and are crossed by several major transportation routes (Figure 2). Interstate I-95 bisects all three watersheds, and State Highway 216 (Scaggsville Road) runs roughly along the border between Hammond Branch and Rocky Gorge subwatersheds. Other major thoroughfares include Clarksville Pike (Route 108), Washington Boulevard (Route 1), Little Patuxent Parkway (Route 175), and Waterloo Road (Route 957). The Rocky Gorge subwatershed is located along the Patuxent River just downstream of Brighton Dam and continues just below Rocky Gorge Dam.

1 Methodologies

Stream monitoring was conducted throughout the watershed and involved measuring instream water quality, sampling and assessing the biological community (benthic macroinvertebrates), visually assessing the instream and riparian physical habitat, and performing cross sectional and substrate particle size measurement and analysis. Monitoring was conducted at 10 sites within each of the three PSUs (Rocky Gorge, Hammond Branch, and Dorsey Run). The assessment methods followed the current MBSS protocols (DNR, 2007) and the SOPs described in the County's QAPP (DPW, 2001). All data collection occurred between March 12 and March 30, 2009, within the Spring Index Period as required by the MBSS sampling protocols. Monitoring sites were marked in the field using tree tags (when possible) at the midpoint of the reach. The position of each site was collected using a GPS unit accurate to within 2 meters. All field data were entered into the Ecological Data Application System (EDAS) Version 3.0 (Tetra Tech, 1999). Photographs were taken to document conditions at the time of data collection. A summary of the methods used and the results of the monitoring are documented in this report.

1.1 Selection of Sampling Sites

The sampling design employed a randomized census approach stratified by stream order, with a total of 30 sites distributed among the three PSUs. Ten sites were located in each subwatershed.

To select primary and alternate sampling sites, stream lengths were summed by stream order within each subwatershed. The length of stream by stream order and its percentage of the total length within the subwatershed determined the number of sites selected on that order stream.

The randomized approach was then applied within each subwatershed. The National Hydrography Dataset (NHD) stream layer was divided into 1-meter reaches and each reach was assigned a number. A random number generator was used to select sampling reaches for 2009. Both primary and alternate sites were selected in case the primary site was ephemeral (dry), inaccessible, or unsafe to sample. Site codes contain the PSU code and initials of the watershed (**09RG**-1-01-2009), stream order (09RG-**1**-01-2009), a two-digit sequential number (09RG -1-**01**-2009), and the year sampled (09RG -1-01-**2009**). Alternate sites are coded with an "a" after the sequential number.

Three additional biological samples were collected as quality assurance/quality control (QA/QC) samples at duplicate sites, one in each of the three subwatersheds. Biological sampling, habitat assessments and water quality measurements were repeated at the duplicate sites. These sites were selected in the field. Duplicate sampling reaches were the same length as the paired sampling sites (75 meters) were located immediately upstream of their paired sampling sites, had similar habitat characteristics and were not impacted by road crossings or confluences.

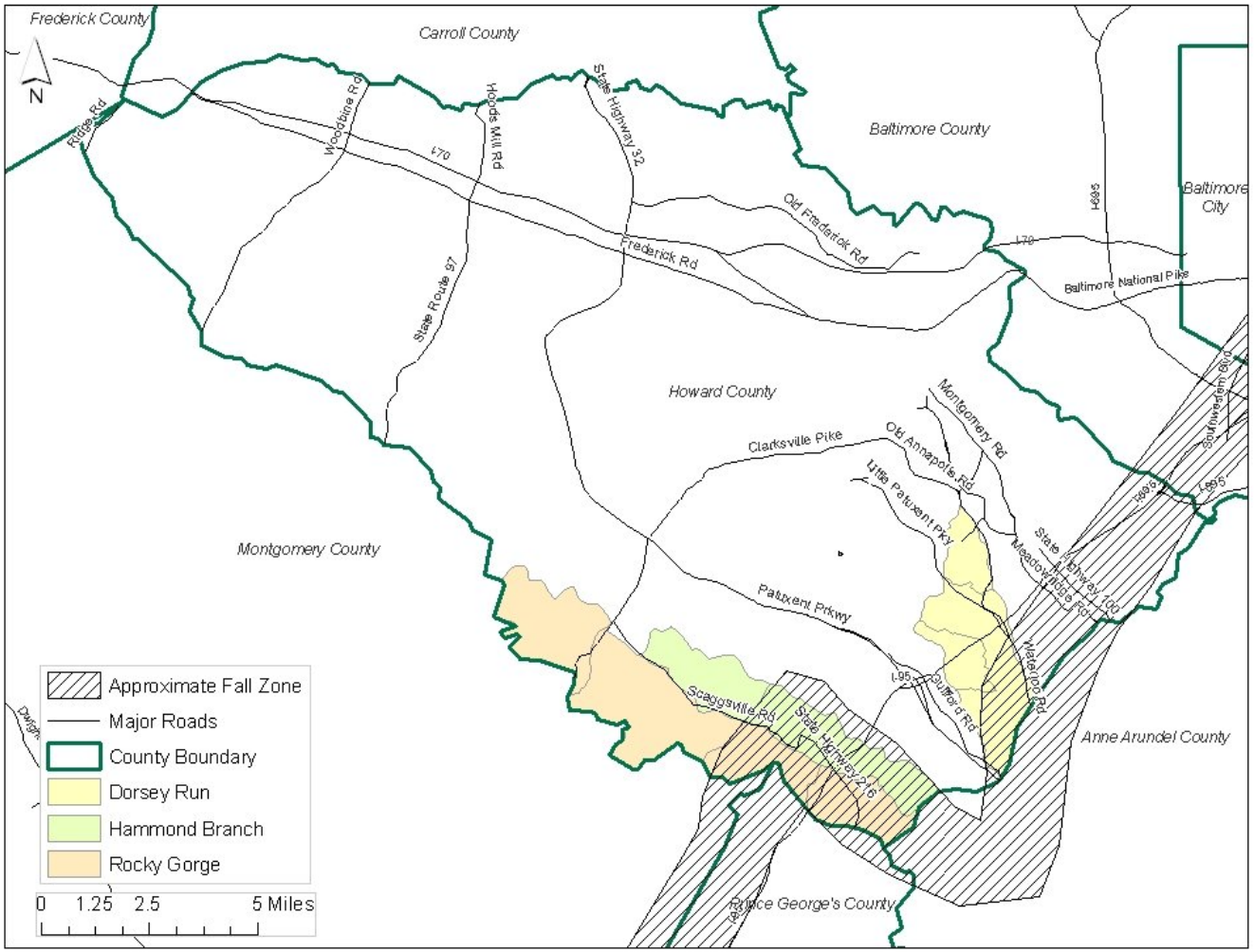


Figure 2 - Location Map of Dorsey Run, Hammond Branch and Rocky Gorge Watersheds

1.2 Impervious Surface Analysis

The impervious surface acreage and percent was calculated for the drainage area to each site using County GIS data. Drainage areas were first delineated to each sampling site using two-foot contours. Imperviousness was derived from Maryland Department of Planning (MDP) 2002 land use for Howard County and percent impervious values for each land use. Since the Patuxent River is a large watershed draining several counties, additional GIS data from Carroll, Frederick, and Montgomery Counties were also used to delineate drainage areas and calculate imperviousness based on land use. Values for percent impervious by land use were derived from the Natural Resources Conservation Services (NRCS) TR-55 (USDA, 1986). A table with the percent of land use in each subwatershed and the imperviousness percentages applied to each land use is included in Appendix A.

1.3 Water Quality Sampling

To supplement the macroinvertebrate sampling and habitat assessment, instream water quality measurements were performed. Field water quality measurements were collected *in situ* at all sites according to methods in the County QAPP. Each parameter listed in Table 2 was recorded at the bottom, middle and upstream portion of each sampling reach (including field QC sites) and averaged for a final value. Most *in situ* parameters were measured using a YSI® Professional Plus series multiprobe water quality meter. Turbidity was measured with a Hach® 2100 Turbidimeter. Water quality meters were regularly inspected, maintained, and calibrated to ensure proper usage and accuracy of the readings. Calibration logs were kept by field crew leaders and checked by the project manager regularly.

The Maryland Department of the Environment (MDE) has established acceptable standards for several water quality parameters for each designated Stream Use Classification. These standards are listed in the *Code of Maryland Regulations (COMAR) 26.08.02.03-03 - Water Quality* (MDE, 1994). The Rocky Gorge, Hammond Branch, and Dorsey Run drainage areas are in *COMAR* Sub-Basin 02-13-11: Patuxent River Area. The Rocky Gorge subwatershed below Rocky Gorge Dam along with Hammond Branch and Dorsey Run subwatersheds are all classified as Use I-P, Water Contact Recreation, Protection of Aquatic Life, and Public Water Supply. The Patuxent River below Brighton Dam and above Rocky Gorge Dam is classified as a Use IV-P water body, Recreational Trout Waters and Public Water Supply. The acceptable standards for Use I-P and IV-P streams are listed in Table 2. A comparison of these standards to data collected at each station is included in the site summary text in Section 2.1.

Table 2 - Water Quality Sampling and COMAR Standards, Use I-P and IV-P Waters

Parameter	Units	Acceptable COMAR Standard
pH	standard pH units	6.5 to 8.5
Temperature	degrees Celsius, °C	maximum of 90°F (32°C) or ambient temperature of the surface water, whichever is greater
Dissolved Oxygen (DO)	milligrams per liter, mg/L	may not be less than 5 mg/L at any time
Conductivity	microSiemans per centimeter, µS/cm	no COMAR standard set
Turbidity	Nephelometer Turbidity Units, NTU	maximum of 150 NTUs and maximum monthly average of 50 NTUs

1.4 Biological Sampling

Biological monitoring was conducted throughout the Rocky Gorge, Hammond Branch, and Dorsey Run watersheds following methods detailed in the County's QAPP (DPW, 2001). Biological assessment methods within Howard County are designed to be consistent and comparable with the methods used by Maryland Department of Natural Resources (DNR) in their Maryland Biological Stream Survey (MBSS). The County has adopted the MBSS methodology to be consistent with statewide monitoring programs and programs adopted by other Maryland counties. The methods have been developed locally and are calibrated to Maryland's physiographic regions and stream types. Because MBSS methods dictate that habitat assessments occur during the Summer Index Period while sampling fish communities, which the County does not complete, physical habitat condition for the Patuxent watershed was assessed using the EPA's Rapid Bioassessment Protocol (RBP) (Barbour et. al, 1999) habitat assessment for high-gradient streams. Certain MBSS habitat parameters, namely percent shading, require full leaf out to accurately assess, which is often misrepresented during the Spring Index Period when leaves typically have not yet opened. However, it should be noted that MBSS physical habitat data is collected to supplement RBP data, and potentially for use in future investigations or comparisons. Locations of the bioassessment sites are shown in Figure 3 with the inclusion of The National Hydrography Dataset (NHD) stream layer.

1.4.1 Benthic Macroinvertebrate Sampling

Benthic macroinvertebrate collection followed the QAPP which closely mirrors MBSS procedures (DNR, 2007). Benthic macroinvertebrate sampling is conducted during the Spring Index Period (March 1st to May 1st) along a 75-meter reach. The multi-habitat D-frame net approach was used to sample a range of the most productive habitat types within the reach. In this sampling approach, a total of twenty jabs are distributed among all available habitats within the stream system and combined into one composite sample. Sampled habitats include submerged vegetation, overhanging bank vegetation, leaf packs, mats of organic matter, stream bed substrate, submerged materials (i.e., logs, stumps, snags, dead branches, and other debris) and rocks.

1.4.2 Sample Processing and Laboratory Identification

Benthic macroinvertebrate samples were processed and subsampled according to methods described in the MBSS *Laboratory Methods for Benthic Macroinvertebrate Processing and Taxonomy* (Boward and Friedman, 2000). Subsampling is conducted to standardize the sample size and reduce variation caused by samples of different sizes. In this method the sample is spread evenly across a gridded tray and each grid is picked clean of organisms until a count of 120 is reached. The 120-organism target is used to allow for specimens that are missing parts or are not a late enough instar for proper identification. If samples were sorted beyond the 120-organism target, the sample was spread in a petri dish subdivided into grids and re-subsampled by randomly selecting grids and counting all specimens in each grid until the sample was within an acceptable range.

The samples were sent to a lab (Environmental Services and Consulting[1]) for identification. Identification of the samples was conducted to the genus level for most organisms. Groups including Oligochaeta and Nematomorpha were identified to the family level while Nematoda was left at phylum. Individuals of early instars or those that were damaged were identified to the lowest possible level, which in most cases was family. Chironomidae was further subsampled depending on the number of individuals in the sample and the numbers in each subfamily or tribe. Most taxa were identified using a stereoscope. Temporary slide mounts were used to identify Oligochaeta to family with a compound scope. Chironomid sorting to subfamily and tribe was also conducted using

[1] Address: 101 Professional Park Drive, STE 303, Blacksburg, VA

temporary slide mounts. Permanent slide mounts were then used for final genus level identification. Results were logged on a bench sheet and entered into a spreadsheet for analysis.

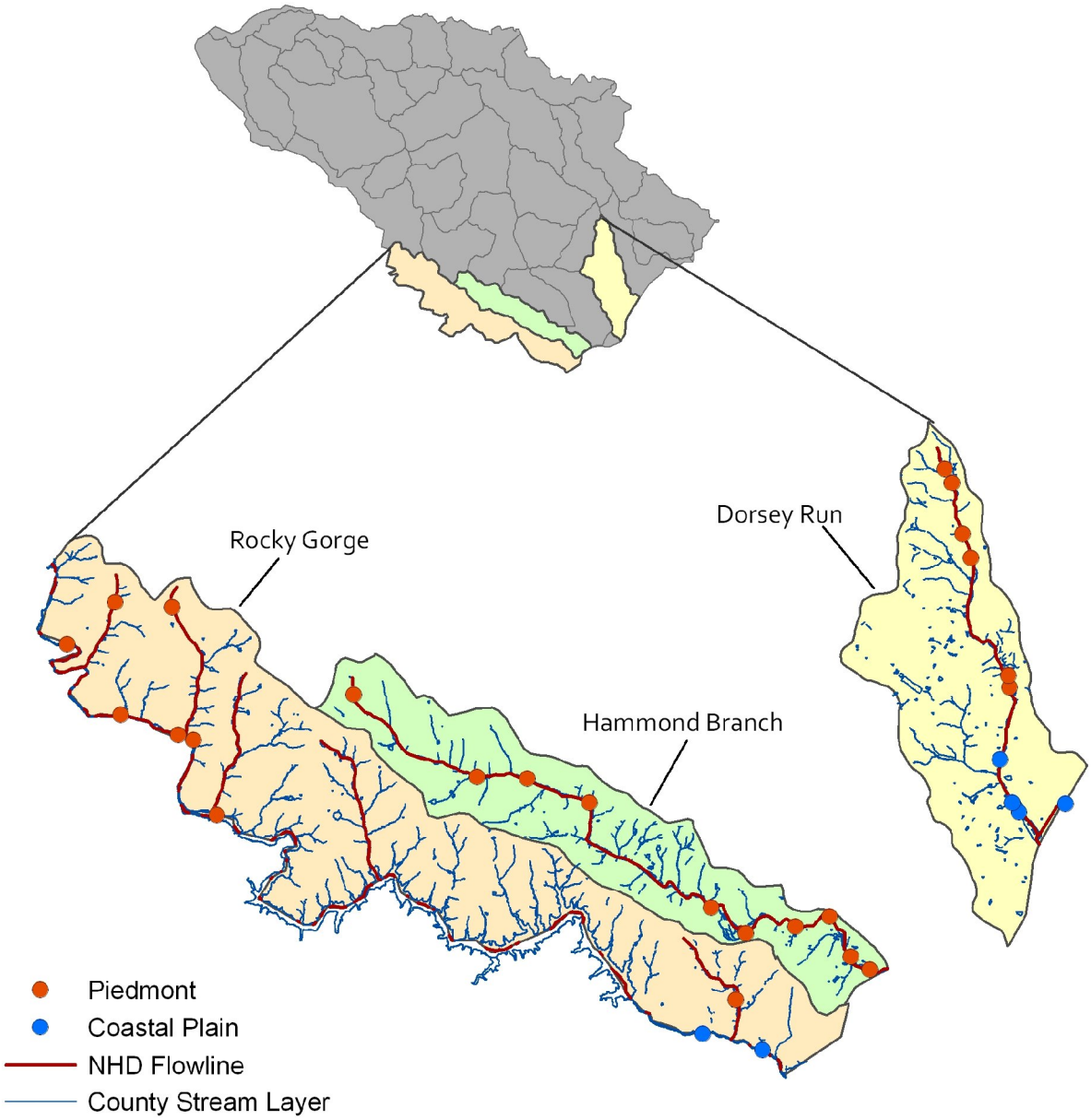


Figure 3 – Dorsey Run, Hammond Branch and Rocky Gorge Bioassessment Sampling Locations

For samples with greater than 120 organisms identified, a post-processing subsampling was conducted using a spreadsheet-based method (Tetra Tech, 2006). This post-processing randomly subsamples the identified organisms to a desired target number for the sample. Each taxon is subsampled based on its original proportion to the entire sample. In this case, the desired sample size selected was 110 individuals. This allows for a final sample size of approximately 110 individuals (±20%) but keeps the total number of individuals below the 120 maximum.

1.4.3 Biological Data Analysis

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

Raw values from each metric are given a score of 1, 3 or 5 based on ranges of values developed for each metric. The results are combined into a scaled BIBI score ranging from 1.0 to 5.0, and a corresponding narrative rating is applied. 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 physiogeographic regions. The Rocky Gorge, Hammond Branch, and Dorsey Run subwatersheds are located in the transition zone (i.e., Fall Zone) between the piedmont and coastal plain regions. While the line that demarcates these regions (i.e., Fall Line) generally follows Interstate 95 along the east coast, the transition is often more gradual and can occur over a span of several miles.

The benthic metrics, scoring criteria, and individual species tolerance were updated by DNR in 2005. The data collected in the first round of sampling of the Rocky Gorge, Hammond Branch, and Dorsey Run subwatersheds was analyzed using the old metrics (Stribling et. al 1998), and as such, the results are not directly comparable to the current sampling data. Therefore, all data from the 2003 sampling were recalculated using the updated metrics to allow for direct comparison to the current data (KCI, 2008). For this report, any mention of 2003 BIBI scores refer to these recalculated values.

The following metrics and BIBI scoring were used for data analysis:

Piedmont BIBI Metrics:

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

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

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

Percent Intolerant Urban – Equals the percentage of individuals in the sample that are considered intolerant to urbanization (tolerance values [TV] = 0 – 3). The percent of intolerant urban is expected to decrease with decreasing water quality.

Percent Chironomidae – Equals the percentage of individuals in the sample that are in the Chironomidae family. An increase in the percentage of Chironomidae is generally an indicator of decreasing water quality.

Percent Clingers – Equals the percentage of the total number of individuals who are adapted to attaching to surfaces in stream riffles. Higher percentages of clingers are representative of a decrease in stressors and higher water quality.

Information on trophic or functional feeding group and habit were based heavily on information compiled by DNR and from Merritt and Cummins (1996). Scoring criteria for the piedmont and coastal plain BIBI's are shown below in Tables 3 and 4, respectively. The raw metric value ranges are given with the corresponding score of 1, 3 or 5. Table 5 provides the BIBI scoring ranges and corresponding biological condition ratings.

Table 3 – Biological Index Scoring for Piedmont Benthic Macroinvertebrates

Metric	Score		
	5	3	1
Total Number of Taxa	≥25	15 – 24	<15
Number of EPT Taxa	≥11	5 – 10	<5
Number of Ephemeroptera Taxa	≥4	2 – 3	<2
Percent Intolerant Urban	≥51	12 – 50	<12
Percent Chironomidae	≤4.6	4.7 – 63	>63
Percent Clingers	≥74	31 – 73	<31

Coastal Plain BIBI Metrics:

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

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

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

Percent Intolerant Urban – Equals the percentage of individuals in the sample that are considered intolerant to urbanization (tolerance values [TV] = 0 – 3). The percent of intolerant urban is expected to decrease with decreasing water quality.

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

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

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

Table 4 – Biological Index Scoring for Coastal Plain Benthic Macroinvertebrates

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	≥2.0	1-1	<1.0
Percent Intolerant Urban	≥28	10-27	<10.0
Percent Ephemeroptera Taxa	≥11	0.8-10.9	<0.8
Number Scraper Taxa	≥2	1-1	<1.0
Percent Climber Taxa	≥8.0	0.9-7.9	<0.9

Table 5 – 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

1.5 Physical Habitat Assessment

Each biological monitoring site is characterized based on physical characteristics and various habitat parameters following the Environmental Protection Agency's Rapid Bioassessment Protocol (RBP) habitat assessment for high gradient streams (Barbour et. al, 1999). For sites occurring within the fall zone that were characteristic of the coastal plain physiographic region, additional low gradient habitat assessment parameters were also evaluated.

The RBP habitat assessment consists of visually assessing ten biologically significant habitat parameters that evaluate a stream's ability to support an acceptable level of biological health. Each parameter is given a numerical score from 0-20 and a categorical rating of optimal, suboptimal, marginal or poor. Overall habitat quality typically increases as the total score for each site increases. The parameters assessed for high gradient streams are listed in Table 6. Table 7 lists the parameters assessed for low gradient streams.

Table 6 – RBP Habitat Parameters - High Gradient Streams

Parameters Assessed	
Epifaunal substrate/available cover	Channel alteration
Embeddedness	Frequency of riffles/bends
Velocity/depth regime	Bank stability
Sediment deposition	Vegetative protection
Channel flow status	Riparian vegetative zone width

Table 7 – RBP Habitat Parameters - Low Gradient Streams

Parameters Assessed	
Epifaunal substrate/available cover	Channel alteration
Pool substrate characterization	Sinuosity
Pool variability	Bank stability
Sediment deposition	Vegetative protection
Channel flow status	Riparian vegetative zone width

The above parameters for each site (including QC sites) were summed to obtain a total habitat score. Since reference conditions were not available for comparison, the percent comparability was calculated based on the highest attainable score (200). The percent of reference score, or percent comparability score, is then used to place each site into corresponding narrative rating categories as shown in Table 8.

Table 8 – RBP Habitat Score and Ratings

Percent of Reference	Narrative Rating
>90.0	Comparable to Reference
75.1 – 89.9	Supporting
60.1 – 75.0	Partially Supporting
<60.0	Non-supporting

1.6 Geomorphic Analysis

The goal of the physical monitoring was to create a geomorphic characterization of the stream channels in the watershed. Assessment techniques include the cross sectional survey, substrate particle size analysis and measurement of channel slope.

1.6.1 Cross Section Analysis

Cross sections were surveyed at each monitoring station to develop a channel characterization and measurement of cross sectional area and discharge. Methods followed the Howard County SOP. Each cross section was located on a representative cross-over reach and was surveyed with a laser level and stadia rod.

The cross sections include survey of the floodplain and all pertinent channel features including:

- Top of bank
- Bankfull elevation
- Edge of water
- Limits of point and instream depositional features
- Thalweg
- Floodprone elevation

Sinuosity was calculated based on the length of the field-surveyed profile and the straight-line distance between the top and bottom of each profile. The floodprone width is estimated at an elevation two times the bankfull depth.

Where possible, additional survey points were taken near the upstream, midpoint, and downstream end of the sampling reach to obtain the slope through the reach so that estimates of discharge could be derived. Survey points for slope calculations were typically taken at the top of riffle features, although this was not always possible, especially for sampling reaches on the Patuxent River mainstem that contained only one riffle in the vicinity of the sampling reach.

The stream cross section, bed and bank material data and profile information (including slope) were analyzed using the Ohio Department of Natural Resources Reference Reach Spreadsheet Version 4.3L (Mecklenburg, 2006). The following values and ratios were calculated:

Sinuosity	Entrenchment ratio	Bankfull cross section area
Slope	Bankfull height	Velocity
Floodprone width	Bankfull width	Discharge
Width / depth ratio	Mean depth	Shear stress

1.6.2 Particle Size Analysis

The channel bed and bank materials were characterized at each cross section using pebble count analysis. A single pebble count, modified from the technique developed by Wolman (1954), was conducted in each reach to determine the composition of channel materials and the median particle size for each site. The pebble count procedure was adapted from *Stream Channel Reference Sites: An Illustrated Guide to Field Technique* (Harrelson et al, 1994). The pebble count was conducted at 10 transects across the entire assessment reach. Transects were positioned based on the proportion of riffles/pools/runs in the assessment reach as estimated by visual inspection. The count was conducted within the entire bankfull channel. The pebble counts provide roughness values necessary for calculations of velocity and discharge.

1.6.3 Rosgen Classification

Additionally, a Rosgen Level II characterization (Rosgen, 1996) was completed for each stream reach based on field-collected data. Table 9 includes general descriptions for each channel type classification based on the Rosgen classification system for natural rivers (Rosgen, 1996).

Table 9 – Rosgen Level II Channel Type Description

Channel Type	General Description (from Rosgen, 1996)
Aa+	Very steep, deeply entrenched, debris transport, torrent streams.
A	Steep, entrenched, confined, cascading, step/pool streams. High energy/debris transport associated with depositional soils. Very stable if bedrock or boulder dominated channel.
B	Moderately entrenched, moderate gradient, riffle dominated channel with infrequently spaced pools. Moderate width/depth ratio. Narrow, gently sloping valleys. Very stable plan and profile. Stable banks.
C	Low gradient, meandering, slightly entrenched, point-bar, riffle/pool, alluvial channels with broad, well-defined floodplains.
D	Braided channel with longitudinal and transverse bars. Very wide channel with eroding banks. Active lateral adjustment, high bedload and bank erosion.
DA	Anastomosing (multiple channels) narrow and deep with extensive, well-vegetated floodplains and associated wetlands. Very gentle relief with highly variable sinuosities and width/depth ratios. Very stable streambanks.
E	Low gradient, Highly sinuous, riffle/pool stream with low width/depth ratio and little deposition. Very efficient and stable. High meander/width ratio.
F	Entrenched, meandering riffle/pool channel on low gradients with high width/depth ratio and high bank erosion rates.
G	Entrenched "gully" step/pool and low width/depth ratio on moderate gradients. Narrow valleys. Unstable, with grade control problems and high bank erosion rates.

2 Results

2.1 Index Selection

Several sampling sites in each subwatershed were located within the transitional Fall Zone, which is roughly delineated by Interstate 95. As a result, preliminary analyses were conducted to determine the appropriate biological index (i.e., Piedmont or Coastal Plain) for rating the biological condition of these reaches. To determine if a single index could be applied to all sites, coastal plain and piedmont BIBI scores for sites within the transitional zone were regressed (Figure 4), a correlation analysis was performed to determine significance. Sites within Hammond Branch were omitted since there was not observed transition from high to low gradient streams in this watershed (i.e., the furthest downstream site was clearly characteristic of a high gradient, piedmont stream). A comparison of the final index scores indicates that the results are not significantly correlated (Pearson correlation = 0.417 with a significance level of 0.264), indicating the need to calculate separate BIBI's for sites exhibiting coastal plain characteristics. Best professional judgment was applied to determine which sites are characteristic of coastal plain stream, and hence, should be assessed using coastal plain metrics. For example, reaches with a high proportion of riffles and larger substrate particles such as cobbles were deemed to be characteristic of the piedmont, while low gradients reaches dominated by sand and gravel and lacking cobbles were considered characteristic of the coastal plain. Consequently, four sites downstream of US Route 1 on Dorsey Run and two sites on the Patuxent River downstream of Rocky Gorge Dam were considered to be coastal plain streams and were assessed using the coastal plain BIBI. All remaining sites were assessed using the piedmont biological index.

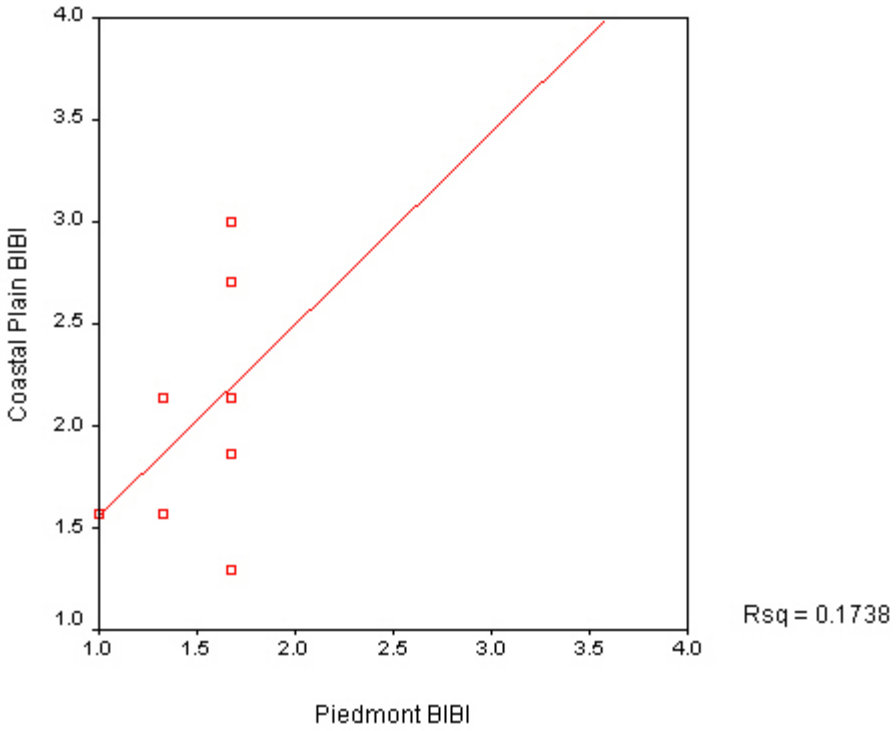


Figure 4 – BIBI Regression

2.2 Subwatershed Summaries

A total of 30 sites were sampled in the Rocky Gorge, Hammond Branch, and Dorsey Run subwatersheds, ten within each individual subwatershed. Additionally, one biological QA/QC sample was collected in each subwatershed at stations where upstream habitat was considered similar. The summary results of the habitat assessment, biological assessment, land use, and Rosgen characterization (Rosgen, 1996) are divided among the three subwatersheds and presented in detail in this section. A map of each subwatershed displaying the results of the RBP habitat assessment and BIBI is also presented. Full data results are displayed in Appendices A through F.

2.2.1 Rocky Gorge

In 2009, four of the ten sampling sites in the Rocky Gorge subwatershed were on first order streams and six were on fourth order streams. The field QC sample was collected at site 09RG-1-04a. Two sites located on the Patuxent River mainstem below Rocky Gorge Dam were low gradient and considered to be characteristic of the coastal plain. As a result, sites 4-02a and 4-03 were assessed using the coastal plain BIBI. The subwatershed had an average BIBI score of 2.94 and a 'Poor' condition rating, with scores ranging from 1.67 to 4.33. The average RBP habitat assessment comparability score 61.7, or 'Partially-Supporting', with scores ranging from 56.0 percent ('Non-supporting') to 71.5 percent ('Partially Supporting'). Channels were generally classified as Rosgen type B, C, or F types with predominantly gravel/sand substrate. A summary of the results for the Rocky Gorge subwatershed is found in Table 10.

Rocky Gorge Site Descriptions:

09RG-1-01-2009
This site is located on an unnamed tributary to Rocky Gorge Reservoir just upstream of where it empties into the reservoir. Heavy deposition of silt/clay was observed in this F4 channel, which is likely due to backup when the reservoir is at full capacity. Within the 908-acre drainage area, the predominant land use is forested land cover (44.1 percent) followed by low density residential (24.8 percent) and agriculture (22.6 percent). Impervious land cover accounted for 10 percent of the drainage area, in line with the subwatershed average of 10 percent. The habitat assessment resulted in a comparability score of 56.0, with a rating of 'Non-supporting', the lowest habitat score within the Rocky Gorge subwatershed. The banks were observed to be moderately unstable with poor or lacking benthic substrate. There were a total of 15 taxa in the benthic macroinvertebrate sample with no EPT taxa present. Close to half of the sample (46 percent) consisted of worms of the Tubificidae and Enchytraeidae families. At 48 percent, this station had one of the highest percentages of individuals of the Chironomidae family (midges) and one of the lowest percentages of individuals intolerant to urban stressors (two percent). This station received an overall BIBI score of 2.00 and a 'Poor' biological classification. Water quality results indicated all parameters were within acceptable COMAR standards.

09RG-1-02-2009
This site is located on a small, B4c headwaters stream surrounded by lawn and pasture land. This site had minimal buffer on both banks with a small retention pond draining from the left bank. However, water quality results indicated no parameters had exceeded acceptable COMAR standards. At 58-acres, this site had the smallest drainage area of the subwatershed, with 7.6 percent impervious land cover. Over half of the drainage area consisted of agricultural land use and 30.2 percent classified as low density residential. Habitat was rated as 'Non-supporting' and received a comparability score of 58.0 due to poor bank stability and minimal riparian vegetative protection. Gravel was the dominant substrate type for this sampling reach. While this station received a low habitat rating, this station received one of the highest BIBI scores within the Rocky Gorge subwatershed of 3.67 and a 'Fair' classification. This is a result of the benthic macroinvertebrate sample consisting of a very high total number of taxa (31 taxa) with ten EPT taxa present and a high percentage of individuals intolerant to urban stressors (33 percent).

09RG-1-03-2009
This sampling reach is located on a small, C5 headwater stream with a predominately gravel and sand substrate. In the 127-acre drainage area, low density residential land use accounts for 70.6 percent, followed by forest land cover at 24.4 percent. The high percentage of low density residential land use results in a drainage area with 17.7 percent imperviousness, well above the subwatershed average of 10 percent. While this stream drains a horse pasture with an abundance of manure observed , water quality results indicated no parameters that exceeded acceptable COMAR standards. The habitat assessment indicated a 'Non-supporting' habitat with a comparability score of 58.5 due to marginal scores for sediment deposition, bank stability, and vegetative protection. This station received the highest BIBI score of 4.33 with the only narrative rating of 'Good'. There were a total of 31 taxa present in this benthic macroinvertebrate sample with 12 EPT taxa, six of which were Ephemeroptera—the highest number of EPT and Ephemeroptera taxa for a Rocky Gorge sample. This station also had the highest percent of individuals intolerant to urban stressors, which accounted for 57 percent of the sample. It is possible that nutrient enrichment is responsible for the high BIBI score, given the proximity to horse pastures and abundance of nitrogen rich manure observed.

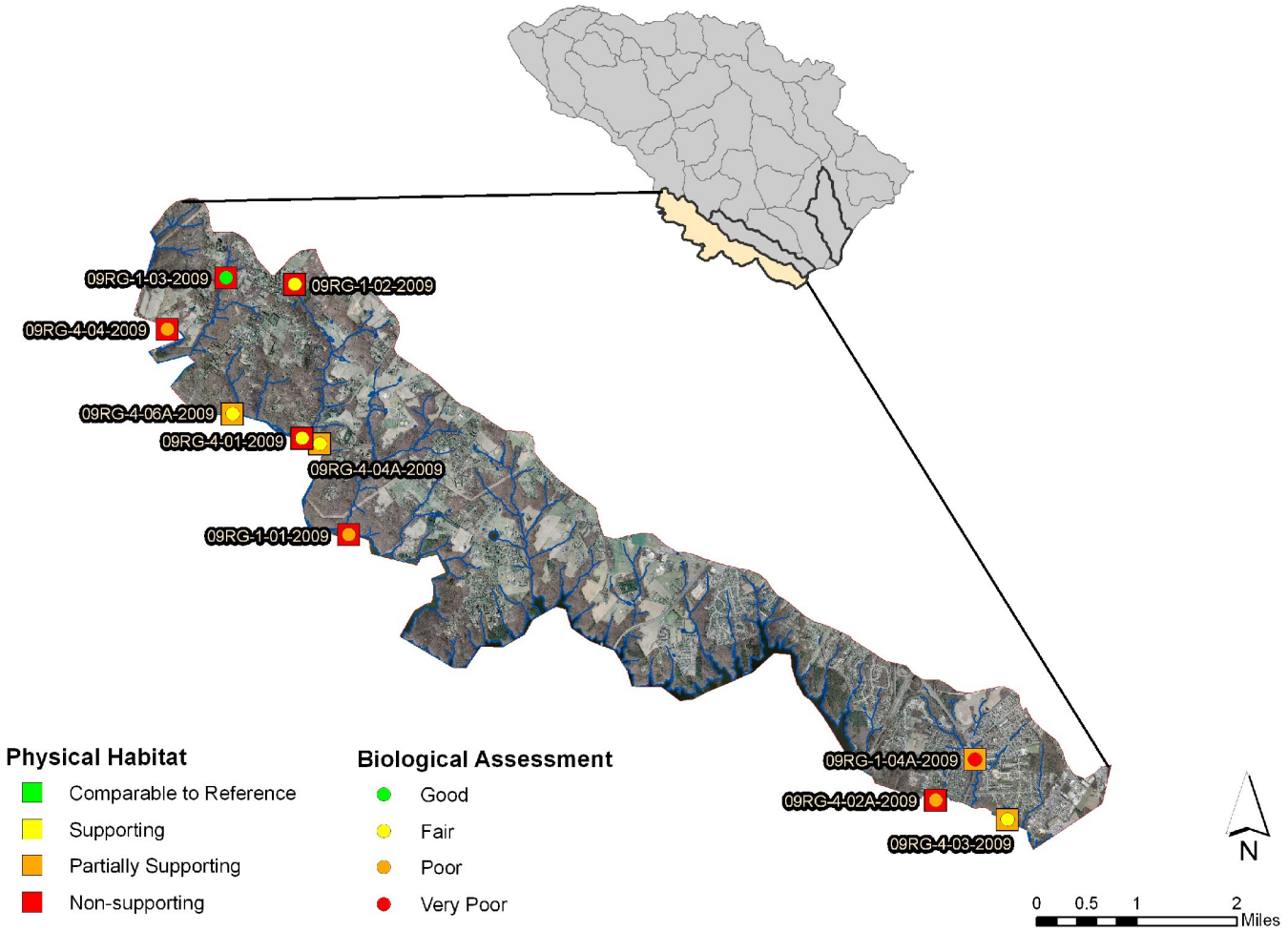


Figure 5 – Rocky Gorge PSU Sampling Results

Table 10 - Rocky Gorge Summary

Site ID	Latitude (Decimal Degrees)	Longitude (Decimal Degrees)	Drainage Area (ac)	Impervious Surface Percent	BIBI Score	BIBI Narrative Rating	Habitat Comparability Score	Habitat Narrative Rating	Rosgen Channel Type
09RG-1-01-2009	39.149131	-76.968012	908.1	10.1	2.00	Poor	56.0	Non-supporting	F4
09RG-1-02-2009	39.185505	-76.978080	57.9	7.6	3.67	Fair	58.0	Non-supporting	B4c
09RG-1-03-2009	39.186447	-76.990935	127.4	17.7	4.33	Good	58.5	Non-supporting	C5
09RG-1-04a-2009*	39.116421	-76.851157	442.7	25.3	1.67	Very Poor	71.5	Partially Supporting	B4
09RG-4-01-2009	39.163178	-76.976725	71,517.0	6.4	3.33	Fair	59.5	Non-supporting	C4
09RG-4-02a-2009	39.110533	-76.858521	86,842.3	7.3	2.71	Poor	58.5	Non-supporting	F4
09RG-4-03-2009	39.107656	-76.845117	87,798.0	7.6	3.00	Fair	61.0	Partially Supporting	C4
09RG-4-04-2009	39.179015	-77.001899	51,422.7	4.9	2.00	Poor	60.0	Non-supporting	F4
09RG-4-04a-2009	39.162315	-76.973376	72,414.0	6.4	3.67	Fair	65.5	Partially Supporting	C4
09RG-4-06a-2009	39.166697	-76.989680	70,940.2	6.4	3.00	Fair	68.5	Partially Supporting	F6
Minimum	--	--	57.9	4.9	1.67	Very Poor	56.0	Non-supporting	--
Maximum	--	--	87,798.0	25.3	4.33	Good	71.5	Partially Supporting	--
Mean	--	--	51,671.0	10.0	2.94	Poor	61.7	Partially Supporting	--
Standard Deviation	--	--	36,868.9	6.5	0.86	--	5.1	--	--

*QC sampling was conducted at this site
Bold sites indicate coastal plain physiography

09RG-1-04a-2009
This site is located on a small, F4 headwater stream next to Route 216 with a substrate consisting predominately of gravel and bedrock. This alternate site was chosen because the primary site was located on the mainstem Patuxent River, which is a fourth order stream, however the proportional allocation required four first order streams be sampled in this watershed. Even though close to half of the drainage area for this site consists of forested land cover, a combination of high density residential (20.7 percent) and medium density residential (17.2 percent) land use led to the highest percentage of impervious land cover for this subwatershed, at 25.3 percent. This site received the highest habitat comparability score within the Rocky Gorge subwatershed of 71.5 with a rating of 'Partially supporting'. Water quality results indicated all parameters within acceptable COMAR standards. However, this site had one of the highest average conductivity values (694 µS/cm) within the subwatershed, which may be in part due to its proximity to Route 216. There were only eight taxa present in this benthic macroinvertebrate sample with just one EPT taxa and no individuals intolerant to urban stressors. The benthic sample consisted primarily of worms from the families Tubificidae and Naididae (75 percent of the sample). As a result, this site received the lowest BIBI score of 1.67 with the only narrative rating of 'Very Poor'. A QC site was assessed just upstream of 09RG-1-04a and received a slightly lower habitat assessment score of 67.5 but the same rating of 'Partially supporting'. A total of 15 taxa were present in the QC sample, two of which were EPT taxa. Similar to 09RG-1-04a, the QC site had no individuals intolerant to urban stressors and a high percentage of worms from the Tubificidae and Naidiae families. Ultimately, the QC site received a BIBI score of 2.0 and a biological assessment rating of 'Poor'. A high average conductivity (702 µS/cm) was also observed at the QC site, but water quality results indicated no parameters that exceeded acceptable COMAR standards.

09RG-4-01-2009
This site is located on a fourth-order pool/glide segment of the Patuxent River, upstream of Clarksville Pike. This stream was classified as a C4 channel with predominately gravel substrate. Impervious land cover accounted for 6.4 percent of the 71,517-acre drainage area, below the subwatershed average. The predominant land use for this site is agriculture (43.1 percent) followed by forest land cover (33.3 percent) and low density residential (17.2 percent). Poor bank stability, high embeddedness, and a lack of riffles resulted in a habitat comparability score of 59.5 and a rating of 'Non-supporting'. The benthic macroinvertebrate sample for this site had a high total number of taxa (25), six of which were EPT taxa, with two Ephemeroptera present. While amphipods accounted for 25 percent of the sample, 23 percent of the sample consisted of individuals intolerant to urban stressors. Based on the BIBI score of 3.33, this site was given a 'Fair' biological condition rating. Water quality results indicated all parameters within acceptable COMAR standards.

09RG-4-02a-2009
This sampling reach is located on the Patuxent River mainstem and is classified as a F4 channel, with a substrate predominately consisting of gravel and sand. This site is one of two sites located below Rocky Gorge Dam, which was considered to be characteristic of the coastal plain and was therefore assessed using the coastal plain BIBI. This alternate site was chosen because the primary site was located within the Rocky Gorge Reservoir. At 86,842 acres, this site had the second largest drainage area for the entire Rocky Gorge subwatershed with 7.3 percent of the drainage area consisting of impervious land cover—below the subwatershed average. Land use in the drainage area is primarily agriculture and forested land cover (38.5 percent and 34.4 percent, respectively) followed by low density residential (18.6 percent). Generally poor riffle quality and poor bank stability and vegetative protection resulted in a habitat comparability score of 58.5 with a 'Non-supporting' classification. While there is a large storm drain present directly upstream of the site, water quality results indicated no parameters that exceeded acceptable COMAR standards. There were a total of 20 taxa in the

benthic macroinvertebrate sample, four of which were EPT taxa, with one Ephemeroptera present and two scraper taxa present. Close to half of this sample (40 percent) was comprised of amphipods. However, only seven percent of the sample consisted of individuals intolerant to urban stressors and no climbers were present in the sample. Although there were numerous taxa present, the low level of intolerant individuals and complete lack of climbers contributed to an overall BIBI score of 2.71 for this site, resulting in a biological rating of 'Poor'.

09RG-4-03-2009
This site, located on the Patuxent River mainstem below Rocky Gorge Dam, was assessed using the coastal plain BIBI due to its low gradient, lack of riffles, and dominance of pool features, all of which are characteristic of coastal plain streams. This stream was classified as a C4 channel with predominately sand and gravel substrate. This site had the largest drainage area of the subwatershed at 87,798 acres, 7.6 percent of which was impervious land cover. Like site 09RG-4-02a, this drainage area consisted primarily of agriculture (38.1 percent) and forested land cover (34.4 percent) followed by low density residential (18.4 percent). Because of a lack of riffles, high embeddedness, and poor riparian vegetative zone this site received a habitat comparability score of 61.0 with a rating of 'Partially supporting'. Water quality results indicated all parameters within acceptable COMAR standards. This station received a BIBI rating of 'Fair' with a score of 3.00. Seventeen total taxa were present in this benthic macroinvertebrate sample, two of which were EPT taxa and three were scraper taxa. No Ephemeroptera were present in this sample, and only eight percent of the sample consisted of individuals intolerant to urban stressors. The benthic sample consisted primarily of amphipods (25 percent) and tolerant midges such as *Hydrobaenus* (22 percent) and *Orthocladius* (18 percent).

09RG-4-04-2009
This sampling reach is located in a large, deep pool feature of the Patuxent River just upstream of Haviland Mill Road. Close to half of the drainage area for this site is classified as agriculture (47.1 percent), with 32.6 percent as forested land cover and 17.0 percent classified as low density residential. In the 51,423-acre drainage area, this site had the lowest percentage of impervious land cover at 4.9 percent, well below the subwatershed average. Classified as a F4 channel, this sampling reach is dominated by gravel substrate and received a habitat comparability score of 60.0 with a rating of 'Non-supporting' due to poor bank stability and poor vegetative protection. There were a total of 24 taxa present in this benthic macroinvertebrate sample, consisting of five EPT taxa and one Ephemeroptera. This sample had the lowest percentage of midges out of all samples in the subwatershed at 16 percent and was dominated by amphipods, accounting for 50 percent of the sample. However, this sample also had one of the lowest percentages of individuals intolerant to urban stressors (three percent) and the lowest percentage of clingers (16 percent) resulting in a BIBI score of 2.0 with a rating of 'Poor'. Water quality results indicated all parameters were within acceptable COMAR standards.

09RG-4-04a-2009
This site is located on the Patuxent River mainstem, with a large bridge culvert (Clarksville Pike) spanning the middle portion of the reach. This reach was classified as a C4 channel type with a predominately gravel and silt/clay substrate. This alternate site was chosen because the primary site was located within the Rocky Gorge Reservoir. Land use in the 72,414-acre drainage area is primarily agricultural (43.0 percent) and forested land cover (33.4 percent), with the majority of the remainder as low density residential (17.3 percent). The overall imperviousness in this drainage area is 6.4 percent, which is below average for the subwatershed. Because of a general lack of riffles, this site received a habitat assessment comparability score of 65.5 with a rating of 'Partially Supporting'. Water quality results indicated no parameters that exceeded acceptable COMAR standards. Due to the depth of the sampling reach, benthic macroinvertebrate sampling was performed along one bank of the reach and within a riffle feature approximately 75 feet upstream of the site. There were a total of 39

taxa in the sample, the most taxa present within all samples in the Rocky Gorge subwatershed. Within the benthic sample, seven EPT taxa and four Ephemeroptera taxa were present. However, this site had a low percentage of individuals intolerant to urban stressors (13 percent) and a high percentage (49 percent) of individuals of the Chironomidae family (midges). Because of the numerous taxa present and high number of EPT and Ephemeroptera taxa, this sample received one of the highest BIBI scores in this subwatershed (3.76) and a biological rating of 'Fair'.

09RG-4-06a-2009
This sampling reach is located in a fourth-order section of the Patuxent River mainstem, upstream of site 09RG-4-01. This alternate site was chosen because the primary site was located within the Rocky Gorge Reservoir. Similar to site 09RG-4-01 and 09RG-4-04a, the predominant land use for the 70,940-acre drainage area of this site is agriculture (43.3 percent) followed by forested land cover (33.1 percent) and low density residential (17.1 percent), which resulted in 6.4 percent imperviousness. This reach was classified as an F6 channel and the substrate was dominated by silt/clay particles. Because this site was located in the middle of a large pool feature, the lack of riffles present resulted in a habitat assessment comparability score of 68.5 with 'Partially supporting' classification. Due to the depth of the sampling reach, benthic macroinvertebrate sampling included one riffle located just downstream of the site. Based on the BIBI score of 3.00, this site was given a 'Fair' biological condition rating. In this benthic macroinvertebrate sample, 33 taxa were present, ten of which were EPT taxa with two were Ephemeroptera. Clingers accounted for 54 percent of this sample, while individuals of the Chironomidae family (midges) made up 40 percent of the sample and individuals intolerant to urban stressors accounted for only seven percent of the sample. Water quality results indicated all parameters were within acceptable COMAR standards.

2.2.2 Hammond Branch

All ten sites sampled in 2009 within the Hammond Branch PSU were on first order streams as defined by the National Hydrography Dataset. The field QC sample was collected immediately upstream of site 14HB-1-10. Habitat assessment comparability scores ranged from 38.0 percent, with a classification of 'Non-supporting' to 79.5 percent and a classification of 'Supporting'. The mean habitat comparability score was 63.0 with a rating of 'Partially Supporting'. All sites were considered characteristic of piedmont streams and were assessed using the piedmont BIBI. There were no sites that received biological condition ratings of 'Fair' or 'Good', with scores that ranged from a low of 1.33, or 'Very Poor' to 2.67, or 'Poor'. The mean BIBI score was 2.10, with an average biological condition rating of 'Poor'. Stream reaches were classified as either B, C, or F channels, with sand, gravel, or cobble dominated substrates. A summary of the results for the Hammond Branch subwatershed is found in Table 11.

Hammond Branch Site Descriptions:

14HB-1-01-2009
This site is located on a large, scoured reach downstream of I-95, with 56 feet of the sampling reach falling within the box culvert beneath the interstate. This sampling reach was classified as a F5 channel with sand and silt/clay substrate. Water quality results indicated no parameters that exceeded acceptable COMAR standards. The land use within the 3,528-acre drainage area is predominantly agricultural (42.4 percent) followed by low density residential (22.3 percent) and forested land cover (20.4 percent). The percentage of impervious surface in the drainage area is 13.6 percent, which is slightly above the subwatershed average of 13.0 percent. This sampling reach contained no riffles, had poor bank stability, high embeddedness and poor vegetative protection. As a result, this site received the lowest comparability score for the Hammond Branch subwatershed with a score of 38.0 and a rating of 'Non-supporting'. The BIBI score was 2.00, with a biological rating of 'Poor.' Of the

20 taxa present, no EPT taxa and no Ephemeroptera were present, with only one percent of the sampling comprising individuals intolerant to urban stressors. The majority of the sample (49 percent) consisted of individuals of the Chironomidae family (midges), with worms of the Tubificidae family accounting for 31 percent of the benthic sample.

14HB-1-02-2009
Located behind Promise Court, this sampling reach is a C4 channel. The predominant substrate of this stream is gravel. Heavy sediment deposition, erosion, and poor riffle quality attributed to the habitat assessment rating of 'Non-supporting' with a score of 49.0. Thirteen percent of the 3,682 acre-drainage area consists of impervious land cover— exactly the average impervious percentage for the subwatershed. The dominant land use for this drainage area is agriculture (41.0 percent) followed by forested land cover (23.3 percent) and low density residential (21.4 percent). There were 29 taxa in the benthic macroinvertebrate sample, six of which were EPT taxa and one of which was Ephemeroptera. Sixty-four percent of the individuals in this sample were of the Chironomidae family (midges), while 49 percent of the sample consisted of clingers and only five percent consisted of individuals intolerant to urban stressors. Overall, this site received a BIBI score of 2.33 with a narrative rating of 'Poor'. Water quality results indicated all parameters within acceptable COMAR standards.

14HB-1-03-2009
This site is located on a stream that runs parallel to a sewer line clearing and gravel utility access road. Classified as a C4 channel, the dominant substrate for this sampling reach is gravel, with an abundance of cobble also present. At 4,560 acres, this is the largest drainage area in the subwatershed. Agriculture is the predominant land use in this drainage area (35.6 percent) followed by forested land cover (23.7 percent), low density residential (17.7 percent) and medium density residential (10.7 percent). With low density and medium density residential equating to 28.4 percent of the total land use, this drainage area has the second highest percentage of impervious surface within the subwatershed at 17.3 percent. Habitat was rated as 'Partially supporting' and received a comparability score of 71.0 due to moderately unstable banks and suboptimal vegetative protection and riparian zone width. Water quality results indicated no parameters that exceeded acceptable COMAR standards. There were 19 taxa in this benthic macroinvertebrate sample with six EPT taxa and two Ephemeroptera taxa present. Only two percent of the subsample consisted of individuals intolerant to urban stressors and individuals of the Chironomidae family (midges) accounted for 40 percent of the subsample. Because of a high percentage of clingers present in this sample (64 percent) and a relatively high number of total taxa and EPT taxa present, this sample received one of the highest BIBI scores within the subwatershed of 2.67 (tied with sites 14HB-1-04 and 14HB-1-09) and a corresponding biological condition rating of 'Poor'.

14HB-1-04-2009
Located behind Glendower Court, this sampling reach was classified as a C3 channel with a predominately cobble substrate. At this site, the majority of the surrounding land use in the 3,953-acre drainage area is agriculture (41.0 percent) followed by forested land cover (23.7 percent) and low density residential (20.1 percent). Impervious surface accounted for 13.1 percent of the drainage area—0.1 percent above the subwatershed average. With a habitat comparability score of 79.5, this site is one of only two sites within this subwatershed to receive a 'Supporting' habitat rating (i.e., site 14HB-1-06 was also rated as 'Supporting'). This sampling reach also received one of the highest BIBI scores of 2.67 with a rating of 'Poor' (tied with site 14HB-1-03 and 14HB-1-09). A total of 26 taxa were in the subsample, six of which were EPT taxa and two of which were Ephemeroptera taxa. Individuals of the Chironomidae family (midges) dominated this sample (73 percent) and only eight percent of the sample consisted of individuals intolerant to urban stressors. Water quality results indicated all parameters within COMAR standards.

14HB-1-05-2009
This site is located on an incised F4 channel with a predominately gravel substrate. Water quality results indicated no parameters that exceeded acceptable COMAR standards. Over half of the land use in this drainage area is classified as agriculture (52.7 percent) with low density residential accounting for 26.4 percent and forested land cover accounting for 15.4 percent. The overall imperviousness within the 2,116-acre drainage area is 9.6 percent, which is below the subwatershed average of 13.0 percent. Because of marginal and poor scores for sediment deposition, bank stability and vegetative protection, this sampling reach received a habitat comparability score of 55.5 and corresponding rating of 'Non-supporting.' Of the 20 taxa present in this benthic macroinvertebrate sample, only three EPT taxa were present and just one Ephemeroptera taxa. Additionally, chironomids (midges) accounted for 83 percent of the sample, the highest percentage within this subwatershed, with *Orthocladius* (tolerance value [TV] = 9.2) and *Hydrobaenus* (TV = 7.2) dominating the subsample. This site received one of the lowest BIBI scores within this subwatershed with a score of 1.33 and a narrative rating of 'Very poor' (tied with sites 14HB-1-07 and 14HB-1-10QC).

14HB-1-06-2009
This sampling site is located in a riffle dominated channel with several bedrock outcrops. The reach was classified as a B3 channel with a mix of cobble and gravel as the dominate substrate types. In the 4,079-acre drainage area to this site, the majority of the surrounding land use is agriculture (39.7 percent) and forested land cover (23.6 percent), with 19.8 percent low density residential. The percentage of impervious surface in the drainage area is 13.9 percent, which is slightly above the subwatershed average of 13.0 percent. Most water quality parameters were within COMAR limits; however, pH (8.84) was just slightly above the upper allowable limit of 8.5 for Use I-P streams. While the source of the alkaline water conditions is unclear, it is likely due to natural geologic sources in the bedrock (e.g., calcium carbonate) considering the abundance of bedrock outcrops within the stream bed and banks. As a result of optimal riffle quality, moderately stable banks, and good vegetative protection, this site received one of the highest habitat comparability scores of 79.5 with a rating of 'Supporting' (tied with 14HB-1-04 for the highest habitat score). While this benthic macroinvertebrate sample had a high number of taxa (26), this sample only had four EPT taxa and just one Ephemeroptera taxa present. Individuals of the Chironomidae family (midges) dominated this sample at 65 percent, with *Orthocladius* (TV = 9.2) and *Hydrobaenus* (TV = 7.2) accounting for over a third of the subsample. As a result of a large percentage of chironomids and a low percentage of both clingers and individuals intolerant to urban stressors (27 and 5 percent, respectively), this site received a BIBI score of 1.67 and a narrative rating of 'Very Poor'.

14HB-1-07-2009
This site was located on the uppermost headwaters of the Hammond Branch subwatershed. Classified as a F4 channel, the substrate of this sampling reach was predominantly gravel. At 102-acres, this site had the smallest drainage area of the subwatershed. Low density residential land use dominates this drainage area at 73.9 percent, which results in 18.5 percent impervious land cover—the highest percentage in this subwatershed. Forested land cover and agriculture land use combined account for only 26.1 percent of the drainage area. A high measurement of conductivity (1,303 µS/cm) was observed at this site, however, no water quality parameters exceeded acceptable COMAR standards. The habitat assessment indicated a 'Non-supporting' habitat with a comparability score of 59.0 due to poor instream and epifaunal habitat and marginal bank stability and vegetative protection. Only 12 taxa, the lowest total taxa value in the subwatershed, were present in this benthic macroinvertebrate sample, and only three EPT taxa and no Ephemeroptera were present. Over half of this sample consisted of amphipods with chironomids (midges) accounting for 30 percent of the sample. This sample had the lowest percentage of clingers present at two percent, and individuals intolerant to urban stressors comprised only two percent of the sample. Overall, this sample received one of the

lowest BIBI scores for this subwatershed of 1.33, with a rating of 'Very poor' (tied with site 14HB-1-05 and 14HB-1-10QC).

14HB-1-08-2009
Located behind Lime Kiln Middle School off of MD Route 216, this sampling reach was classified as a C4 channel dominated by gravel substrate. Water quality results indicated no parameters that exceeded acceptable COMAR standards. While there was poor bank stability and marginal vegetative protection, this site received a habitat comparability score of 65.0 with a rating of 'Partially Supporting' due to the predominance of riffle habitat. In this 1,200-acre drainage area, agriculture accounted for over half of the land use (51.1 percent) followed by low density residential (31.8 percent), with the remaining 17.1 percent consisting of forested land cover. The overall impervious drainage is just over eight percent, which is below the subwatershed average of 13.0 percent. This site received a BIBI score of 2.33 with a narrative rating of 'Poor'. There were 22 taxa in this benthic macroinvertebrate sample, seven of which were EPT taxa but with only one Ephemeroptera taxa present. While only seven percent of this sample consisted of individuals intolerant to urban stressors, clingers made up 73 percent of the sample with *Cheumatopsyche* (a clinger taxon of the Order Trichoperta) dominating the sample at 39 percent. Additionally, this site had the lowest percentage of individuals of the Chironomidae family (midges) accounting for only 25 percent of the sample.

14HB-1-09-2009
This site is located just upstream of the culvert below the Washington Boulevard crossing, a few thousand feet downstream of site 14HB-1-06. Like site 14HB-1-06, the source of the alkaline water conditions is thought to be natural and not anthropogenic. This sampling reach was classified as a F4 channel with severe bank erosion in some locations. Gravel is the dominate substrate type for this channel. At 4,304 acres, this is the second largest drainage area of this subwatershed. Although 37.7 percent of the drainage area is agriculture and 24.3 percent is forested land cover, combined low/ medium/high density residential accounts for a third of the drainage area. As a result, the drainage area has 15.1 percent of impervious surface, which is above the subwatershed average of 13.0 percent. Habitat was rated as 'Partially Supporting' with a comparability score of 71.5. There were several areas exhibiting severe bank erosion and moderately unstable banks. While there was a high number of total taxa (31) and a high number of EPT taxa present (nine), there was only one Ephemeroptera taxa present in the benthic macroinvertebrate sample. Additionally, chironomids (midges) dominated this sample at 60 percent, with *Orthocladius* (TV = 9.2) accounting for over a third of the subsample. Only four percent of this sample comprised individuals intolerant to urban stressors. This site received one of the highest BIBI scores (2.67; tied with station 1-03 and 1-04) in the subwatershed, which resulted in a 'Poor' biological condition rating.

14HB-1-10-2009
Located just behind a newly developed residential community, this sampling reach was classified as a F4 channel with a mix of sand and gravel substrates. Water quality results indicated all parameters within acceptable COMAR standards. Because of heavy erosion on both banks and poor sedimentation and vegetative protection, this reach received a habitat comparability score of 59.5 with a 'Non-supporting' classification. Over half (53.9 percent) of the land use in the 1,633-acres draining to the site is agricultural land use, with an additional 29.7 percent as low density residential and 15.9 percent as forested land cover. The percentage of impervious surface in the drainage area is 7.9 percent, which is below the subwatershed average of 13.0 percent. Of the 25 total taxa identified in this sample, only four were EPT taxa and Ephemeroptera taxa were absent. Individuals of the Chironomidae family (midges) dominated this sample at 69 percent, with *Orthocladius* (TV = 9.2) accounting for 24 percent of the subsample. Only five percent of this sample consisted of individuals intolerant to urban stressors. Clingers made up 35 percent of the sample with 19 *Cheumatopsyche* (a clinger taxon of the Order Trichoperta) indentified in the subsample. The BIBI score was 2.00, with a

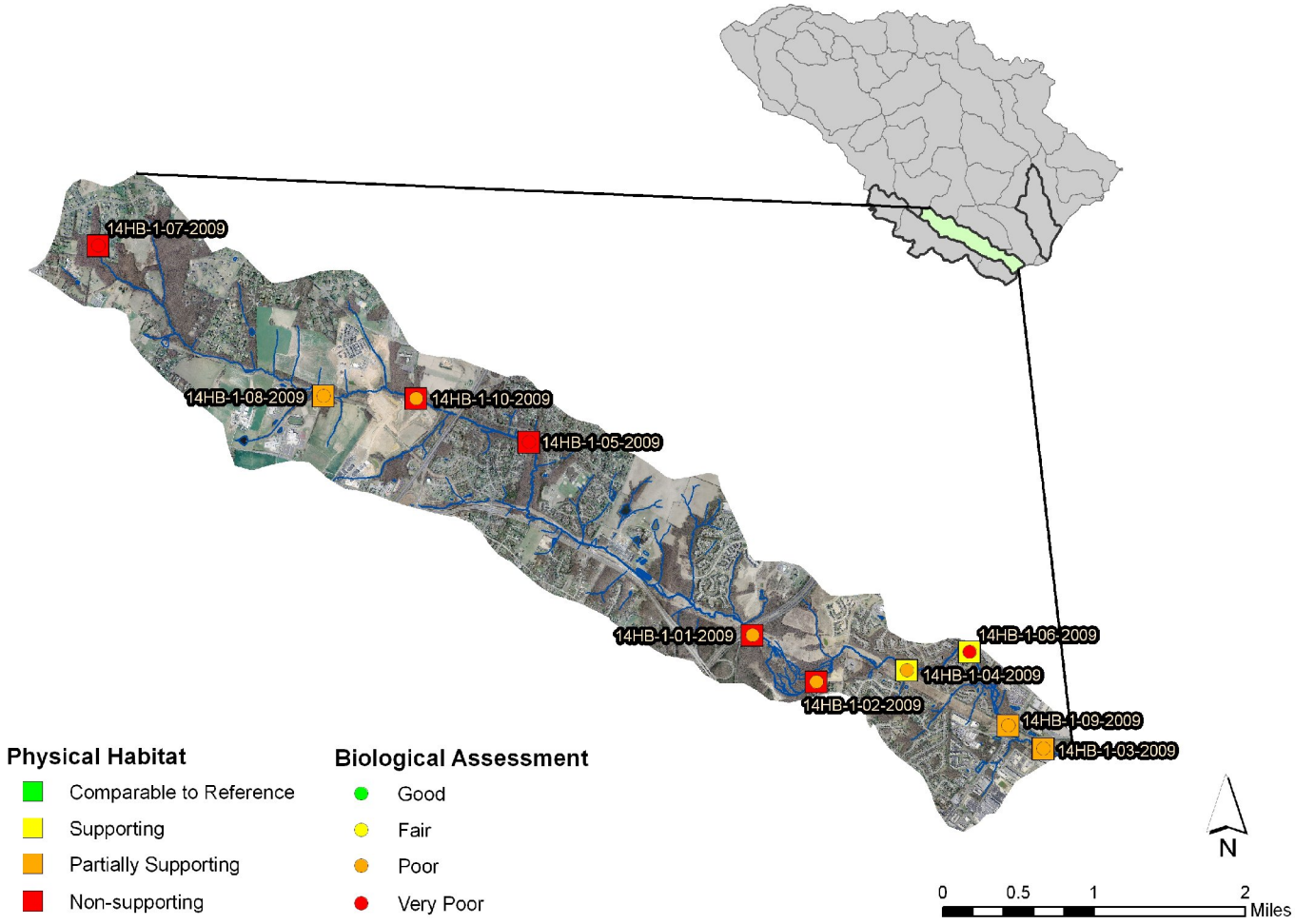


Figure 6 - Hammond Branch PSU Sampling Results

Table 11 - Hammond Branch Summary

Site ID	Latitude (Decimal Degrees)	Longitude (Decimal Degrees)	Drainage Area (ac)	Impervious Surface Percent	BIBI Score	BIBI Narrative Rating	Habitat Comparability Score	Habitat Narrative Rating	Rosgen Channel Type
14HB-1-01-2009	39.132662	-76.856620	3,528.1	13.6	2.00	Poor	38.0	Non-supporting	F5
14HB-1-02-2009	39.128178	-76.848745	3,681.7	13.0	2.33	Poor	49.0	Non-supporting	C4
14HB-1-03-2009	39.121723	-76.820848	4,560.1	17.3	2.67	Poor	71.0	Partially Supporting	C4
14HB-1-04-2009	39.129300	-76.837598	3,952.8	13.1	2.67	Poor	79.5	Supporting	C3
14HB-1-05-2009	39.151272	-76.884088	2,116.2	9.6	1.33	Very Poor	55.5	Non-supporting	F4
14HB-1-06-2009	39.131039	-76.829903	4,078.9	13.9	1.67	Very Poor	79.5	Supporting	B3
14HB-1-07-2009	39.170178	-76.937137	101.6	18.5	1.33	Very Poor	59.0	Non-supporting	F4
14HB-1-08-2009	39.155735	-76.909396	1,200.3	8.1	2.33	Poor	65.0	Partially Supporting	C4
14HB-1-09-2009	39.123951	-76.825198	4,304.5	15.1	2.67	Poor	71.5	Partially Supporting	F4
14HB-1-10-2009*	39.155475	-76.897961	1,632.9	7.9	2.00	Poor	59.5	Non-supporting	F4
Minimum	--	--	101.6	7.9	1.33	Very Poor	38.0	Non-supporting	--
Maximum	--	--	4,560.1	18.5	2.67	Poor	79.5	Supporting	--
Mean	--	--	2,915.7	13.0	2.10	Poor	62.8	Partially Supporting	--
Standard Deviation	--	--	1,533.7	3.6	0.52	--	13.3	--	--

*QC sampling was conducted at this site

biological rating of 'Poor.' A QC site was assessed just upstream of 14HB-1-10 and received a slightly higher habitat assessment score of 60.5 (a difference of only one point), which elevated the habitat rating to 'Partially Supporting'. A total of 18 taxa were identified in the QC sample, three of which were EPT taxa. Similar to 14HB-1-10, the QC site had no Ephemeroptera taxa, a low percentage of individuals intolerant to urban stressors (two percent) and a high percentage of chironomids (79 percent) with *Orthocladius* (TV = 9.2) dominating the sample (52 percent). Clingers accounted for 26 percent of the subsample with 15 *Cheumatopsyche* indentified. Ultimately, the QC site received a BIBI score of 1.33 and a biological assessment rating of 'Very Poor' (tied with stations 14HB-1-05 and 14HB-1-07 as the lowest BIBI score in this subwatershed).

2.2.3 Dorsey Run

All ten sites sampled in the Dorsey Run subwatershed in 2009 were located on first-order streams as defined by the National Hydrography Dataset, four of which were low gradient streams characteristic of the coastal plain. The field QC sample was collected at site 15DR-1-09. All stream reaches were classified as C or F channels, with sand or gravel dominated substrates. A summary of the results for the Dorsey Run subwatershed is in Table 12.

All but three sites within the Dorsey Run PSU were rated as 'Non-Supporting' based on the RBP habitat assessment comparability scores. The mean habitat comparability score of 53.5 for the subwatershed resulted in a 'Non-Supporting' rating.

Eight of the ten sites sampled in the Dorsey Run subwatershed received biological condition ratings of 'Very Poor.' The remaining two sites received 'Poor' biological ratings. BIBI scores ranged from a low of 1.00 to 2.14, which resulted in a mean BIBI score of 1.40 and an overall biological condition rating of 'Very Poor' for the subwatershed

Dorsey Run Site Descriptions:

15DR-1-01-2009
Located behind a hotel off of Crestmount Road and Washington Boulevard, this sampling reach is a high gradient, riffle dominated channel with several bedrock outcrops. The stream was classified as a C4 channel with gravel as the dominant substrate. A high measurement of conductivity (1,406 µS/cm) was observed at this site, but water quality results indicated no parameters that exceeded acceptable COMAR standards. Of the 1,843-acre drainage area, the dominant land use is forested land cover (40.3 percent) followed by commercial and industrial land use (18.9 percent). Low, medium, and high density residential land use, when combined, account for 32.7 percent of the drainage area resulting in an impervious percentage of 30.1, slightly below the subwatershed average of 31.7 percent. This sampling reach received a percent comparability score of 63.0 and a rating of 'Partially supporting' due to marginal embeddedness, fairly stable banks, and suboptimal vegetative protection. The biological condition was rated 'Very Poor' with a BIBI score of 1.33. Of the 16 total taxa identified in the subsample, only three were EPT taxa and Ephemeroptera taxa were absent. Individuals of the Chironomidae family (midges) dominated this sample at 70 percent, with *Orthocladius* (TV = 9.2) comprising 54 percent of the subsample. Clingers accounted for 29 percent of the subsample (the highest percentage within this subwatershed) with 17 *Cheumatopsyche* indentified.

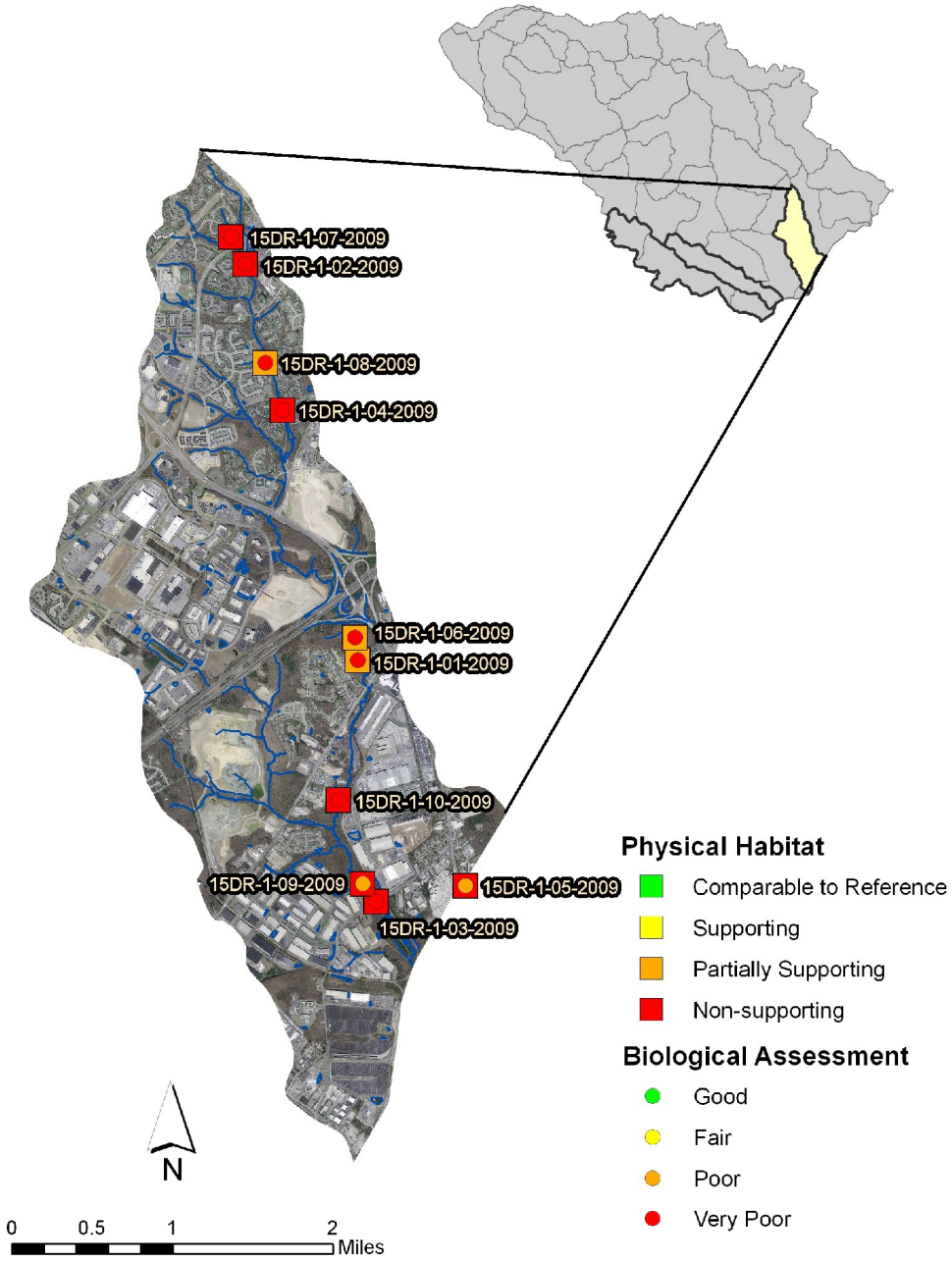


Figure 7 - Dorsey Run PSU Sampling Results

Table 12 - Dorsey Run Summary

Site ID	Latitude (Decimal Degrees)	Longitude (Decimal Degrees)	Drainage Area (ac)	Impervious Surface Percent	BIBI Score	BIBI Narrative Rating	Habitat Comparability Score	Habitat Narrative Rating	Rosgen Channel Type
15DR-1-01-2009	39.171304	-76.789172	1,843.0	30.1	1.33	Very Poor	63.0	Partially Supporting	C4
15DR-1-02-2009	39.207134	-76.802057	189.4	28.3	1.00	Very Poor	60.0	Non-supporting	C4
15DR-1-03-2009	39.149472	-76.787093	4,128.0	37.2	1.86	Very Poor	45.5	Non-supporting	F5
15DR-1-04-2009	39.193946	-76.797798	577.4	35.2	1.00	Very Poor	45.0	Non-supporting	F5
15DR-1-05-2009	39.150897	-76.776748	531.4	18.4	2.14	Poor	35.0	Non-supporting	F4
15DR-1-06-2009	39.173358	-76.789469	1,811.8	30.4	1.00	Very Poor	64.5	Partially Supporting	C4
15DR-1-07-2009	39.209582	-76.803752	33.0	30.3	1.00	Very Poor	57.0	Non-supporting	C4
15DR-1-08-2009	39.198217	-76.799797	504.2	35.3	1.00	Very Poor	61.5	Partially Supporting	C4
15DR-1-09-2009*	39.151096	-76.788657	4,013.4	36.7	2.14	Poor	56.5	Non-supporting	C5
15DR-1-10-2009	39.158659	-76.791448	2,241.7	35.0	1.57	Very Poor	47.0	Non-supporting	C4
Minimum	--	--	33.0	18.4	1.00	Very Poor	35.0	Non-supporting	--
Maximum	--	--	4,128.0	37.2	2.14	Poor	64.5	Partially Supporting	--
Mean	--	--	1,587.3	31.7	1.40	Very Poor	53.5	Non-supporting	--
Standard Deviation	--	--	1,511.6	5.6	0.49	--	9.8	--	--

*QC sampling was conducted at this site
Bold sites indicate coastal plain physiography

15DR-1-02-2009
This site is located on a C4 channel with predominately gravel substrate. While a storm drain and outfall were both connected directly to the stream in sampling reach, water quality results indicated no parameters that exceeded acceptable COMAR standards. Because of suboptimal scores for bank stability, vegetative protection, and sediment deposition this site received a habitat assessment score of 60.0 and a 'Non-supporting' classification. The dominant land use in the 189-acres drainage area is medium density residential (40.5 percent) followed by forested land cover (15.8 percent), high density residential (15.4 percent) and agriculture (13.2 percent). Impervious surface accounted for 28.3 percent of the drainage area, which is below the subwatershed average of 31.7 percent. There were 14 total taxa identified in the benthic macroinvertebrate sample, two of which were EPT taxa. No Ephemeroptera and no individuals intolerant to urban stressors were present in this sample. Individuals of the Chironomidae family (midges) dominated this sample at 87 percent, with *Sympotthastia* (TV = 8.2) accounting for 47 percent of the subsample and *Hydrobaenus* (TV = 7.2) accounting for 22 percent of the subsample. Only nine percent of the subsample consisted of clingers. As a result, this site scored the lowest BIBI possible (1.00) with a biological rating of 'Very Poor'.

15DR-1-03-2009
This site runs parallel to railroad tracks with a large bridge culvert (Dorsey Run Road) spanning the middle portion of the reach. While no water quality parameters exceeded acceptable COMAR standards, high average conductivity (1,332 µS/cm) was measured at this site. With a predominantly sandy substrate, the sampling reach was classified as a F5 channel. This site is one of four within the Dorsey Run subwatershed that exhibits low gradient characteristics of coastal plain streams; therefore, coastal plain metrics were utilized. Poor riffle quality, sediment deposition, suboptimal bank stability, and marginal vegetative protection led to a percent comparability score of 45.5 and a habitat rating of 'Non-supporting'. This site had the largest drainage area in the subwatershed (4,128 acres) with 38.4 percent as forested land cover, 37.1 percent classified as commercial and industrial land use, and 20 percent as low, medium, and high density residential. As a result, this site also had the highest impervious surface percentage at 37.2 percent. Of 18 total taxa identified, only one EPT taxon was present in the subsample. Individuals intolerant to urban stressors accounted for just four percent of the subsample while 11 percent of the sample consisted of climbers. Additionally, no Ephemeroptera and no scrapers were identified. Based on the BIBI score of 1.86, this site was given a 'Very Poor' biological condition rating.

15DR-1-04-2009
This site is located on a F5 channel with 85 feet of the middle portion of the sampling reach in a large triple-pipe culvert below Summer Cloud Way. Poor instream habitat, epifaunal substrate, and riffle quality led to a habitat assessment rating of 'Non-supporting' with a percent comparability score of 45.0. The predominant land use in the 577-acre drainage area is medium density residential (38.4 percent) followed by high density residential (24.6 percent) and forested land cover (11.8 percent). Overall, the drainage area has 35.2 percent of impervious surface, which is above the average for the Dorsey Run subwatershed. The benthic macroinvertebrate sample was dominated by individuals of the Chironomidae family (92 percent), with *Hydrobaenus* (TV = 7.2) accounting for 30.2 percent of the subsample, *Sympotthastia* (TV = 8.2) accounting for 21.7 percent of the subsample, and *Orthocladius* (TV = 9.2) also accounting for 21.7 percent of the subsample. There were only nine total taxa in this sample with no EPT taxa, no Ephemeroptera taxa, and no individuals intolerant to urban stressors identified—resulting in a BIBI score of 1.00 with a rating of 'Very poor'. Water quality results indicated no parameters that exceeded acceptable COMAR standards.

15DR-1-05-2009
This site is located on an extensively channelized reach that runs parallel to railroad tracks and crosses under Waterloo Road. High conductivity (703 µS/cm) was recorded at this site, but the remaining

water quality parameters were within acceptable COMAR standards. Classified as a F4 channel, the substrate of this sampling reach was dominated by gravel. Coastal plain metrics were also used at this site based on the low gradient and coastal plain characteristics of the reach. This sampling reach received the lowest habitat assessment score in the subwatershed (a score of 35.0 with a rating of 'Non-supporting') due to extensive channelization, lack of riparian buffers, poor instream habitat and epifaunal substrate, and poor pool quality. Forested land cover is the dominant land use in this 531-acre drainage area (36.7 percent) with low and medium density residential accounting for over a third of the land use and agriculture accounting for 15 percent. Impervious surface draining to this site (18.4 percent) is the lowest percentage in the subwatershed. There were 20 taxa identified in this sample with no EPT taxa, no Ephemeroptera, and no individuals intolerant to urban stressors present. Because of the numerous taxa present and the high level of scraper taxa (three present), this site received one of the highest BIBI scores within the subwatershed with a score of 2.14 and a rating of 'Poor.'

15DR-1-06-2009
Located in a densely forested area west of Route 175, this sampling reach was classified as a C4 channel with a predominately gravel substrate. High average conductivity (1,339 µS/cm) was measured at this site, but water quality results indicated all parameters within acceptable COMAR standards. This site received the highest habitat assessment score in the Dorsey Run subwatershed with a percent comparability score of 64.5 and a rating of 'Partially Supporting.' Land use in the 1,812-acre drainage area is primarily forested land cover (39.8 percent) and commercial and industrial land use (19.2 percent); however, when combined, low/medium/high density residential accounts for a third of the drainage area. The overall imperviousness based on land use is 30.4 percent, slightly below the subwatershed average of 31.7 percent. There were 13 total taxa identified in the benthic macroinvertebrate sample, two of which were EPT taxa. Individuals of the Chironomidae family (midges) dominated this sample at 82 percent, with *Orthocladius* (TV = 9.2) comprising half of the subsample. There were no Ephemeroptera and no individuals intolerant to urban stressors identified in the subsample, and only 16 percent of the sample consisted of clingers. As a result, this site received a BIBI score of 1.00 with a rating of 'Very Poor'.

15DR-1-07-2009
This site is located on a small headwater stream behind Window Latch Way. The reach was classified as a C4 channel type with a predominantly gravel substrate. Water quality results indicated all parameters within acceptable COMAR standards. The habitat assessment indicated a 'Non-supporting' habitat with a score of 57.0 due to poor instream habitat, sediment deposition, and a high percentage of embeddedness. At 33-acres, this is the smallest drainage area in the subwatershed with 30.3 percent impervious surface—slightly below the subwatershed average. The predominant surrounding land use of the drainage area is medium density residential (76.2 percent) followed by open urban land (12.5 percent) and agriculture and forested land cover (with a combined percentage of 11.3). The BIBI score for this site was 1.00, resulting in a narrative rating of 'Very Poor'. Of the 12 total taxa identified in this subsample, none were EPT taxa or Ephemeroptera taxa, and only one percent of the sample consisted of individuals intolerant of urban stressors. Individuals of the Chironomidae family (midges) dominated this sample at 85 percent, with *Hydrobaenus* (TV = 7.2) accounting for 41 percent of the subsample, *Sympotthastia* (TV = 8.2) accounting for 26 percent of the subsample, and *Orthocladius* (TV = 9.2) accounting for 13 percent of the subsample.

15DR-1-08-2009
Located in a residential community, this sampling reach is classified as a C4 channel with a predominately grave substrate and runs parallel to a sewer line clearing. Water quality results indicated no parameters that exceeded acceptable COMAR standards. The drainage area to this site is 504 acres and is comprised primarily of medium density residential (31.3 percent) and high density

residential (28.2 percent) land use. Imperviousness in the drainage area is 35.3 percent, above the subwatershed average of 31.7 percent. Because of suboptimal and marginal scores for bank stability, vegetative protection and sediment deposition, this site received a habitat comparability score of 61.5 and a rating of 'Partially Supporting'. There were 13 total taxa in this sample, one of which was an EPT taxon. There were no Ephemeroptera taxa and no individuals intolerant to urban stressors identified in this sample. Individuals of the Chironomidae family (midges) dominated this sample at 90 percent, with *Orthocladius* (TV = 9.2) accounting for 24 percent and *Hydrobaenus* (TV = 7.2) accounting for 22 percent of the subsample. Only nine percent of the subsample consisted of clingers. This site received a BIBI score of 1.00 with a corresponding rating of 'Very Poor'.

15DR-1-09-2009

Due to the low gradient and characteristics similar to coastal plain streams, this site was also assessed using the coastal plain BIBI and RBP habitat assessment for low gradient streams. While no water quality parameters exceeded acceptable COMAR standards, conductivity values were high (1,363µS/cm). The stream was classified as a C5 channel with sand as the dominant substrate. At 4,013 acres, this is the second largest drainage area in the subwatershed with 36.7 percent impervious surface, which is above the subwatershed average. Land use in the drainage area is primarily forested land cover (39.0 percent) and commercial and industrial (36.0 percent) with the remaining 20 percent consisting of low, medium, and high density residential. Physical habitat was rated as 'Non-supporting' with a comparability score of 56.5 percent due to marginal scores for sediment deposition, bank stability, vegetative protection and frequency of riffles. This sampling reach received one of the highest BIB scores in the subwatershed with a score of 2.14 and a biological rating of 'Poor.' There were 17 total taxa in the subsample with no EPT taxa, no Ephemeroptera taxa, and one scraper present. Climbers accounted for nine percent of the subsample with only two percent of the subsample consisting of individuals intolerant to urban stressors. A QC site was assessed just upstream of 15DR-1-09 and received a slightly higher habitat assessment score of 57.5 (a difference of only one point), with the same rating of 'Non-supporting'. Similar to 15DR-1-09, the QC site had 18 total taxa with no EPT, no Ephemeroptera, and a low percentage of climbers (three percent of the subsample). No individuals intolerant to urban stressors were identified in the QC sample. Ultimately, the QC site received the same BIBI score as 15DR-1-09 (2.14 with a rating of 'Poor').

15DR-1-10-2009

This site is located on an over-widened reach with areas of heavy bank erosion and a large concrete storm drain entering the downstream end of the reach. The reach was classified as a C4 channel with a predominately grave substrate. While no water quality parameters exceeded acceptable COMAR standards, high conductivity (1,396 µS/cm) was measured at this site. Because this sampling reach was low gradient and exhibited characteristics of coastal plain streams, the coastal plain BIBI and RBP low gradient habitat assessment were utilized for this site. The habitat assessment resulted in a comparability score of 47.0, or 'Non-supporting', with marginal to poor scores received for channel sinuosity, pool substrate and variability, bank stability, and epifaunal substrate. Of the 2,242-acres draining to this site, 35.0 percent is impervious, which is above the average impervious surface of the subwatershed. The predominant land use for the drainage area is forested land cover (36.0 percent) followed by commercial and industrial land use (27.1 percent) and when combined, low/medium/high density residential accounted for 30.2 percent of the drainage area. Of the ten total taxa identified in the benthic macroinvertebrate sample, no EPT taxa, Ephemeroptera, or individuals intolerant to urban stressors were present. Only two percent of the sample consisted of climbers and one scraper taxon was identified. The subsample was dominated by *Cricotopus*, a pollution-tolerant midge (TV = 9.6), which accounted for 71 percent of the subsample. The overall BIBI score was 1.57, resulting in a biological condition rating of 'Very Poor'.

3 Discussion and Comparison

3.1 Discussion

3.1.1 2009 Assessment Results

Bioassessment

Biological and physical habitat assessment results for 2009 in Rocky Gorge, Hammond Branch, and Dorsey Run indicate subwatersheds that are moderately to severely impaired. Only one of the thirty benthic macroinvertebrate samples received a rating of 'Good' and five received a 'Fair' rating. The remaining sites (80 percent) were rated as either 'Poor' or 'Very Poor.' Site 09RG-1-03-2009 was the only site to receive a biological condition rating of 'Good.' No sites received a 'Good' or 'Fair' biological condition ratings in the Hammond Branch and Dorsey Run subwatersheds.

Physical Habitat

RBP habitat assessment results indicate average subwatershed physical habitat conditions that were 'Partially Supporting' (Rocky Gorge, Hammond Branch) and 'Non-supporting'(Dorsey Run). Only two sites received 'Supporting' physical habitat ratings (i.e., 14HB-1-04-2009 and 14HB-1-06-2009) both located within the Hammond Branch subwatershed.

Water Quality

All but two sites (14HB-1-09-2009 and 14HB-1-06-2009) showed pH readings within the allowable COMAR range. Conductivity was elevated at many sites throughout the watershed with values from 74 to 1,406 µS/cm. An analysis of these values indicates that there was also a strong negative correlation between the BIBI score and specific conductance. Within this range of values, one-third of sites sampled in 2009 had a value less than 200 µS/cm. Average subwatershed conductivity values were 252 µS/cm, 313 µS/cm, and 994 µS/cm, for Rocky Gorge, Hammond Branch, and Dorsey Run, respectively. These elevated values are typically measured in road runoff during storm events, and may indicate an elevated background level of pollutants.

Specific conductance is related to the type and concentrations of inorganic ions in solution. Natural sources within a watershed can include salt from poorly drained soils, salt from ground water, and erosion from geologic formations of marine origin. Unnatural sources may come from both non-point source runoff from residential and urban areas and point source inputs from effluent waters. Typically, roadway pollutants tend to concentrate along the edge of a road, making them susceptible to runoff to streams from rainfall or snow melt and flow-off from wind or vehicle turbulence. Inorganic salts that are associated with roadways include de-icing salts and atmospheric washout from vehicle emissions. A site-by-site breakdown of field-measured water quality parameters is included in Appendix B.

Geomorphology

The geomorphic assessment results indicate a variable system. Many of the channels sampled throughout the subwatersheds were classified as stable type B or C channels; however, a good portion of channels were classified as unstable, incised F channels. Gravel was the dominant substrate type in the majority of sampling reaches, however sand, silt/clay and cobble dominate streams were also present.

Imperviousness

The average percentage of impervious area in the Rocky Gorge, Hammond Branch, and Dorsey Run subwatersheds is 10, 13, and 32 percent, respectively. Imperviousness for the areas draining to each sampling site range from five (5) percent to 37 percent (see Appendix A for impervious values). The benthic community in a freshwater stream can be adversely affected by impervious cover and associated runoff at values as low as 10 percent (CWP, 2003). A statistical correlation between imperviousness and the BIBI was identified and is discussed in the following section.

Results Correlations

The Pearson correlation coefficient measures the linear association between two variables. Values of the coefficient range from -1 to 1. Negative values indicate an inverse relationship between the two values (i.e., when one variable increases the other decreases), while positive values indicate a positive relationship (i.e., both variables increase). The absolute value of the number indicates the strength of the association, with larger absolute values indicating stronger associations between the two variables. The significance level is a measure of the likelihood that the two variables are related, with smaller values indicating a stronger likelihood of relation. A significance level of 0.05 is typically used as a cutoff for strong correlations. The interpretation of a correlation is somewhat arbitrary, especially as values move away from +/- 1. Table 13 includes correlation and significance values, while the scatterplot matrix in Figure 8 provides a visual display of the data and the best fit line associated with the correlation.

Pearson correlations between the BIBI scores and two parameters (percent imperviousness and specific conductivity) showed significant relationships. The percentage of imperviousness to each sampling site indicates a strong negative relationship (correlation of -0.605 with a significance level of <0.001) to BIBI scores, implying biological condition decreases with increased watershed imperviousness. Specific conductivity and BIBI scores also showed a strong negative correlation (correlation of -0.507 with a significance level of 0.004). These results support the notion that overall water quality and biological health are likely being affected by the amount of development, and hence imperviousness, in the watershed. These findings are in concurrence with the Impervious Cover Model (CWP, 2003) which suggests that overall stream quality decreases with increased watershed impervious cover. A strong correlation was also observed between impervious percent and specific conductivity (correlation of 0.718 with a significance level of <0.001), suggesting that increased conductivity is due in large part to urban runoff. In addition, a strong negative correlation was found between RBP habitat scores and imperviousness (-0.444, with a significance level of 0.014), inferring that altered hydrologic regimes are degrading the physical habitat through more intense discharges and higher peak flows in more developed watersheds.

The correlation with RBP habitat comparability scores and BIBI scores (correlation of 0.340 with a significance level of 0.066), was not significant suggesting that physical habitat assessments are not the best predictor of biological condition in these watersheds. Water quality and imperviousness are better predictors of biological condition.

Table 13 - Pearson Correlations

		Habitat Assessment	Percent Impervious	Specific Conductance
BIBI n=30	Correlation	0.340	-0.605**	-0.507
	Significance	0.066	<0.001	0.004
Habitat Assessment n=30	Correlation		-0.444*	-0.265
	Significance		0.014	0.157
Percent Impervious n=30	Correlation			0.718**
	Significance			<0.001

* Correlation is significant at the 0.05 level (2-tailed).
**Correlation is significant at the 0.05 level (2-tailed).

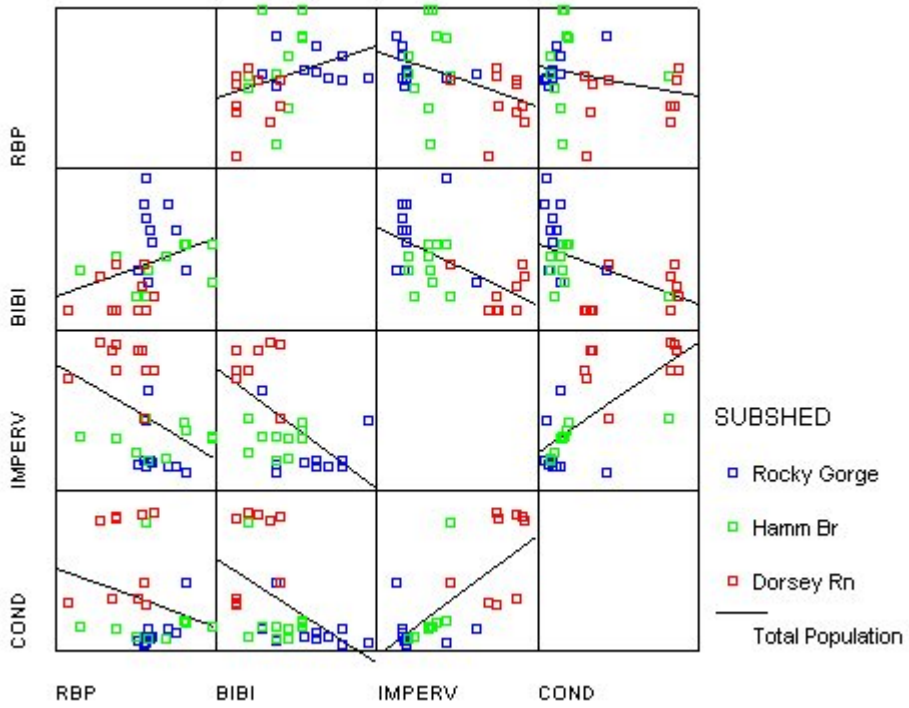


Figure 8 - Scatterplot Matrix for several 2009 Data Parameters (BIBI, Habitat Assessment, Percent Impervious Cover and Specific Conductivity), best fit line represents the total 2009 sample population.

3.1.2 Comparison of 2003 and 2009 Bioassessment data

BIBI

A summary of the results for 2003 and 2008 biological index data is shown in Table 14, and a box plot comparing BIBI scores for each subwatershed is displayed in Figure 9. Results from the Round One assessment (2003) indicated that the Rocky Gorge subwatershed was in a 'Poor' overall biological condition, according to the updated BIBI scores (BIBI = 2.83 ± 0.84). Round Two results show a similar 'Poor' biological condition (BIBI = 2.94 ± 0.86), which a t-test reveals did not differ significantly (t = -0.278, p = 0.784) from 2003.

In the Hammond Branch subwatershed, the mean BIBI score declined between 2003 (BIBI = 2.93 ± 0.80) and 2009 (BIBI = 2.10 ± 0.52). While the narrative rating of 'Poor' did not change, t-test results indicate that the difference was significant (t = 2.762, p = 0.013). This suggests that biological conditions in the watershed may, in fact be getting worse. One notable change occurring in the watershed since 2003 was the completion of the Route 216 extension between Route 29 and I-95, which runs directly adjacent to Hammond Branch. However, it should also be noted that due to the random nature of site selection there were no sites in 2003 sampled downstream of the I-95 corridor, whereas six sites were sampled in this area in 2009. Imperviousness in this portion of the watershed typically exceeds 13 percent, as compared to roughly 10 percent or less upstream of I-95. Unfortunately, impervious drainage to each site was not calculated in 2003, which would allow for a direct comparison to determine whether there is a significant difference in mean watershed imperviousness to sampling locations and not due to land use changes during this period of time.

The largest difference in BIBI scores was observed in the Dorsey Run subwatershed, where BIBI scores declined significantly between 2003 (BIBI = 2.20 ± 0.48) and 2009 (BIBI = 1.40 ± 0.49) dropping a full narrative rating to 'Very Poor' biological condition. T-test results indicate that the difference was significant (t = 3.699, p = 0.002), suggesting a decline in biological condition throughout the subwatershed since 2003. Imperviousness data from 2009 indicated that all but one site (15DR-1-05) exceeded 25 percent, however, without such data from 2003 it is difficult to determine whether or not increased imperviousness is largely responsible for the decline in biological condition.

Table 14 - Comparison of 2003 and 2009 BIBI Data

Sampling Year	Patapsco Subwatershed	Number of sites sampled	Min. BIBI	Max. BIBI	Median BIBI	Mean BIBI	Narrative Rating	Standard Deviation
2003	Rocky Gorge	10	1.33	4.00	3.00	2.83	Poor	0.84
	Hammond Branch	10	1.00	4.00	3.00	2.93	Poor	0.80
	Dorsey Run	10	1.67	3.00	2.17	2.20	Poor	0.48
2009	Rocky Gorge	10	1.67	4.33	3.00	2.94	Poor	0.86
	Hammond Branch	10	1.33	2.67	2.17	2.10	Poor	0.52
	Dorsey Run	10	1.00	2.14	1.17	1.40	Very Poor	0.49

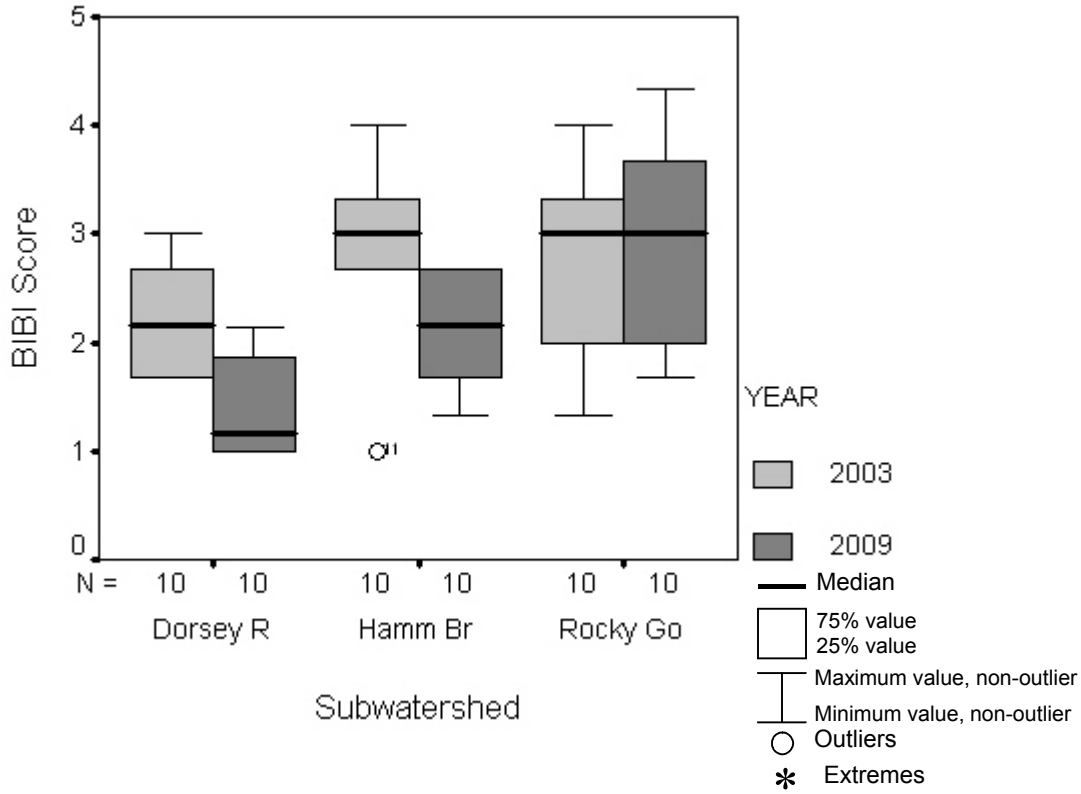


Figure 9 - Comparison of 2003 and 2009 BIBI scores.

RBP Physical Habitat Assessment

Overall, minor but insignificant changes in physical habitat conditions were observed between Round One and Round Two assessments. RBP physical habitat condition ratings increased for two subwatersheds (i.e., Rocky Gorge and Hammond Branch) from 'Non-supporting' to 'Partially Supporting.' However, the slight change in mean RBP habitat assessment scores was not statistically significant ($t = -1.317$, $p = 0.204$ and $t = -1.057$, $p = 0.305$, for Rocky Gorge and Hammond Branch, respectively). No significant difference was observed in the Dorsey Run subwatershed, where the RBP habitat assessment rating remained 'Non-Supporting' ($t = -0.347$, $p = 0.732$). A summary of 2003 and 2009 RBP physical habitat assessment data can be found in Table 15 and a box plot comparing RBP scores over this time period is shown in Figure 10.

Table 15 - Comparison of 2003 and 2009 RBP Physical Habitat Assessment Data

Sampling Year	Patapsco Subwatershed	Number of sites Assessed	Min. RBP Score	Max. RBP Score	Median RBP Score	Mean RBP Score	Narrative Rating	Standard Deviation
2003	Rocky Gorge	10	87	145	116	114	Non-Supporting	19.4
	Hammond Branch	10	87	142	116	115	Non-Supporting	16.2
	Dorsey Run	10	68	145	98	100	Non-Supporting	24.9
2009	Rocky Gorge	10	112	143	120	123	Partially Supporting	10.1
	Hammond Branch	10	76	159	125	126	Partially Supporting	26.6
	Dorsey Run	10	70	129	114	107	Non-Supporting	19.5

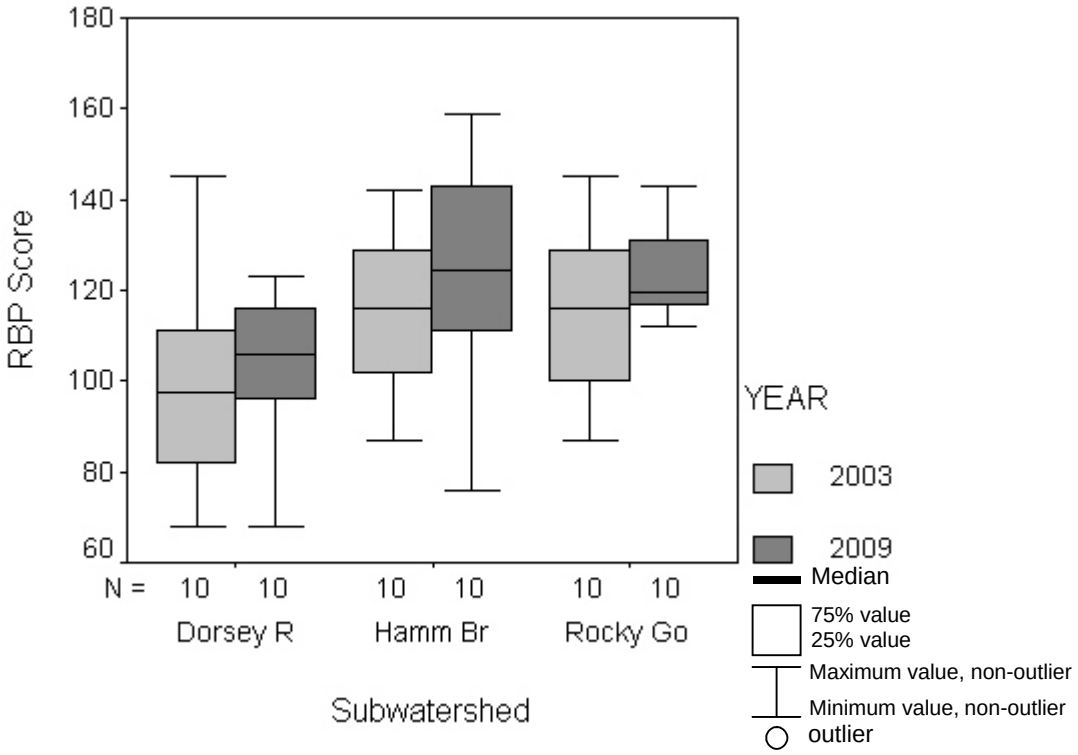


Figure 10 - Comparison of 2003 and 2009 RBP Physical Habitat Assessment scores.

4 Conclusion and Recommendations

Watershed Conditions

Results of the 2009 assessment indicate degraded biological conditions in all three watersheds, and statistically significant decreases in mean BIBI scores were observed in Dorsey Run and Hammond Branch since Round One. While physical habitat scores resulted in slight changes, there were no statistically significant changes between Round One and Round Two results. The observed decreases in biological condition paired with relatively unchanged physical habitat conditions suggests that changes in water quality and/or quantity may be responsible. Furthermore, strong correlations were found between biological condition and both imperviousness and conductivity, strengthening the weight of evidence toward water quality/hydrologic stressors.

Increasing residential and commercial development in Howard County is leading to rising levels of impervious surface. Continued monitoring is critical to determining whether these changes in land use will detrimentally impact the health of the watershed, and more importantly, to what extent. In addition, it would be useful to conduct impervious drainage analysis on Round One data to allow for direct comparisons regarding increases in impervious cover since Round One and whether observed changes in biological condition can be correlated to such changes.

Additional Water Quality Sampling

The 'Supporting' and 'Partially Supporting' habitat conditions identified were not always substantiated by a healthy benthic community. This can be an indication of degraded water quality conditions. Although very few of the water quality parameters measured (pH only) were outside of the acceptable COMAR standards, additional sampling is recommended, especially on those streams rated as 'Poor' or 'Very Poor' for biological condition, in order to determine whether there are other chemical stressors affecting the biota.

In 2009, conductivity levels were the only measured parameter considered high across much of the watershed. However, the limited number of water quality parameters measured during the spring sampling season decreases the ability to identify specific stressors. A more in-depth analysis of water quality should be performed to determine the types and potential sources of pollutants. Supplementary sampling should evaluate additional parameters such as nutrients and metals, which may potentially be of concern.

Because the biological monitoring is conducted generally under baseflow conditions there is the potential for missing pollutants associated with stormwater runoff, specifically in more urbanized portions of the watershed. Wet weather monitoring in these watersheds should also be conducted to determine the presence of additional water quality stressors.

Comparability with Statewide Methods

Howard County adopted the DNR's MBSS methods in 2001. The MBSS program continues to evolve and refine their sampling design, field procedures, and data analysis protocols, with the most recent field sampling protocols having been updated in 2007. While no changes have occurred to the benthic macroinvertebrate collection methods implemented herein, additional surveys have been added to the data collection efforts (i.e., seasonal pool search in the Spring), which may be of interest to the County. Howard County should continue to update their methods in the future to stay current with the latest MBSS sampling protocols.

Quality Assurance and Quality Control

The QA/QC procedures outlined in the Quality Assurance Project Plan (QAPP) for the Howard County Biological Monitoring and Assessment Program (Howard County, 2001) should be re-

evaluated considering the evolution of the metric scoring system, which may not be appropriate for incremental data such as that found in the scaled BIBI metrics.

The BIBI scoring system is not continuous. That is, each metric is assigned a value of 1, 3, or 5 and then averaged for a final BIBI score. This means that scores increase incrementally by 0.3 or 0.4. Additionally, the relative percent difference (RPD) between low scores (2.0 and 2.3) will be higher than a comparison of higher scores (4.7 and 5.0). This can lead to a site not meeting the measurement quality objective (MQO) despite the scores being only one scoring increment apart. A relatively minor difference between samples can lead to the MQO not being met.

Watershed Studies

Numerous Stream Corridor Assessment (SCA) surveys have been completed throughout Howard County including the Little Patuxent, Middle Patuxent, Patapsco, and Deep Run Watersheds. The SCA surveys are performed to compile a list of observable environmental problems in order to target restoration efforts in those watersheds. Similar watershed scale assessments for the Rocky Gorge, Hammond Branch, and Dorsey Run subwatersheds would be beneficial to identify specific problem areas and targeting areas with the greatest restoration potential in an effort to improve and preserve the conditions of these watersheds, which ultimately drains into the Chesapeake Bay. The current 2009 data could be incorporated into the monitoring plans for any restoration or preservation projects deemed necessary for these subwatersheds.

5 References

Barbour, M.T., J. Gerritsen, B.D. Snyder, and J.B. Stribling. 1999. Rapid Bioassessment Protocols for Use in Streams and Wadeable Rivers: Periphyton, Benthic Macroinvertebrates and Fish, Second Edition. EPA 841-B-99-002. U.S. Environmental Protection Agency, Office of Water; Washington D.C.

Boward, D. and E. Friedman. 2000. Maryland Biological Stream Survey Laboratory Methods for Benthic Macroinvertebrate Processing and Taxonomy. Maryland Department of Natural Resources Monitoring and Non-Tidal Assessment Division. Annapolis, MD. CBWP-MANTA-EA-00-6.

Center for Watershed Protection (CWP). 2003. Impacts of Impervious Cover on Aquatic Systems. Watershed Protection Research Monograph No. 1. Center for Watershed Protection. Ellicott City, MD. March 2003.

Howard County Department of Public Works (DPW). 2001. Quality Assurance Project Plan (QAPP). Howard County, Maryland. Department of Public Works, Stormwater Management Division. Columbia, MD.

Gallardo, A.C., J.E. Garrish, C.R. Hill, and J.B. Stribling 2006. Biological Assessment of the Cattail Creek and Brighton Dam Watershed, Howard County, Maryland. Prepared by Tetra Tech, Inc., Owings Mills, MD for Howard County, Department of Public Works. Stormwater Management Division. Columbia, MD. January 2006.

Harrelson, C.C, C.L. Rawlins, and J.P. Potyondy. 1994. Stream channel reference sites: An illustrated guide to field technique. Gen. Tech. Rep. RM-245. U.S. Department of Agriculture, Forest Service, Rocky Mountain Forest and Range Experiment Station.

Hill, C.R., J.B. Stribling, and A.C. Gallardo. 2005. *Documentation of Method Performance Characteristics for the Anne Arundel County Biological Monitoring Program.* Prepared by Tetra Tech, Inc., Owings Mills, MD for Anne Arundel County Office of Environmental & Cultural Resources. Annapolis, MD

Howard County. 2001. Quality Assurance Project Plan for Howard County Biological Monitoring and Assessment Program. Prepared for Howard County Department of Public Works Stormwater Management Division by Tetra Tech, Inc.

KCI. 2008. Howard County Biological Monitoring and Assessment Calculation of Benthic Index of Biotic Integrity (BIBI) Scoring. Prepared by KCI Technologies, Inc., Hunt Valley, MD for Howard County Department of Public Works Bureau of Environmental Services, Stormwater Management Division, NPDES Watershed Management Programs. Columbia, MD. August 2008.

Kazyak, P.F. 2001 Maryland Biological Stream Survey Sampling Manual. Maryland Department of Natural Resources Monitoring and Non-Tidal Assessment Division. Annapolis, MD.

Kazyak, P.F., Brindley, A., and M.T. Southerland. 2005. Maryland Biological Stream Survey 2000-2004 Voulme 8: County Results. DNR-12-0305-0107. Maryland Department of Natural Resources Monitoring and Non-Tidal Assessment Division. Annapolis, MD.

Maryland Department of the Environment. Code of Maryland Regulations (COMAR). Continuously updated. Code of Maryland Regulations, Title 26- Department of the Environment. 26.08.02.01-Water Quality.

Maryland Department of Natural Resources (DNR). 2003. Patapsco River Stream Corridor Assessment Survey in Howard County. Prepared by Watershed Assessment and Targeting Division, Watershed Services Unit, Maryland DNR, Annapolis, MD for Howard County Department of Public Works Bureau of Environmental Services, Stormwater Management Division, NPDES Watershed Management Programs. Columbia, MD. December 2003.

Maryland Department of Natural Resources (DNR). 2007. Maryland Biological Stream Survey Sampling Manual: Field Protocols. CBWP-MANTA-EA-07-01. Published by the Maryland Department of Natural Resources, Annapolis, MD. Publication # 12-2162007-190.

Mecklenburg, Dan. 2006. The Reference Reach Spreadsheet. Version 4.3 L. Ohio Department of Natural Resources.

Merritt, R.W. and Cummins, K.W. 1996 An Introduction to the Aquatic Insects of North America, 3rd edition, Kendall / Hunt Publishing Company.

Pavlik, K.L. and J.B. Stribling. 2004. *Biological Assessment of the Rocky Gorge, Dorsey Run, and Hammond Branch Watersheds, Howard County, Maryland*. Prepared by Tetra Tech, Inc., Owings Mills, MD for Howard County, Department of Public Works. Stormwater Management Division. Columbia, MD. January 2004.

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

Southerland, M.T., G.M. Rogers, M.J. Kline, R.P. Morgan, D.M. Boward, P.F. Kazyak, R.J. Klauda, S.A. Stranko. 2005. New Biological Indicators to Better Assess the Condition of Maryland Streams. DNR-12-0305-0100. Maryland Department of Natural Resources, Monitoring and Non-Tidal Assessment Division. Annapolis, MD.

Stribling, J.B., Jessup, B.K. and J.S. White. 1998. Development of a Benthic Index of Biotic Integrity for Maryland Streams. CBWP-EA-98-3. Maryland Department of Natural Resources, Monitoring and Non-Tidal Assessment Division. Annapolis, MD.

Tetra Tech, Inc. 1999. Ecological Data Application System (EDAS). A user's guide. November. For further information, contact Erik Leppo at 410/356-8993.

Tetra Tech, Inc. 2006. Random Subsample Routine. Developed by Eric W. Leppo.

United States Department of Agriculture, Natural Resources Conservation Service. 1986. Urban Hydrology for Small Watersheds. Technical Release 55 (TR55).

Wolman, M.G. 1954. A method of sampling coarse river-bed material. Transactions of American Geophysical Union.

Appendix A: Land Use and Imperviousness

Land Use Imperviousness Percentages

Impervious values per land use type used to calculate imperviousness for each monitoring site's drainage area.

Land Use Code	Description	Imperviousness (%)
11	Low Density Residential	25
12	Medium Density Residential	38
13	High Density Residential	65
14	Commercial	85
15	Industrial	72
16	Institutional	50
17	Extractive	11
18	Open Urban Land	11
21	Cropland	0
22	Pasture	0
23	Orchards	0
24	Feeding Operations	0
25	Row Crops	0
41	Deciduous Forest	0
42	Evergreen Forest	0
43	Mixed Forest	0
44	Brush	0
50	Water	0
60	Wetlands	0
70	Barren Land	50
71	Beaches	0
72	Bare Exposed Rock	100
73	Bare Ground	50
80	Transportation	75
191	Large Lot Agricultural	15
192	Large Lot Forest	15
241	Feeding Operations	10
242	Agricultural Buildings	10

Source: USDA, 1986.

Site ID	Drainage Area (Acres)[1]	LDR	MDR	HDR	CI	INST	OUL	AGR	FOR	OW	WET	BG	% Impervious[2]
Dorsey Run													
15DR-1-01-2009	1,843.04	4.66%	17.70%	10.36%	18.94%	1.10%	3.32%	3.46%	40.32%			0.15%	30.14
15DR-1-02-2009	189.39	8.49%	40.53%	15.43%			6.49%	13.22%	15.84%				28.27
15DR-1-03-2009	4,128.00	2.11%	11.00%	6.89%	37.09%	0.66%	1.71%	2.06%	38.42%			0.07%	37.24
15DR-1-04-2009	577.36	7.33%	38.39%	24.58%	0.84%	1.80%	10.60%	4.67%	11.79%				35.18
15DR-1-05-2009	531.35	20.34%	18.89%		6.76%	2.34%		15.01%	36.65%				18.40
15DR-1-06-2009	1,811.85	4.74%	17.62%	10.54%	19.17%	1.11%	3.38%	3.52%	39.77%			0.16%	30.44
15DR-1-07-2009	33.02		76.22%				12.52%	8.91%	2.34%				30.34
15DR-1-08-2009	504.22	7.76%	31.32%	28.15%	0.96%	2.06%	12.13%	5.35%	12.26%				35.32
15DR-1-09-2009	4,013.44	2.17%	11.09%	7.09%	36.02%	0.67%	1.76%	2.12%	39.01%			0.07%	36.67
15DR-1-10-2009	2,241.72	3.83%	17.62%	8.74%	27.05%	0.93%	2.86%	2.84%	35.99%			0.13%	35.00
Hammond Branch													
14HB-1-01-2009	3,528.11	22.33%	8.10%	1.91%	3.66%	1.22%		42.36%	20.42%				13.56
14HB-1-02-2009	3,681.66	21.40%	7.81%	1.83%	3.51%	1.17%		41.03%	23.25%				13.01
14HB-1-03-2009	4,560.12	17.73%	10.66%	4.29%	6.86%	1.15%		35.60%	23.72%				17.34
14HB-1-04-2009	3,952.78	20.12%	8.35%	2.44%	3.27%	1.09%		41.00%	23.73%				13.05
14HB-1-05-2009	2,116.20	26.43%	3.40%		1.77%	0.28%		52.70%	15.41%				9.61
14HB-1-06-2009	4,078.93	19.82%	8.97%	3.62%	3.17%	1.06%		39.73%	23.63%				13.88
14HB-1-07-2009	101.64	73.91%						11.49%	14.60%				18.48
14HB-1-08-2009	1,200.34	31.83%						51.10%	17.08%				8.07
14HB-1-09-2009	4,304.48	18.78%	9.85%	4.54%	3.73%	1.15%		37.65%	24.29%				15.07
14HB-1-10-2009	1,632.92	29.71%			0.24%	0.26%		53.93%	15.86%				7.85
Rocky Gorge													
09RG-1-01-2009	908.06	24.83%				7.75%		22.64%	44.08%	0.70%			10.08
09RG-1-02-2009	57.90	30.19%						60.39%	9.42%				7.55
09RG-1-03-2009	127.39	70.60%						4.98%	24.42%				17.65
09RG-1-04a-2009	442.65	3.53%	17.20%	20.71%	5.17%			4.04%	49.34%				25.28
09RG-4-01-2009	71,516.95	17.20%	2.45%	0.10%	0.44%	1.30%	0.69%	43.07%	33.29%	1.41%	0.05%	0.01%	6.42
09RG-4-02a-2009	86,842.27	18.59%	3.40%	0.28%	0.51%	1.22%	0.70%	38.54%	34.43%	2.29%	0.04%	0.01%	7.26
09RG-4-03-2009	87,797.95	18.40%	3.71%	0.53%	0.57%	1.24%	0.69%	38.14%	34.41%	2.27%	0.04%	0.01%	7.56
09RG-4-04-2009	51,422.67	17.04%	0.19%		0.25%	0.55%	0.43%	47.09%	32.57%	1.80%	0.07%	0.01%	4.92
09RG-4-04a-2009	72,413.95	17.30%	2.42%	0.10%	0.44%	1.29%	0.68%	42.95%	33.39%	1.39%	0.05%	0.01%	6.42
09RG-4-06a-2009	70,940.17	17.10%	2.47%	0.10%	0.45%	1.31%	0.70%	43.32%	33.09%	1.42%	0.05%	0.01%	6.41

LDR: Low Density Residential (11)[3,4]
MDR: Medium Density Residential (12)
HDR: High Density Residential (13)
CI: Commercial & Industrial (14, 15)
INST: Institutional (16)
EXT: Extractive (17)
OUL: Open Urban Land (18)
AGR: Agriculture (21, 22, 23, 25, 241, 242)
FOR: Forest (41 - 44)
OW: Open Water (50)
WET: Wetlands (60)
BG: Bare Ground (73)

1 Drainage areas provided are delineated to each sampling site.
2 See text for discussion of impervious percent.
3 Land use is based on Maryland Department of Planning (MDP) 2002 data.
4 Numbers in parentheses correspond to MDP land use codes.

Appendix B: Water Quality Data

Site ID	Collection Date	pH	Water Temperature *°C*	Dissolved Oxygen *mg/l*	Turbidity *NTU*	Conductivity *µS/cm*
Rocky Gorge						
09RG-1-01-2009	3/17/2009	**7.40**	**6.30**	**12.04**	**2.5**	**110.2**
09RG-1-02-2009	3/17/2009	**7.05**	**7.60**	**10.02**	**6.3**	**74.4**
09RG-1-03-2009	3/30/2009	**7.09**	**10.67**	**12.37**	**n/a**	**89.6**
09RG-1-04A-2009	3/25/2009	**8.19**	**8.67**	**13.75**	**2.0**	**694.3**
09RG-4-01-2009	3/30/2009	**7.32**	**9.27**	**10.73**	**n/a**	**232.0**
09RG-4-02A-2009	3/24/2009	**7.64**	**6.63**	**12.92**	**2.8**	**159.1**
09RG-4-03-2009	3/25/2009	**7.60**	**4.77**	**12.19**	**3.1**	**159.2**
09RG-4-04-2009	3/27/2009	**7.53**	**8.93**	**11.97**	**n/a**	**139.6**
09RG-4-04A-2009	3/30/2009	**7.69**	**9.43**	**10.61**	**n/a**	**227.0**
09RG-4-06A-2009	3/27/2009	**7.63**	**7.53**	**10.01**	**2.9**	**186.5**
Hammond Branch						
14HB-1-01-2009	3/13/2009	**7.24**	**7.33**	**10.51**	**3.8**	**249.9**
14HB-1-02-2009	3/13/2009	**7.58**	**7.10**	**12.34**	**4.0**	**236.2**
14HB-1-03-2009	3/12/2009	**7.73**	**6.33**	**12.10**	**1.6**	**312.8**
14HB-1-04-2009	3/13/2009	**7.54**	**6.70**	**12.99**	**3.6**	**251.3**
14HB-1-05-2009	3/16/2009	**7.34**	**6.63**	**11.61**	**2.0**	**161.2**
14HB-1-06-2009	3/12/2009	**8.84**	**9.27**	**12.34**	**2.3**	**260.9**
14HB-1-07-2009	3/17/2009	**7.13**	**9.87**	**11.08**	**1.8**	**1303.0**
14HB-1-08-2009	3/16/2009	**7.22**	**8.67**	**12.60**	**2.8**	**129.0**
14HB-1-09-2009	3/12/2009	**8.78**	**7.70**	**14.81**	**1.9**	**290.4**
14HB-1-10-2009	3/16/2009	**7.36**	**7.50**	**12.75**	**2.2**	**124.3**
Dorsey Run						
15DR-1-01-2009	3/20/2009	**8.24**	**7.10**	**15.70**	**2.3**	**1406.3**
15DR-1-02-2009	3/24/2009	**7.25**	**8.97**	**16.57**	**1.5**	**492.0**
15DR-1-03-2009	3/18/2009	**7.32**	**7.27**	**10.92**	**5.5**	**1332.0**
15DR-1-04-2009	3/24/2009	**7.72**	**3.27**	**15.86**	**3.8**	**537.7**
15DR-1-05-2009	3/18/2009	**7.03**	**6.43**	**9.42**	**2.4**	**703.3**
15DR-1-06-2009	3/20/2009	**8.26**	**8.83**	**15.50**	**2.3**	**1339.7**
15DR-1-07-2009	3/27/2009	**7.40**	**11.73**	**12.56**	**n/a**	**474.3**
15DR-1-08-2009	3/24/2009	**7.75**	**3.60**	**18.14**	**1.0**	**544.3**
15DR-1-09-2009	3/18/2009	**7.40**	**9.27**	**13.99**	**3.7**	**1363.7**
15DR-1-10-2009	3/18/2009	**7.73**	**6.67**	**12.43**	**4.8**	**1396.3**

Appendix C: Benthic Macroinvertebrate Data

		Raw Data									Scaled Metrics										
						Piedmont Metrics		Coastal Plain Metrics							Piedmont Metrics		Coastal Plain Metrics				
Site ID	Date	Total Number of Taxa	Number of EPT Taxa	Number of Ephemeroptera Taxa	Percent Intolerant Urban Taxa	Percent Chironomidae Taxa	Percent Clinger Taxa	Percent Ephemeroptera	Number of Scraper Taxa	Percent Climbers	Total Number of Taxa	Number of EPT Taxa	Number of Ephemeroptera Taxa	Percent Intolerant Urban Taxa	Percent Chironomidae Taxa	Percent Clinger Taxa	Percent Ephemeroptera	Number of Scraper Taxa	Percent Climbers	BIBI Score	Narrative Rating
Rocky Gorge																			**Rocky Gorge Average:**	**2.94**	**Poor**
09RG-1-01-2009	3/17/09	15	0	0	1.8	48.2	41.1	**	**	**	3	1	1	1	3	3	**	**	**	2.00	Poor
09RG-1-02-2009	3/17/09	31	10	4	33.0	27.0	32.2	**	**	**	5	3	5	3	3	3	**	**	**	3.67	Fair
09RG-1-03-2009	3/30/09	33	12	6	56.5	30.4	38.3	**	**	**	5	5	5	5	3	3	**	**	**	4.33	Good
09RG-1-04A-2009	3/25/09	8	1	0	0.0	22.9	70.3	**	**	**	1	1	1	1	3	3	**	**	**	1.67	Very Poor
09RG-1-04A-2009QC	3/25/09	15	2	0	0.0	49.1	36.6	**	**	**	3	1	1	1	3	3	**	**	**	2.00	Poor
09RG-4-01-2009	3/30/09	25	6	2	23.1	35.9	41.9	**	**	**	5	3	3	3	3	3	**	**	**	3.33	Fair
09RG-4-02A-2009	3/25/09	20	4	1	6.9	**	**	1.7	2.0	0.0	3	3	3	1	**	**	3	5	1	2.71	Poor
09RG-4-03-2009	3/25/09	17	2	1	8.2	**	**	0.9	4.0	2.7	3	3	3	1	**	**	3	5	3	3.00	Fair
09RG-4-04-2009	3/27/09	24	5	1	2.5	16.1	16.1	**	**	**	3	3	1	1	3	1	**	**	**	2.00	Poor
09RG-4-04A-2009	3/30/09	39	7	4	12.6	48.6	31.5	**	**	**	5	3	5	3	3	3	**	**	**	3.67	Fair
09RG-4-06A-2009	3/27/09	33	10	2	6.9	40.2	53.9	**	**	**	5	3	3	1	3	3	**	**	**	3.00	Fair
Hammond Branch																			**Hammond Branch Average:**	**2.10**	**Poor**
14HB-1-01-2009	3/13/09	20	0	0	0.9	48.6	35.5	**	**	**	3	1	1	1	3	3	**	**	**	2.00	Poor
14HB-1-02-2009	3/13/09	29	6	1	4.6	64.2	48.6	**	**	**	5	3	1	1	1	3	**	**	**	2.33	Poor
14HB-1-03-2009	3/12/09	19	6	2	1.8	40.2	64.3	**	**	**	3	3	3	1	3	3	**	**	**	2.67	Poor
14HB-1-04-2009	3/13/09	26	6	2	8.0	72.6	39.8	**	**	**	5	3	3	1	1	3	**	**	**	2.67	Poor
14HB-1-05-2009	3/16/09	20	3	1	5.5	82.6	19.3	**	**	**	3	1	1	1	1	1	**	**	**	1.33	Very Poor
14HB-1-06-2009	3/12/09	26	4	1	5.1	65.3	27.1	**	**	**	5	1	1	1	1	1	**	**	**	1.67	Very Poor
14HB-1-07-2009	3/17/09	12	3	0	1.7	29.6	1.7	**	**	**	1	1	1	1	3	1	**	**	**	1.33	Very Poor
14HB-1-08-2009	3/16/09	22	7	1	6.8	25.4	72.9	**	**	**	3	3	1	1	3	3	**	**	**	2.33	Poor
14HB-1-09-2009	3/12/09	31	9	1	4.4	59.6	39.5	**	**	**	5	3	1	1	3	3	**	**	**	2.67	Poor
14HB-1-10-2009	3/16/09	25	4	0	4.5	69.1	35.5	**	**	**	5	1	1	1	1	3	**	**	**	2.00	Poor
14HB-1-10-2009QC	3/16/09	18	3	0	1.8	78.8	25.7	**	**	**	3	1	1	1	1	1	**	**	**	1.33	Very Poor
Dorsey Run																			**Dorsey Run Average:**	**1.40**	**Poor**
15DR-1-01-2009	3/20/09	16	3	0	0.0	70.4	28.7	**	**	**	3	1	1	1	1	1	**	**	**	1.33	Very Poor
15DR-1-02-2009	3/24/09	14	2	0	0.0	87.3	9.3	**	**	**	1	1	1	1	1	1	**	**	**	1.00	Very Poor
15DR-1-03-2009	3/18/09	18	1	0	4.3	**	**	0.0	0.0	11.1	3	1	1	1	**	**	1	1	5	1.86	Very Poor
15DR-1-04-2009	3/24/09	9	0	0	0.0	92.5	7.5	**	**	**	1	1	1	1	1	1	**	**	**	1.00	Very Poor
15DR-1-05-2009	3/18/09	20	0	0	0.0	**	**	0.0	3.0	5.3	3	1	1	1	**	**	1	5	3	2.14	Poor
15DR-1-06-2009	3/20/09	13	2	0	0.0	81.9	15.5	**	**	**	1	1	1	1	1	1	**	**	**	1.00	Very Poor
15DR-1-07-2009	3/27/09	12	0	0	0.9	84.5	9.1	**	**	**	1	1	1	1	1	1	**	**	**	1.00	Very Poor
15DR-1-08-2009	3/24/09	13	1	0	0.0	89.6	9.4	**	**	**	1	1	1	1	1	1	**	**	**	1.00	Very Poor
15DR-1-09-2009	3/18/09	17	0	0	1.8	**	**	0.0	1.0	9.0	3	1	1	1	**	**	1	3	5	2.14	Poor
15DR-1-09-2009QC	3/18/09	18	0	0	0.0	**	**	0.0	2.0	2.8	3	1	1	1	**	**	1	5	3	2.14	Poor
15DR-1-10-2009	3/20/09	10	0	0	0.0	**	**	0.0	1.0	1.8	1	1	1	1	**	**	1	3	3	1.57	Very Poor

**Metric not calculated for this site

Dorsey Run, Hammond Branch, and Rocky Gorge Watersheds
Benthic Macroinvertebrate Data
2009

Subphylum/ Class	Order	Family	Genus	Final ID	Note[1]	# of Org	FFG[2]	Habit[3]	Tolerance Value[4]
Insecta	Diptera	Empididae	Clinocera	Clinocera	I	3	Predator	cn	7.4
Insecta	Diptera	Chironomidae	Cryptochironomus	Cryptochironomus	I	8	Predator	sp	7.6
Clitellata	Haplotaxida	Enchytraeidae	not identified	Enchytraeidae	U	12	Collector	bu	9.1
Insecta	Diptera	Chironomidae	Hydrobaenus	Hydrobaenus	I	12	Scraper	sp	7.2
Insecta	Diptera	Chironomidae	Microtendipes	Microtendipes	I	2	Filterer	cn	4.9
Insecta	Diptera	Chironomidae	Natarsia	Natarsia	I	3	Predator	sp	6.6
not identified	not identified	not identified	not identified	Nematomorpha	U	2	Parasite	bu	na
Insecta	Megaloptera	Corydalidae	Nigronia	Nigronia	I	1	Predator	cn	1.4
Insecta	Diptera	Chironomidae	not identified	Orthocladiinae	P	2	Collector	bu	7.6
Insecta	Diptera	Chironomidae	Orthocladius	Orthocladius	I	10	Collector	sp	9.2
Insecta	Diptera	Chironomidae	Parametriocnemus	Parametriocnemus	P	4	Collector	sp	4.6
Insecta	Diptera	Chironomidae	Polypedilum	Polypedilum	I	8	Shredder	cb	6.3
Insecta	Diptera	Simuliidae	Prosimulium	Prosimulium	I	1	Filterer	cn	2.4
Insecta	Diptera	Chironomidae	not identified	Tanytarsini	I	4	Filterer	na	3.5
Insecta	Diptera	Chironomidae	Thienemanniella	Thienemanniella	I	1	Collector	sp	5.1
Clitellata	Haplotaxida	Tubificidae	not identified	Tubificidae	U	39	Collector	cn	8.4

1 Life Stage, I - Immature, P- Pupa, A - Adult; 2 Functional Feeding Group; 3 Primary habit or form of locomotion, includes bu - burrower, cn - clinger, cb - climber, sk - skater, sp - sprawler; 4 Tolerance Values, based on Hilsenhoff, modified for Maryland; na idicates information for the particular taxa was not available.

Dorsey Run, Hammond Branch, and Rocky Gorge Watersheds
Benthic Macroinvertebrate Data
2009

09RG-1-02-2009

Subphylum/ Class	Order	Family	Genus	Final ID	Note[1]	# of Org	FFG[2]	Habit[3]	Tolerance Value[4]
Insecta	Ephemeroptera	Ameletidae	Ameletus	Ameletus	I	1	Collector	sw	2.6
Insecta	Plecoptera	Nemouridae	Amphinemura	Amphinemura	I	16	Shredder	sp	3
Insecta	Diptera	Ceratopogonidae	not identified	Ceratopogonidae	I	4	Predator	sp	3.6
Hexapoda	Collembola	not identified	not identified	Collembola	A	8	Collector	sp	6
Insecta	Diptera	Chironomidae	Corynoneura	Corynoneura	I	8	Collector	sp	4.1
Insecta	Trichoptera	Hydropsychidae	Diplectrona	Diplectrona	I	1	Filterer	cn	2.7
Clitellata	Haplotaxida	Enchytraeidae	not identified	Enchytraeidae	U	1	Collector	bu	9.1
Insecta	Ephemeroptera	Ephemerellidae	Ephemerella	Ephemerella	I	2	Collector	cn	2.3
Insecta	Ephemeroptera	Ephemerellidae	Eurylophella	Eurylophella	I	2	Scraper	cn	4.5
Insecta	Odonata	Gomphidae	not identified	Gomphidae	I	1	Predator	bu	2.2
Insecta	Trichoptera	Hydropsychidae	Hydropsyche	Hydropsyche	I	1	Filterer	cn	7.5
Insecta	Ephemeroptera	Leptophlebiidae	not identified	Leptophlebiidae	I	6	Collector	sw	1.7
Clitellata	Haplotaxida	not identified	not identified	Lumbricina	U	1	Collector	bu	10
Insecta	Trichoptera	Psychomyiidae	Lype	Lype	I	1	Scraper	cn	4.7
Insecta	Diptera	Chironomidae	Micropsectra	Micropsectra	I	2	Collector	cb	2.1
Insecta	Diptera	Chironomidae	not identified	Orthocladiinae	I	1	Collector	bu	7.6
Insecta	Coleoptera	Dryopidae	Oulimnius	Oulimnius	I	2	Scraper	cn	2.7
Insecta	Diptera	Chironomidae	Parametriocnemus	Parametriocnemus	I	4	Collector	sp	4.6
Insecta	Diptera	Chironomidae	Paratanytarsus	Paratanytarsus	I	1	Collector	sp	7.7
Insecta	Diptera	Chironomidae	Phaenopsectra	Phaenopsectra	I	2	Collector	cn	8.7
Insecta	Diptera	Chironomidae	Polypedilum	Polypedilum	I	2	Shredder	cb	6.3
Insecta	Diptera	Tipulidae	Pseudolimnophila	Pseudolimnophila	I	4	Predator	bu	2.8
Insecta	Trichoptera	Limnephilidae	Pycnopsyche	Pycnopsyche	I	1	Shredder	sp	3.1
Insecta	Trichoptera	Rhyacophilidae	Rhyacophila	Rhyacophila	I	3	Predator	cn	2.1
Insecta	Diptera	Simuliidae	not identified	Simuliidae	P	1	Filterer	cn	3.2
Insecta	Diptera	Simuliidae	Simulium	Simulium	I	20	Filterer	cn	5.7
Insecta	Coleoptera	Elmidae	Stenelmis	Stenelmis	A	1	Scraper	cn	7.1
Insecta	Diptera	Chironomidae	Tanytarsus	Tanytarsus	I	3	Filterer	cb	4.9
Insecta	Diptera	Chironomidae	Thienemannimyia	Thienemannimyia	I	1	Predator	sp	6.7
Clitellata	Haplotaxida	Tubificidae	not identified	Tubificidae	U	1	Collector	cn	8.4
Turbellaria	not identified	not identified	not identified	Turbellaria	U	6	Predator	sp	4
Insecta	Diptera	Chironomidae	Tvetenia	Tvetenia	I	3	Collector	sp	5.1
Insecta	Diptera	Chironomidae	Zavrelimyia	Zavrelimyia	I	4	Predator	sp	5.3

1 Life Stage, I - Immature, P- Pupa, A - Adult; 2 Functional Feeding Group; 3 Primary habit or form of locomotion, includes bu - burrower, cn - clinger, cb - climber, sk - skater, sp - sprawler; 4 Tolerance Values, based on Hilsenhoff, modified for Maryland; na idicates information for the particular taxa was not available.

Dorsey Run, Hammond Branch, and Rocky Gorge Watersheds
Benthic Macroinvertebrate Data
2009

09RG-1-03-2009

Subphylum/ Class	Order	Family	Genus	Final ID	Note[1]	# of Org	FFG[2]	Habit[3]	Tolerance Value[4]
Insecta	Ephemeroptera	Baetidae	Acerpenna	Acerpenna	I	4	Collector	sw	2.6
Insecta	Ephemeroptera	Ameletidae	Ameletus	Ameletus	I	1	Collector	sw	2.6
Insecta	Plecoptera	Nemouridae	Amphinemura	Amphinemura	I	7	Shredder	sp	3
Insecta	Diptera	Ceratopogonidae	not identified	Ceratopogonidae	I	7	Predator	sp	3.6
Insecta	Diptera	Chironomidae	not identified	Chironomidae	I	1	Collector	na	6.6
Insecta	Diptera	Chironomidae	not identified	Chironomini	I	1	Collector	bu	5.9
Insecta	Plecoptera	Chloroperlidae	not identified	Chloroperlidae	I	1	Predator	cn	1.6
Hexapoda	Collembola	not identified	not identified	Collembola	A	1	Collector	sp	6
Insecta	Diptera	Chironomidae	Corynoneura	Corynoneura	I	2	Collector	sp	4.1
Insecta	Trichoptera	Hydropsychidae	Diplectrona	Diplectrona	I	1	Filterer	cn	2.7
Insecta	Plecoptera	Perlidae	Eccoptura	Eccoptura	I	2	Predator	cn	0.6
Insecta	Ephemeroptera	Ephemerellidae	Ephemerella	Ephemerella	I	4	Collector	cn	2.3
Insecta	Ephemeroptera	Ephemerellidae	Eurylophella	Eurylophella	I	2	Scraper	cn	4.5
Insecta	Diptera	Tipulidae	Hexatoma	Hexatoma	I	1	Predator	bu	1.5
Insecta	Ephemeroptera	Leptophlebiidae	not identified	Leptophlebiidae	I	4	Collector	sw	1.7
Insecta	Plecoptera	Leuctridae	not identified	Leuctridae	I	1	Shredder	sp	0.8
Clitellata	Haplotaxida	not identified	not identified	Lumbricina	U	1	Collector	bu	10
Clitellata	Haplotaxida	not identified	not identified	Lumbricina	U	1	Collector	bu	10
Insecta	Ephemeroptera	Heptageniidae	Maccaffertium	Maccaffertium	I	2	Scraper	cn	2.6
Insecta	Diptera	Chironomidae	Micropsectra	Micropsectra	I	8	Collector	cb	2.1
Clitellata	Haplotaxida	Naididae	not identified	Naididae	U	1	Collector	bu	9.1
Insecta	Diptera	Chironomidae	Natarsia	Natarsia	I	1	Predator	sp	6.6
Insecta	Diptera	Chironomidae	not identified	Orthocladiinae	I	5	Collector	bu	7.6
Insecta	Diptera	Chironomidae	not identified	Orthocladiinae	P	1	Collector	bu	7.6
Insecta	Diptera	Chironomidae	Orthocladius	Orthocladius	I	2	Collector	sp	9.2
Insecta	Coleoptera	Dryopidae	Oulimnius	Oulimnius	A	6	Scraper	cn	2.7
Insecta	Coleoptera	Dryopidae	Oulimnius	Oulimnius	I	17	Scraper	cn	2.7
Insecta	Diptera	Chironomidae	Paracladopelma	Paracladopelma	I	1	Collector	sp	6.6
Insecta	Diptera	Chironomidae	Parakiefferiella	Parakiefferiella	P	1	Collector	sp	2.1
Insecta	Diptera	Chironomidae	Parametriocnemus	Parametriocnemus	I	4	Collector	sp	4.6
Insecta	Diptera	Chironomidae	Paraphaenocladius	Paraphaenocladius	I	2	Collector	sp	4
Bivalvia	Veneroida	Pisidiidae	not identified	Pisidiidae	I	3	Filterer	bu	5.5
Insecta	Trichoptera	Polycentropodidae	Polycentropus	Polycentropus	I	1	Filterer	cn	1.1
Insecta	Diptera	Chironomidae	Polypedilum	Polypedilum	I	1	Shredder	cb	6.3
Insecta	Diptera	Tipulidae	Pseudolimnophila	Pseudolimnophila	I	4	Predator	bu	2.8
Insecta	Coleoptera	Elmidae	Stenelmis	Stenelmis	A	1	Scraper	cn	7.1
Insecta	Diptera	Chironomidae	not identified	Tanypodinae	I	1	Predator	sp	7.5
Insecta	Diptera	Chironomidae	Tanytarsus	Tanytarsus	I	3	Filterer	cb	4.9
Insecta	Diptera	Chironomidae	Thienemannimyia	Thienemannimyia	I	1	Predator	sp	6.7
Clitellata	Haplotaxida	Tubificidae	not identified	Tubificidae	U	7	Collector	cn	8.4

1 Life Stage, I - Immature, P- Pupa, A - Adult; 2 Functional Feeding Group; 3 Primary habit or form of locomotion, includes bu - burrower, cn - clinger, cb - climber, sk - skater, sp - sprawler; 4 Tolerance Values, based on Hilsenhoff, modified for Maryland; na idicates information for the particular taxa was not available.

Dorsey Run, Hammond Branch, and Rocky Gorge Watersheds
Benthic Macroinvertebrate Data
2009

09RG-1-04A-2009

Subphylum/ Class	Order	Family	Genus	Final ID	Note[1]	# of Org	FFG[2]	Habit[3]	Tolerance Value[4]
Insecta	Trichoptera	Hydropsychidae	Cheumatopsyche	Cheumatopsyche	I	1	Filterer	cn	6.5
Hexapoda	Collembola	not identified	not identified	Collembola	A	2	Collector	sp	6
Insecta	Diptera	Chironomidae	Cricotopus	Cricotopus	I	8	Shredder	cn	9.6
Insecta	Diptera	Chironomidae	Diamesa	Diamesa	I	5	Collector	sp	8.5
Insecta	Diptera	Chironomidae	Hydrobaenus	Hydrobaenus	I	10	Scraper	sp	7.2
Clitellata	Haplotaxida	Naididae	not identified	Naididae	U	14	Collector	bu	9.1
Insecta	Diptera	Chironomidae	not identified	Orthocladiinae	I	2	Collector	bu	7.6
Insecta	Diptera	Chironomidae	Sympotthastia	Sympotthastia	I	2	Collector	sp	8.2
Clitellata	Haplotaxida	Tubificidae	not identified	Tubificidae	U	74	Collector	cn	8.4

1 Life Stage, I - Immature, P- Pupa, A - Adult; 2 Functional Feeding Group; 3 Primary habit or form of locomotion, includes bu - burrower, cn - clinger, cb - climber, sk - skater, sp - sprawler; 4 Tolerance Values, based on Hilsenhoff, modified for Maryland; na idicates information for the particular taxa was not available.

Dorsey Run, Hammond Branch, and Rocky Gorge Watersheds
Benthic Macroinvertebrate Data
2009

09RG-1-04A-2009-QC

Subphylum/ Class	Order	Family	Genus	Final ID	Note[1]	# of Org	FFG[2]	Habit[3]	Tolerance Value[4]
Insecta	Trichoptera	Hydropsychidae	Cheumatopsyche	Cheumatopsyche	I	1	Filterer	cn	6.5
Insecta	Diptera	Chironomidae	not identified	Chironomidae	I	1	Collector	na	6.6
Hexapoda	Collembola	not identified	not identified	Collembola	A	2	Collector	sp	6
Insecta	Diptera	Chironomidae	Cricotopus	Cricotopus	P	1	Shredder	cn	9.6
Insecta	Diptera	Chironomidae	Cricotopus	Cricotopus	I	10	Shredder	cn	9.6
Insecta	Diptera	Ceratopogonidae	Dasyhelea	Dasyhelea	I	1	Collector	sp	3.6
Insecta	Diptera	Chironomidae	Diamesa	Diamesa	I	9	Collector	sp	8.5
Insecta	Diptera	Chironomidae	Eukiefferiella	Eukiefferiella	I	1	Collector	sp	6.1
Gastropoda	Basommatophora	Lymnaeidae	Fossaria	Fossaria	U	1	Scraper	cb	6.9
Insecta	Diptera	Chironomidae	Hydrobaenus	Hydrobaenus	I	13	Scraper	sp	7.2
Insecta	Trichoptera	Hydropsychidae	Hydropsyche	Hydropsyche	I	3	Filterer	cn	7.5
Clitellata	Haplotaxida	Naididae	not identified	Naididae	U	23	Collector	bu	9.1
Insecta	Diptera	Chironomidae	not identified	Orthocladiinae	I	2	Collector	bu	7.6
Insecta	Diptera	Chironomidae	Orthocladius	Orthocladius	I	7	Collector	sp	9.2
Insecta	Diptera	Chironomidae	Orthocladius	Orthocladius	P	8	Collector	sp	9.2
Insecta	Diptera	Chironomidae	Phaenopsectra	Phaenopsectra	I	1	Collector	cn	8.7
Insecta	Diptera	Chironomidae	not identified	Tanytarsini	I	1	Filterer	na	3.5
Insecta	Diptera	Chironomidae	Tanytarsus	Tanytarsus	I	1	Filterer	cb	4.9
Insecta	Diptera	Tipulidae	Tipula	Tipula	I	1	Shredder	bu	6.7
Clitellata	Haplotaxida	Tubificidae	not identified	Tubificidae	U	25	Collector	cn	8.4

1 Life Stage, I - Immature, P- Pupa, A - Adult; 2 Functional Feeding Group; 3 Primary habit or form of locomotion, includes bu - burrower, cn - clinger, cb - climber, sk - skater, sp - sprawler; 4 Tolerance Values, based on Hilsenhoff, modified for Maryland; na idicates information for the particular taxa was not available.

Dorsey Run, Hammond Branch, and Rocky Gorge Watersheds
Benthic Macroinvertebrate Data
2009

09RG-4-01-2009

Subphylum/ Class	Order	Family	Genus	Final ID	Note[1]	# of Org	FFG[2]	Habit[3]	Tolerance Value[4]
Insecta	Coleoptera	Elmidae	Ancyronyx	Ancyronyx	I	2	Scraper	cn	7.8
Insecta	Odonata	Coenagrionidae	Argia	Argia	I	2	Predator	cn	9.3
Insecta	Ephemeroptera	Baetidae	Centroptilum	Centroptilum	I	2	Collector	sw	2.3
Insecta	Trichoptera	Hydropsychidae	Cheumatopsyche	Cheumatopsyche	I	2	Filterer	cn	6.5
Insecta	Diptera	Chironomidae	not identified	Chironomidae	I	1	Collector	na	6.6
Insecta	Diptera	Chironomidae	not identified	Chironomini	I	1	Collector	bu	5.9
Insecta	Diptera	Chironomidae	not identified	Chironomini	P	2	Collector	bu	5.9
Insecta	Diptera	Tabanidae	Chrysops	Chrysops	I	2	Predator	sp	2.9
Insecta	Diptera	Empididae	Clinocera	Clinocera	I	1	Predator	cn	7.4
Crustacea	Amphipoda	Crangonyctidae	Crangonyx	Crangonyx	U	29	Collector	sp	6.7
Insecta	Diptera	Chironomidae	Cricotopus	Cricotopus	P	1	Shredder	cn	9.6
Insecta	Diptera	Chironomidae	Cricotopus	Cricotopus	I	5	Shredder	cn	9.6
Insecta	Diptera	Chironomidae	Dicrotendipes	Dicrotendipes	I	1	Collector	bu	9
Insecta	Odonata	Gomphidae	not identified	Gomphidae	I	1	Predator	bu	2.2
Insecta	Diptera	Chironomidae	Hydrobaenus	Hydrobaenus	I	6	Scraper	sp	7.2
Insecta	Trichoptera	Hydroptilidae	Hydroptila	Hydroptila	I	2	Scraper	cn	6
Malacostraca	Isopoda	Asellidae	Lirceus	Lirceus	U	3	Collector	sp	3.3
Insecta	Ephemeroptera	Heptageniidae	Maccaffertium	Maccaffertium	I	8	Scraper	cn	2.6
Insecta	Coleoptera	Dryopidae	Macronychus	Macronychus	I	4	Scraper	cn	6.8
Gastropoda	Basommatophora	Planorbidae	Menetus	Menetus	U	1	Scraper	cb	7.6
Insecta	Diptera	Chironomidae	Microtendipes	Microtendipes	I	5	Filterer	cn	4.9
Insecta	Diptera	Chironomidae	Nanocladius	Nanocladius	I	2	Collector	sp	7.6
Insecta	Plecoptera	Nemouridae	Nemoura	Nemoura	I	1	Shredder	sp	2.9
Insecta	Diptera	Chironomidae	not identified	Orthocladiinae	I	1	Collector	bu	7.6
Insecta	Diptera	Chironomidae	Orthocladius	Orthocladius	P	2	Collector	sp	9.2
Insecta	Diptera	Chironomidae	Orthocladius	Orthocladius	I	5	Collector	sp	9.2
Insecta	Diptera	Chironomidae	Paratanytarsus	Paratanytarsus	P	2	Collector	sp	7.7
Insecta	Diptera	Chironomidae	Paratanytarsus	Paratanytarsus	I	3	Collector	sp	7.7
Insecta	Trichoptera	Polycentropodidae	Polycentropus	Polycentropus	I	13	Filterer	cn	1.1
Insecta	Diptera	Chironomidae	Rheotanytarsus	Rheotanytarsus	I	2	Filterer	cn	7.2
Insecta	Diptera	Chironomidae	Tanytarsus	Tanytarsus	I	3	Filterer	cb	4.9
Clitellata	Haplotaxida	Tubificidae	not identified	Tubificidae	U	2	Collector	cn	8.4

1 Life Stage, I - Immature, P- Pupa, A - Adult; 2 Functional Feeding Group; 3 Primary habit or form of locomotion, includes bu - burrower, cn - clinger, cb - climber, sk - skater, sp - sprawler; 4 Tolerance Values, based on Hilsenhoff, modified for Maryland; na idicates information for the particular taxa was not available.

Dorsey Run, Hammond Branch, and Rocky Gorge Watersheds
Benthic Macroinvertebrate Data
2009

09RG-4-02A-2009

Subphylum/ Class	Order	Family	Genus	Final ID	Note[1]	# of Org	FFG[2]	Habit[3]	Tolerance Value[4]
Insecta	Diptera	Chironomidae	Ablabesmyia	Ablabesmyia	I	1	Predator	sp	8.1
Insecta	Odonata	Coenagrionidae	Argia	Argia	I	3	Predator	cn	9.3
Insecta	Ephemeroptera	Baetidae	not identified	Baetidae	I	1	Collector	sw	2.3
Insecta	Ephemeroptera	Baetidae	Centroptilum	Centroptilum	I	1	Collector	sw	2.3
Insecta	Diptera	Chironomidae	not identified	Chironomini	P	1	Collector	bu	5.9
Crustacea	Amphipoda	Crangonyctidae	Crangonyx	Crangonyx	U	47	Collector	sp	6.7
Insecta	Diptera	Chironomidae	Cricotopus	Cricotopus	I	2	Shredder	cn	9.6
Insecta	Diptera	Chironomidae	Cricotopus	Cricotopus	P	2	Shredder	cn	9.6
Insecta	Diptera	Chironomidae	Hydrobaenus	Hydrobaenus	I	13	Scraper	sp	7.2
Insecta	Trichoptera	Hydroptilidae	Hydroptila	Hydroptila	I	2	Scraper	cn	6
Insecta	Diptera	Chironomidae	Limnophyes	Limnophyes	I	1	Collector	sp	8.6
Clitellata	Haplotaxida	not identified	not identified	Lumbricina	U	1	Collector	bu	10
Insecta	Diptera	Chironomidae	Nanocladius	Nanocladius	I	4	Collector	sp	7.6
Insecta	Diptera	Chironomidae	not identified	Orthocladiinae	P	1	Collector	bu	7.6
Insecta	Diptera	Chironomidae	not identified	Orthocladiinae	I	1	Collector	bu	7.6
Insecta	Diptera	Chironomidae	Orthocladius	Orthocladius	P	2	Collector	sp	9.2
Insecta	Diptera	Chironomidae	Orthocladius	Orthocladius	I	7	Collector	sp	9.2
Insecta	Diptera	Chironomidae	Paratanytarsus	Paratanytarsus	I	1	Collector	sp	7.7
Insecta	Diptera	Chironomidae	Phaenopsectra	Phaenopsectra	I	1	Collector	cn	8.7
Bivalvia	Veneroida	Pisidiidae	not identified	Pisidiidae	U	10	Filterer	bu	5.5
Bivalvia	Veneroida	Pisidiidae	Pisidium	Pisidium	U	2	Filterer	bu	5.7
Insecta	Trichoptera	Polycentropodidae	Polycentropus	Polycentropus	I	5	Filterer	cn	1.1
Insecta	Diptera	Ceratopogonidae	Probezzia	Probezzia	I	1	Predator	bu	3
Insecta	Diptera	Chironomidae	Rheotanytarsus	Rheotanytarsus	P	1	Filterer	cn	7.2
Insecta	Diptera	Chironomidae	Rheotanytarsus	Rheotanytarsus	I	1	Filterer	cn	7.2
Insecta	Trichoptera	Leptoceridae	Triaenodes	Triaenodes	I	2	Shredder	sw	5
Clitellata	Haplotaxida	Tubificidae	not identified	Tubificidae	I	2	Collector	cn	8.4

1 Life Stage, I - Immature, P- Pupa, A - Adult; 2 Functional Feeding Group; 3 Primary habit or form of locomotion, includes bu - burrower, cn - clinger, cb - climber, sk - skater, sp - sprawler; 4 Tolerance Values, based on Hilsenhoff, modified for Maryland; na idicates information for the particular taxa was not available.

Dorsey Run, Hammond Branch, and Rocky Gorge Watersheds
Benthic Macroinvertebrate Data
2009

Subphylum/ Class	Order	Family	Genus	Final ID	Note[1]	# of Org	FFG[2]	Habit[3]	Tolerance Value[4]
Insecta	Coleoptera	Elmidae	Ancyronyx	Ancyronyx	A	1	Scraper	cn	7.8
Insecta	Diptera	Chironomidae	Brillia	Brillia	I	1	Shredder	bu	7.4
Crustacea	Amphipoda	Crangonyctidae	Crangonyx	Crangonyx	U	28	Collector	sp	6.7
Insecta	Diptera	Chironomidae	Cricotopus	Cricotopus	I	6	Shredder	cn	9.6
Insecta	Coleoptera	Elmidae	Dubiraphia	Dubiraphia	A	1	Scraper	cn	5.7
Insecta	Diptera	Empididae	Hemerodromia	Hemerodromia	I	1	Predator	sp	7.9
Insecta	Diptera	Chironomidae	Hydrobaenus	Hydrobaenus	I	24	Scraper	sp	7.2
Insecta	Diptera	Chironomidae	Hydrobaenus	Hydrobaenus	P	3	Scraper	sp	7.2
Insecta	Diptera	Chironomidae	Limnophyes	Limnophyes	I	1	Collector	sp	8.6
Insecta	Ephemeroptera	Heptageniidae	Maccaffertium	Maccaffertium	I	1	Scraper	cn	2.6
Insecta	Diptera	Chironomidae	not identified	Orthocladiinae	I	1	Collector	bu	7.6
Insecta	Diptera	Chironomidae	Orthocladius	Orthocladius	I	20	Collector	sp	9.2
Insecta	Diptera	Chironomidae	Parakiefferiella	Parakiefferiella	I	4	Collector	sp	2.1
Bivalvia	Veneroida	Pisidiidae	not identified	Pisidiidae	U	6	Filterer	bu	5.5
Insecta	Trichoptera	Polycentropodidae	Polycentropus	Polycentropus	I	3	Filterer	cn	1.1
Insecta	Diptera	Chironomidae	Rheotanytarsus	Rheotanytarsus	I	2	Filterer	cn	7.2
Insecta	Diptera	Chironomidae	Tanytarsus	Tanytarsus	I	3	Filterer	cb	4.9
Clitellata	Haplotaxida	Tubificidae	not identified	Tubificidae	U	3	Collector	cn	8.4
Insecta	Diptera	Chironomidae	Xestochironomus	Xestochironomus	I	1	Filterer	cn	1.8

1 Life Stage, I - Immature, P- Pupa, A - Adult; 2 Functional Feeding Group; 3 Primary habit or form of locomotion, includes bu - burrower, cn - clinger, cb - climber, sk - skater, sp - sprawler; 4 Tolerance Values, based on Hilsenhoff, modified for Maryland; na idicates information for the particular taxa was not available.

Dorsey Run, Hammond Branch, and Rocky Gorge Watersheds
Benthic Macroinvertebrate Data
2009

Subphylum/ Class	Order	Family	Genus	Final ID	Note[1]	# of Org	FFG[2]	Habit[3]	Tolerance Value[4]
Insecta	Odonata	Calopterygidae	Calopteryx	Calopteryx	I	1	Predator	cb	8.3
Insecta	Trichoptera	Hydropsychidae	Cheumatopsyche	Cheumatopsyche	I	2	Filterer	cn	6.5
Crustacea	Amphipoda	Crangonyctidae	Crangonyx	Crangonyx	U	59	Collector	sp	6.7
Insecta	Coleoptera	Scirtidae	Cyphon	Cyphon	I	1	Scraper	cb	7
Insecta	Diptera	Dixidae	Dixella	Dixella	I	2	Predator	sw	5.8
Insecta	Diptera	Empididae	Hemerodromia	Hemerodromia	I	4	Predator	sp	7.9
Crustacea	Amphipoda	Hyalellidae	Hyalella	Hyalella	U	6	Shredder	sp	4.2
Insecta	Trichoptera	Hydropsychidae	Hydropsyche	Hydropsyche	I	6	Filterer	cn	7.5
Insecta	Ephemeroptera	Heptageniidae	Maccaffertium	Maccaffertium	I	1	Scraper	cn	2.6
Insecta	Diptera	Chironomidae	Microtendipes	Microtendipes	I	1	Filterer	cn	4.9
Insecta	Plecoptera	Nemouridae	Nemoura	Nemoura	I	1	Shredder	sp	2.9
Insecta	Diptera	Chironomidae	Orthocladius	Orthocladius	I	5	Collector	sp	9.2
Insecta	Diptera	Chironomidae	Orthocladius	Orthocladius	P	2	Collector	sp	9.2
Insecta	Diptera	Chironomidae	Parametriocnemus	Parametriocnemus	I	1	Collector	sp	4.6
Insecta	Diptera	Chironomidae	Paratanytarsus	Paratanytarsus	I	1	Collector	sp	7.7
Bivalvia	Veneroida	Pisidiidae	Pisidium	Pisidium	I	2	Filterer	bu	5.7
Insecta	Trichoptera	Polycentropodidae	Polycentropus	Polycentropus	I	1	Filterer	cn	1.1
Insecta	Diptera	Chironomidae	Polypedilum	Polypedilum	I	1	Shredder	cb	6.3
Insecta	Diptera	Chironomidae	Rheotanytarsus	Rheotanytarsus	I	5	Filterer	cn	7.2
Insecta	Diptera	Simuliidae	Simulium	Simulium	I	3	Filterer	cn	5.7
Bivalvia	Veneroida	Pisidiidae	Sphaerium	Sphaerium	U	9	Filterer	bu	5.5
Crustacea	Amphipoda	Crangonyctidae	Stygobromus	Stygobromus	U	1	Collector	sp	6.5
Insecta	Diptera	Chironomidae	Tanytarsus	Tanytarsus	I	1	Filterer	cb	4.9
Insecta	Diptera	Chironomidae	Thienemanniella	Thienemanniella	I	1	Collector	sp	5.1
Insecta	Diptera	Chironomidae	Tvetenia	Tvetenia	I	1	Collector	sp	5.1

1 Life Stage, I - Immature, P- Pupa, A - Adult; 2 Functional Feeding Group; 3 Primary habit or form of locomotion, includes bu - burrower, cn - clinger, cb - climber, sk - skater, sp - sprawler; 4 Tolerance Values, based on Hilsenhoff, modified for Maryland; na idicates information for the particular taxa was not available.

Subphylum/ Class	Order	Family	Genus	Final ID	Note[1]	# of Org	FFG[2]	Habit[3]	Tolerance Value[4]
Insecta	Diptera	Chironomidae	Ablabesmyia	Ablabesmyia	I	2	Predator	sp	8.1
Insecta	Ephemeroptera	Ameletidae	Ameletus	Ameletus	I	2	Collector	sw	2.6
Insecta	Coleoptera	Elmidae	Ancyronyx	Ancyronyx	A	1	Scraper	cn	7.8
Insecta	Odonata	Aeshnidae	Boyeria	Boyeria	I	1	Predator	cb	6.3
Insecta	Diptera	Chironomidae	Brillia	Brillia	P	1	Shredder	bu	7.4
Insecta	Ephemeroptera	Baetidae	Centroptilum	Centroptilum	I	7	Collector	sw	2.3
Insecta	Diptera	Ceratopogonidae	not identified	Ceratopogonidae	I	3	Predator	sp	3.6
Insecta	Trichoptera	Hydropsychidae	Cheumatopsyche	Cheumatopsyche	I	2	Filterer	cn	6.5
Insecta	Diptera	Chironomidae	not identified	Chironomini	I	15	Collector	bu	5.9
Insecta	Diptera	Empididae	Clinocera	Clinocera	I	2	Predator	cn	7.4
Hexapoda	Collembola	not identified	not identified	Collembola	A	1	Collector	sp	6
Crustacea	Amphipoda	Crangonyctidae	Crangonyx	Crangonyx	U	8	Collector	sp	6.7
Insecta	Diptera	Chironomidae	Cricotopus	Cricotopus	I	3	Shredder	cn	9.6
Insecta	Diptera	Ceratopogonidae	Culicoides	Culicoides	I	3	Predator	bu	5.9
Insecta	Diptera	Chironomidae	Dicrotendipes	Dicrotendipes	I	1	Collector	bu	9
Insecta	Coleoptera	Elmidae	Dubiraphia	Dubiraphia	A	1	Scraper	cn	5.7
Insecta	Coleoptera	Elmidae	Dubiraphia	Dubiraphia	I	1	Scraper	cn	5.7
Insecta	Diptera	Empididae	not identified	Empididae	I	1	Predator	sp	7.5
Insecta	Ephemeroptera	Ephemerellidae	not identified	Ephemerellidae	I	1	Collector	cn	2.6
Clitellata	Arhynchobdellida	Erpobdellidae	not identified	Erpobdellidae	U	1	Predator	sp	10
Insecta	Diptera	Chironomidae	Eukiefferiella	Eukiefferiella	I	2	Collector	sp	6.1
Insecta	Diptera	Empididae	Hemerodromia	Hemerodromia	I	2	Predator	sp	7.9
Insecta	Diptera	Chironomidae	Hydrobaenus	Hydrobaenus	I	2	Scraper	sp	7.2
Insecta	Trichoptera	Hydropsychidae	Hydropsyche	Hydropsyche	I	2	Filterer	cn	7.5
Insecta	Trichoptera	Hydroptilidae	Hydroptila	Hydroptila	I	4	Scraper	cn	6
Insecta	Ephemeroptera	Heptageniidae	Maccaffertium	Maccaffertium	I	1	Scraper	cn	2.6
Insecta	Coleoptera	Dryopidae	Macronychus	Macronychus	I	1	Scraper	cn	6.8
Insecta	Coleoptera	Dryopidae	Macronychus	Macronychus	A	2	Scraper	cn	6.8
Insecta	Diptera	Chironomidae	Microtendipes	Microtendipes	I	1	Filterer	cn	4.9
Insecta	Diptera	Chironomidae	Nanocladius	Nanocladius	I	2	Collector	sp	7.6
Insecta	Diptera	Chironomidae	not identified	Orthocladiinae	I	2	Collector	bu	7.6
Insecta	Diptera	Chironomidae	Orthocladius	Orthocladius	P	1	Collector	sp	9.2
Insecta	Diptera	Chironomidae	Orthocladius	Orthocladius	I	2	Collector	sp	9.2
Insecta	Diptera	Chironomidae	Parakiefferiella	Parakiefferiella	P	2	Collector	sp	2.1
Insecta	Diptera	Chironomidae	Paratanytarsus	Paratanytarsus	I	1	Collector	sp	7.7
Insecta	Diptera	Chironomidae	Phaenopsectra	Phaenopsectra	I	2	Collector	cn	8.7
Insecta	Diptera	Chironomidae	Polypedilum	Polypedilum	I	1	Shredder	cb	6.3
Insecta	Diptera	Simuliidae	Prosimulium	Prosimulium	I	1	Filterer	cn	2.4
Enopla	Hoplonemertea	Tetrastemmatidae	Prostoma	Prostoma	U	1	Predator	na	7.3
Insecta	Diptera	Chironomidae	Rheotanytarsus	Rheotanytarsus	I	3	Filterer	cn	7.2
Insecta	Diptera	Simuliidae	Simulium	Simulium	I	1	Filterer	cn	5.7
Insecta	Diptera	Chironomidae	Tanytarsus	Tanytarsus	I	8	Filterer	cb	4.9
Insecta	Diptera	Chironomidae	Thienemannimyia	Thienemannimyia	I	1	Predator	sp	6.7
Hexapoda	Hemiptera	Corixidae	Trichocorixa	Trichocorixa	A	1	Predator	sw	5.6
Clitellata	Haplotaxida	Tubificidae	not identified	Tubificidae	U	6	Collector	cn	8.4
Insecta	Diptera	Chironomidae	Tvetenia	Tvetenia	I	1	Collector	sp	5.1
Insecta	Diptera	Chironomidae	Tvetenia	Tvetenia	P	1	Collector	sp	5.1

1 Life Stage, I - Immature, P- Pupa, A - Adult; 2 Functional Feeding Group; 3 Primary habit or form of locomotion, includes bu - burrower, cn - clinger, cb - climber, sk - skater, sp - sprawler; 4 Tolerance Values, based on Hilsenhoff, modified for Maryland; na idicates information for the particular taxa was not available.

Dorsey Run, Hammond Branch, and Rocky Gorge Watersheds
Benthic Macroinvertebrate Data
2009

09RG-4-06A-2009

Subphylum/ Class	Order	Family	Genus	Final ID	Note[1]	# of Org	FFG[2]	Habit[3]	Tolerance Value[4]
Insecta	Coleoptera	Elmidae	Ancyronyx	Ancyronyx	I	3	Scraper	cn	7.8
Insecta	Coleoptera	Elmidae	Ancyronyx	Ancyronyx	A	6	Scraper	cn	7.8
Insecta	Diptera	Tipulidae	Antocha	Antocha	I	1	Collector	cn	8
Insecta	Diptera	Ceratopogonidae	not identified	Ceratopogonidae	I	1	Predator	sp	3.6
Insecta	Trichoptera	Hydropsychidae	Ceratopsyche	Ceratopsyche	I	2	Filterer	cn	5
Insecta	Trichoptera	Hydropsychidae	Cheumatopsyche	Cheumatopsyche	I	7	Filterer	cn	6.5
Insecta	Trichoptera	Philopotamidae	Chimarra	Chimarra	I	1	Filterer	cn	4.4
Insecta	Diptera	Chironomidae	not identified	Chironomini	I	1	Collector	bu	5.9
Insecta	Diptera	Empididae	Clinocera	Clinocera	I	1	Predator	cn	7.4
Bivalvia	Veneroida	Corbiculidae	Corbicula	Corbicula	U	3	Filterer	bu	6
Crustacea	Amphipoda	Crangonyctidae	Crangonyx	Crangonyx	U	14	Collector	sp	6.7
Insecta	Diptera	Chironomidae	Cricotopus	Cricotopus	P	2	Shredder	cn	9.6
Insecta	Diptera	Chironomidae	Cricotopus	Cricotopus	I	3	Shredder	cn	9.6
Insecta	Diptera	Chironomidae	Dicrotendipes	Dicrotendipes	I	3	Collector	bu	9
Insecta	Ephemeroptera	Ephemerellidae	Ephemerella	Ephemerella	I	1	Collector	cn	2.3
Insecta	Ephemeroptera	Heptageniidae	not identified	Heptageniidae	I	1	Scraper	cn	2.6
Insecta	Diptera	Chironomidae	Hydrobaenus	Hydrobaenus	I	6	Scraper	sp	7.2
Insecta	Diptera	Chironomidae	Hydrobaenus	Hydrobaenus	P	1	Scraper	sp	7.2
Insecta	Trichoptera	Hydropsychidae	Hydropsyche	Hydropsyche	I	3	Filterer	cn	7.5
Insecta	Trichoptera	Hydroptilidae	Hydroptila	Hydroptila	I	4	Scraper	cn	6
Insecta	Trichoptera	Psychomyiidae	Lype	Lype	I	1	Scraper	cn	4.7
Insecta	Coleoptera	Dryopidae	Macronychus	Macronychus	I	2	Scraper	cn	6.8
Insecta	Coleoptera	Dryopidae	Macronychus	Macronychus	A	2	Scraper	cn	6.8
Insecta	Diptera	Chironomidae	Microtendipes	Microtendipes	I	1	Filterer	cn	4.9
Insecta	Diptera	Chironomidae	Nanocladius	Nanocladius	I	1	Collector	sp	7.6
Insecta	Diptera	Chironomidae	not identified	Orthocladiinae	I	1	Collector	bu	7.6
Insecta	Diptera	Chironomidae	not identified	Orthocladiinae	P	3	Collector	bu	7.6
Insecta	Diptera	Chironomidae	Orthocladius	Orthocladius	I	3	Collector	sp	9.2
Insecta	Diptera	Chironomidae	Parakiefferiella	Parakiefferiella	I	2	Collector	sp	2.1
Insecta	Diptera	Chironomidae	Paralauterborniella	Paralauterborniella	I	1	Collector	cn	6.6
Insecta	Diptera	Chironomidae	Phaenopsectra	Phaenopsectra	I	2	Collector	cn	8.7
Insecta	Trichoptera	Polycentropodidae	Polycentropus	Polycentropus	I	2	Filterer	cn	1.1
Insecta	Diptera	Chironomidae	Polypedilum	Polypedilum	I	3	Shredder	cb	6.3
Insecta	Diptera	Chironomidae	Rheotanytarsus	Rheotanytarsus	P	1	Filterer	cn	7.2
Insecta	Diptera	Chironomidae	Rheotanytarsus	Rheotanytarsus	I	3	Filterer	cn	7.2
Insecta	Plecoptera	Nemouridae	Shipsa	Shipsa	I	1	Shredder	sp	2.9
Insecta	Coleoptera	Elmidae	Stenelmis	Stenelmis	A	1	Scraper	cn	7.1
Insecta	Diptera	Chironomidae	Stenochironomus	Stenochironomus	I	1	Shredder	bu	7.9
Insecta	Diptera	Chironomidae	not identified	Tanypodinae	P	1	Predator	sp	7.5
Insecta	Diptera	Chironomidae	Tanytarsus	Tanytarsus	I	2	Filterer	cb	4.9
Clitellata	Haplotaxida	Tubificidae	not identified	Tubificidae	U	4	Collector	cn	8.4

1 Life Stage, I - Immature, P- Pupa, A - Adult; 2 Functional Feeding Group; 3 Primary habit or form of locomotion, includes bu - burrower, cn - clinger, cb - climber, sk - skater, sp - sprawler; 4 Tolerance Values, based on Hilsenhoff, modified for Maryland; na idicates information for the particular taxa was not available.

Dorsey Run, Hammond Branch, and Rocky Gorge Watersheds
Benthic Macroinvertebrate Data
2009

14HB-1-01-2009

Subphylum/ Class	Order	Family	Genus	Final ID	Note[1]	# of Org	FFG[2]	Habit[3]	Tolerance Value[4]
Insecta	Diptera	Chironomidae	not identified	Chironomidae	I	1	Collector	na	6.6
Insecta	Diptera	Chironomidae	not identified	Chironomini	I	4	Collector	bu	5.9
Insecta	Diptera	Chironomidae	Cladotanytarsus	Cladotanytarsus	I	6	Filterer	-	6.6
Insecta	Diptera	Chironomidae	Corynoneura	Corynoneura	I	1	Collector	sp	4.1
Crustacea	Amphipoda	Crangonyctidae	Crangonyx	Crangonyx	U	14	Collector	sp	6.7
Insecta	Diptera	Chironomidae	Cricotopus	Cricotopus	I	1	Shredder	cn	9.6
Insecta	Diptera	Chironomidae	Diplocladius	Diplocladius	I	1	Collector	sp	5.9
Insecta	Odonata	Coenagrionidae	Enallagma	Enallagma	I	1	Predator	cb	9
Insecta	Diptera	Chironomidae	Hydrobaenus	Hydrobaenus	P	4	Scraper	sp	7.2
Insecta	Diptera	Chironomidae	Hydrobaenus	Hydrobaenus	I	3	Scraper	sp	7.2
Insecta	Odonata	Coenagrionidae	Ischnura	Ischnura	I	1	Predator	cb	9
Clitellata	Haplotaxida	Naididae	not identified	Naididae	U	3	Collector	bu	9.1
Insecta	Diptera	Chironomidae	Nanocladius	Nanocladius	I	1	Collector	sp	7.6
Insecta	Diptera	Chironomidae	Parakiefferiella	Parakiefferiella	I	1	Collector	sp	2.1
Insecta	Diptera	Chironomidae	Paratanytarsus	Paratanytarsus	I	15	Collector	sp	7.7
Insecta	Diptera	Chironomidae	Phaenopsectra	Phaenopsectra	I	1	Collector	cn	8.7
Bivalvia	Veneroida	Pisidiidae	Pisidium	Pisidium	U	1	Filterer	bu	5.7
Insecta	Diptera	Chironomidae	Rheotanytarsus	Rheotanytarsus	I	2	Filterer	cn	7.2
Insecta	Coleoptera	Elmidae	Stenelmis	Stenelmis	I	1	Scraper	cn	7.1
Insecta	Diptera	Chironomidae	not identified	Tanytarsini	I	1	Filterer	na	3.5
Insecta	Diptera	Chironomidae	Tanytarsus	Tanytarsus	I	8	Filterer	cb	4.9
Insecta	Diptera	Chironomidae	Thienemanniella	Thienemanniella	I	2	Collector	sp	5.1
Hexapoda	Hemiptera	Corixidae	Trichocorixa	Trichocorixa	A	1	Predator	sw	5.6
Clitellata	Haplotaxida	Tubificidae	not identified	Tubificidae	U	33	Collector	cn	8.4

1 Life Stage, I - Immature, P- Pupa, A - Adult; 2 Functional Feeding Group; 3 Primary habit or form of locomotion, includes bu - burrower, cn - clinger, cb - climber, sk - skater, sp - sprawler; 4 Tolerance Values, based on Hilsenhoff, modified for Maryland; na idicates information for the particular taxa was not available.

Dorsey Run, Hammond Branch, and Rocky Gorge Watersheds
Benthic Macroinvertebrate Data
2009

Subphylum/ Class	Order	Family	Genus	Final ID	Note[1]	# of Org	FFG[2]	Habit[3]	Tolerance Value[4]
Insecta	Coleoptera	Elmidae	Ancyronyx	Ancyronyx	I	2	Scraper	cn	7.8
Insecta	Diptera	Chironomidae	Brillia	Brillia	I	3	Shredder	bu	7.4
Insecta	Trichoptera	Hydropsychidae	Ceratopsyche	Ceratopsyche	I	2	Filterer	cn	5
Insecta	Trichoptera	Hydropsychidae	Cheumatopsyche	Cheumatopsyche	I	11	Filterer	cn	6.5
Insecta	Diptera	Chironomidae	Cladotanytarsus	Cladotanytarsus	I	1	Filterer	-	6.6
Bivalvia	Veneroida	Corbiculidae	Corbicula	Corbicula	I	1	Filterer	bu	6
Insecta	Diptera	Chironomidae	Corynoneura	Corynoneura	I	1	Collector	sp	4.1
Crustacea	Amphipoda	Crangonyctidae	Crangonyx	Crangonyx	U	6	Collector	sp	6.7
Insecta	Diptera	Chironomidae	Cricotopus	Cricotopus	P	2	Shredder	cn	9.6
Insecta	Diptera	Chironomidae	Cricotopus	Cricotopus	I	1	Shredder	cn	9.6
Insecta	Ephemeroptera	Heptageniidae	not identified	Heptageniidae	I	1	Scraper	cn	2.6
Insecta	Diptera	Chironomidae	Hydrobaenus	Hydrobaenus	I	14	Scraper	sp	7.2
Insecta	Diptera	Chironomidae	Hydrobaenus	Hydrobaenus	P	2	Scraper	sp	7.2
Insecta	Trichoptera	Hydropsychidae	Hydropsyche	Hydropsyche	I	1	Filterer	cn	7.5
Insecta	Diptera	Chironomidae	Limnophyes	Limnophyes	I	1	Collector	sp	8.6
Insecta	Diptera	Chironomidae	Micropsectra	Micropsectra	I	1	Collector	cb	2.1
Insecta	Diptera	Chironomidae	Nanocladius	Nanocladius	I	1	Collector	sp	7.6
Insecta	Plecoptera	Nemouridae	not identified	Nemouridae	I	1	Shredder	sp	2.9
Insecta	Megaloptera	Corydalidae	Nigronia	Nigronia	I	1	Predator	cn	1.4
Insecta	Trichoptera	Leptoceridae	Oecetis	Oecetis	I	1	Predator	cn	4.7
Insecta	Diptera	Chironomidae	Orthocladius	Orthocladius	P	1	Collector	sp	9.2
Insecta	Diptera	Chironomidae	Orthocladius	Orthocladius	I	10	Collector	sp	9.2
Insecta	Diptera	Chironomidae	Paratanytarsus	Paratanytarsus	I	5	Collector	sp	7.7
Insecta	Diptera	Simuliidae	Prosimulium	Prosimulium	I	1	Filterer	cn	2.4
Enopla	Hoplonemertea	Tetrastemmatidae	Prostoma	Prostoma	U	1	Predator	na	7.3
Insecta	Diptera	Chironomidae	Rheocricotopus	Rheocricotopus	I	1	Collector	sp	6.2
Insecta	Diptera	Chironomidae	Rheotanytarsus	Rheotanytarsus	P	1	Filterer	cn	7.2
Insecta	Diptera	Chironomidae	Rheotanytarsus	Rheotanytarsus	I	19	Filterer	cn	7.2
Insecta	Diptera	Simuliidae	Simulium	Simulium	I	2	Filterer	cn	5.7
Insecta	Coleoptera	Elmidae	Stenelmis	Stenelmis	I	1	Scraper	cn	7.1
Insecta	Ephemeroptera	Heptageniidae	Stenonema	Stenonema	I	5	Scraper	cn	4.6
Insecta	Diptera	Chironomidae	Tanytarsus	Tanytarsus	I	4	Filterer	cb	4.9
Insecta	Diptera	Chironomidae	Thienemannimyia	Thienemannimyia	I	2	Predator	sp	6.7
Clitellata	Haplotaxida	Tubificidae	not identified	Tubificidae	U	2	Collector	cn	8.4

1 Life Stage, I - Immature, P- Pupa, A - Adult; 2 Functional Feeding Group; 3 Primary habit or form of locomotion, includes bu - burrower, cn - clinger, cb - climber, sk - skater, sp - sprawler; 4 Tolerance Values, based on Hilsenhoff, modified for Maryland; na idicates information for the particular taxa was not available.

Dorsey Run, Hammond Branch, and Rocky Gorge Watersheds
Benthic Macroinvertebrate Data
2009

14HB-1-03-2009

Subphylum/ Class	Order	Family	Genus	Final ID	Note[1]	# of Org	FFG[2]	Habit[3]	Tolerance Value[4]
Insecta	Diptera	Tipulidae	Antocha	Antocha	I	4	Collector	cn	8
Insecta	Odonata	Calopterygidae	Calopteryx	Calopteryx	I	1	Predator	cb	8.3
Insecta	Trichoptera	Hydropsychidae	Ceratopsyche	Ceratopsyche	I	19	Filterer	cn	5
Insecta	Trichoptera	Hydropsychidae	Cheumatopsyche	Cheumatopsyche	I	10	Filterer	cn	6.5
Insecta	Diptera	Chironomidae	Cricotopus	Cricotopus	I	6	Shredder	cn	9.6
Insecta	Diptera	Chironomidae	Diamesa	Diamesa	I	2	Collector	sp	8.5
Insecta	Diptera	Chironomidae	not identified	Diamesinae	I	1	Collector	cn	7.1
Insecta	Diptera	Chironomidae	Hydrobaenus	Hydrobaenus	I	4	Scraper	sp	7.2
Insecta	Diptera	Chironomidae	Hydrobaenus	Hydrobaenus	P	1	Scraper	sp	7.2
Insecta	Trichoptera	Hydropsychidae	Hydropsyche	Hydropsyche	I	9	Filterer	cn	7.5
Insecta	Ephemeroptera	Isonychiidae	Isonychia	Isonychia	I	1	Filterer	sw	2.5
Insecta	Trichoptera	Hydroptilidae	Leucotrichia	Leucotrichia	I	12	Scraper	cn	5
Insecta	Ephemeroptera	Heptageniidae	Maccaffertium	Maccaffertium	I	1	Scraper	cn	2.6
Clitellata	Haplotaxida	Naididae	not identified	Naididae	U	2	Collector	bu	9.1
Not Identified	not identified	not identified	not identified	Nematoda	U	1	Parasite	na	na
Insecta	Diptera	Chironomidae	not identified	Orthocladiinae	I	3	Collector	bu	7.6
Insecta	Diptera	Chironomidae	Orthocladius	Orthocladius	I	23	Collector	sp	9.2
Insecta	Diptera	Chironomidae	Paratanytarsus	Paratanytarsus	I	1	Collector	sp	7.7
Insecta	Diptera	Chironomidae	Rheotanytarsus	Rheotanytarsus	I	3	Filterer	cn	7.2
Insecta	Diptera	Simuliidae	Simulium	Simulium	I	1	Filterer	cn	5.7
Insecta	Coleoptera	Elmidae	Stenelmis	Stenelmis	A	1	Scraper	cn	7.1
Clitellata	Haplotaxida	Tubificidae	not identified	Tubificidae	U	5	Collector	cn	8.4
Insecta	Diptera	Chironomidae	Tvetenia	Tvetenia	I	1	Collector	sp	5.1

1 Life Stage, I - Immature, P- Pupa, A - Adult; 2 Functional Feeding Group; 3 Primary habit or form of locomotion, includes bu - burrower, cn - clinger, cb - climber, sk - skater, sp - sprawler; 4 Tolerance Values, based on Hilsenhoff, modified for Maryland; na idicates information for the particular taxa was not available.

Dorsey Run, Hammond Branch, and Rocky Gorge Watersheds
Benthic Macroinvertebrate Data
2009

14HB-1-04-2009

Subphylum/ Class	Order	Family	Genus	Final ID	Note[1]	# of Org	FFG[2]	Habit[3]	Tolerance Value[4]
Insecta	Diptera	Tipulidae	Antocha	Antocha	I	1	Collector	cn	8
Crustacea	Isopoda	Asellidae	Caecidotea	Caecidotea	U	1	Collector	sp	2.6
Insecta	Trichoptera	Hydropsychidae	Ceratopsyche	Ceratopsyche	I	1	Filterer	cn	5
Insecta	Trichoptera	Hydropsychidae	Cheumatopsyche	Cheumatopsyche	I	4	Filterer	cn	6.5
Insecta	Diptera	Chironomidae	not identified	Chironomidae	P	1	Collector	na	6.6
Insecta	Diptera	Chironomidae	not identified	Chironomini	P	1	Collector	bu	5.9
Insecta	Diptera	Chironomidae	Corynoneura	Corynoneura	I	2	Collector	sp	4.1
Crustacea	Amphipoda	Crangonyctidae	Crangonyx	Crangonyx	U	2	Collector	sp	6.7
Insecta	Diptera	Chironomidae	Cricotopus	Cricotopus	P	3	Shredder	cn	9.6
Insecta	Diptera	Chironomidae	Cricotopus	Cricotopus	I	5	Shredder	cn	9.6
Insecta	Diptera	Chironomidae	Diamesa	Diamesa	I	2	Collector	sp	8.5
Insecta	Diptera	Chironomidae	Diamesa	Diamesa	P	2	Collector	sp	8.5
Insecta	Ephemeroptera	not identified	not identified	Ephemeroptera	I	2	Collector	na	2.9
Insecta	Ephemeroptera	Heptageniidae	not identified	Heptageniidae	I	1	Scraper	cn	2.6
Insecta	Diptera	Chironomidae	Hydrobaenus	Hydrobaenus	I	10	Scraper	sp	7.2
Insecta	Diptera	Chironomidae	Hydrobaenus	Hydrobaenus	P	3	Scraper	sp	7.2
Insecta	Trichoptera	Hydroptilidae	Hydroptila	Hydroptila	I	4	Scraper	cn	6
Insecta	Ephemeroptera	Heptageniidae	Maccaffertium	Maccaffertium	I	3	Scraper	cn	2.6
Insecta	Coleoptera	Dryopidae	Macronychus	Macronychus	I	1	Scraper	cn	6.8
Insecta	Diptera	Chironomidae	Nanocladius	Nanocladius	I	1	Collector	sp	7.6
Insecta	Trichoptera	Leptoceridae	Oecetis	Oecetis	I	1	Predator	cn	4.7
Insecta	Diptera	Chironomidae	not identified	Orthocladiinae	I	2	Collector	bu	7.6
Insecta	Diptera	Chironomidae	Orthocladius	Orthocladius	I	18	Collector	sp	9.2
Insecta	Diptera	Chironomidae	Parakiefferiella	Parakiefferiella	I	2	Collector	sp	2.1
Insecta	Diptera	Chironomidae	Parametriocnemus	Parametriocnemus	I	2	Collector	sp	4.6
Insecta	Diptera	Chironomidae	Paratanytarsus	Paratanytarsus	I	10	Collector	sp	7.7
Insecta	Diptera	Chironomidae	Rheocricotopus	Rheocricotopus	I	3	Collector	sp	6.2
Insecta	Diptera	Chironomidae	Rheotanytarsus	Rheotanytarsus	I	11	Filterer	cn	7.2
Insecta	Diptera	Simuliidae	Simulium	Simulium	I	1	Filterer	cn	5.7
Insecta	Coleoptera	Elmidae	Stenelmis	Stenelmis	I	1	Scraper	cn	7.1
Insecta	Ephemeroptera	Heptageniidae	Stenonema	Stenonema	I	1	Scraper	cn	4.6
Insecta	Diptera	Chironomidae	Tanytarsus	Tanytarsus	I	3	Filterer	cb	4.9
Insecta	Diptera	Chironomidae	Thienemannimyia	Thienemannimyia	I	1	Predator	sp	6.7
Clitellata	Haplotaxida	Tubificidae	not identified	Tubificidae	U	7	Collector	cn	8.4

1 Life Stage, I - Immature, P- Pupa, A - Adult; 2 Functional Feeding Group; 3 Primary habit or form of locomotion, includes bu - burrower, cn - clinger, cb - climber, sk - skater, sp - sprawler; 4 Tolerance Values, based on Hilsenhoff, modified for Maryland; na idicates information for the particular taxa was not available.

Dorsey Run, Hammond Branch, and Rocky Gorge Watersheds
Benthic Macroinvertebrate Data
2009

14HB-1-05-2009

Subphylum/ Class	Order	Family	Genus	Final ID	Note[1]	# of Org	FFG[2]	Habit[3]	Tolerance Value[4]
Insecta	Diptera	Ceratopogonidae	not identified	Ceratopogonidae	I	1	Predator	sp	3.6
Insecta	Trichoptera	Hydropsychidae	Cheumatopsyche	Cheumatopsyche	I	6	Filterer	cn	6.5
Insecta	Trichoptera	Philopotamidae	Chimarra	Chimarra	I	1	Filterer	cn	4.4
Insecta	Diptera	Chironomidae	not identified	Chironomini	I	1	Collector	bu	5.9
Insecta	Diptera	Empididae	Clinocera	Clinocera	I	2	Predator	cn	7.4
Insecta	Diptera	Chironomidae	Cricotopus	Cricotopus	I	2	Shredder	cn	9.6
Insecta	Ephemeroptera	Heptageniidae	not identified	Heptageniidae	I	2	Scraper	cn	2.6
Insecta	Diptera	Chironomidae	Hydrobaenus	Hydrobaenus	I	19	Scraper	sp	7.2
Insecta	Diptera	Chironomidae	not identified	Orthocladiinae	I	4	Collector	bu	7.6
Insecta	Diptera	Chironomidae	Orthocladius	Orthocladius	I	43	Collector	sp	9.2
Insecta	Diptera	Chironomidae	Parakiefferiella	Parakiefferiella	I	3	Collector	sp	2.1
Insecta	Diptera	Chironomidae	Paratanytarsus	Paratanytarsus	I	1	Collector	sp	7.7
Insecta	Diptera	Chironomidae	Polypedilum	Polypedilum	I	4	Shredder	cb	6.3
Insecta	Diptera	Simuliidae	Prosimulium	Prosimulium	I	1	Filterer	cn	2.4
Insecta	Diptera	Chironomidae	Rheocricotopus	Rheocricotopus	I	4	Collector	sp	6.2
Insecta	Diptera	Chironomidae	Rheotanytarsus	Rheotanytarsus	I	1	Filterer	cn	7.2
Insecta	Coleoptera	Elmidae	Stenelmis	Stenelmis	A	1	Scraper	cn	7.1
Insecta	Ephemeroptera	Heptageniidae	Stenonema	Stenonema	I	2	Scraper	cn	4.6
Insecta	Diptera	Chironomidae	Sympotthastia	Sympotthastia	I	1	Collector	sp	8.2
Insecta	Diptera	Chironomidae	Sympotthastia	Sympotthastia	P	1	Collector	sp	8.2
Insecta	Diptera	Chironomidae	not identified	Tanytarsini	I	1	Filterer	na	3.5
Insecta	Diptera	Chironomidae	Tanytarsus	Tanytarsus	I	3	Filterer	cb	4.9
Clitellata	Haplotaxida	Tubificidae	not identified	Tubificidae	U	3	Collector	cn	8.4
Insecta	Diptera	Chironomidae	Tvetenia	Tvetenia	I	2	Collector	sp	5.1

1 Life Stage, I - Immature, P- Pupa, A - Adult; 2 Functional Feeding Group; 3 Primary habit or form of locomotion, includes bu - burrower, cn - clinger, cb - climber, sk - skater, sp - sprawler; 4 Tolerance Values, based on Hilsenhoff, modified for Maryland; na idicates information for the particular taxa was not available.

Dorsey Run, Hammond Branch, and Rocky Gorge Watersheds
Benthic Macroinvertebrate Data
2009

14HB-1-06-2009

Subphylum/ Class	Order	Family	Genus	Final ID	Note[1]	# of Org	FFG[2]	Habit[3]	Tolerance Value[4]
Insecta	Coleoptera	Elmidae	Ancyronyx	Ancyronyx	I	1	Scraper	cn	7.8
Insecta	Diptera	Tipulidae	Antocha	Antocha	I	1	Collector	cn	8
Crustacea	Isopoda	Asellidae	Caecidotea	Caecidotea	U	2	Collector	sp	2.6
Insecta	Trichoptera	Hydropsychidae	Ceratopsyche	Ceratopsyche	I	4	Filterer	cn	5
Insecta	Trichoptera	Philopotamidae	Chimarra	Chimarra	I	2	Filterer	cn	4.4
Insecta	Diptera	Empididae	Clinocera	Clinocera	I	1	Predator	cn	7.4
Hexapoda	Collembola	not identified	not identified	Collembola	U	1	Collector	sp	6
Insecta	Diptera	Chironomidae	Corynoneura	Corynoneura	I	2	Collector	sp	4.1
Crustacea	Amphipoda	Crangonyctidae	Crangonyx	Crangonyx	U	9	Collector	sp	6.7
Insecta	Diptera	Chironomidae	Cricotopus	Cricotopus	I	1	Shredder	cn	9.6
Insecta	Diptera	Chironomidae	Diamesa	Diamesa	I	2	Collector	sp	8.5
Insecta	Diptera	Chironomidae	Diamesa	Diamesa	P	3	Collector	sp	8.5
Insecta	Diptera	Chironomidae	Eukiefferiella	Eukiefferiella	P	1	Collector	sp	6.1
Insecta	Diptera	Chironomidae	Hydrobaenus	Hydrobaenus	I	15	Scraper	sp	7.2
Insecta	Trichoptera	Hydropsychidae	not identified	Hydropsychidae	I	1	Filterer	cn	5.7
Insecta	Ephemeroptera	Heptageniidae	Maccaffertium	Maccaffertium	I	2	Scraper	cn	2.6
Insecta	Diptera	Chironomidae	Micropsectra	Micropsectra	I	1	Collector	cb	2.1
Insecta	Plecoptera	Nemouridae	not identified	Nemouridae	I	1	Shredder	sp	2.9
Insecta	Coleoptera	Elmidae	Optioservus	Optioservus	I	1	Scraper	cn	5.4
Insecta	Diptera	Chironomidae	Orthocladius	Orthocladius	P	6	Collector	sp	9.2
Insecta	Diptera	Chironomidae	Orthocladius	Orthocladius	I	27	Collector	sp	9.2
Insecta	Diptera	Chironomidae	Paratanytarsus	Paratanytarsus	I	8	Collector	sp	7.7
Turbellaria	Tricladida	Planariidae	not identified	Planariidae	U	3	Predator	sp	8.4
Gastropoda	Basommatophora	Planorbidae	not identified	Planorbidae	U	1	Scraper	cb	7.6
Insecta	Diptera	Chironomidae	Rheotanytarsus	Rheotanytarsus	I	7	Filterer	cn	7.2
Insecta	Diptera	Chironomidae	Stenochironomus	Stenochironomus	I	1	Shredder	bu	7.9
Insecta	Diptera	Chironomidae	Sublettea	Sublettea	I	2	Collector	-	10
Insecta	Diptera	Chironomidae	Tanytarsus	Tanytarsus	I	1	Filterer	cb	4.9
Clitellata	Haplotaxida	Tubificidae	not identified	Tubificidae	U	11	Collector	cn	8.4

1 Life Stage, I - Immature, P- Pupa, A - Adult; 2 Functional Feeding Group; 3 Primary habit or form of locomotion, includes bu - burrower, cn - clinger, cb - climber, sk - skater, sp - sprawler; 4 Tolerance Values, based on Hilsenhoff, modified for Maryland; na idicates information for the particular taxa was not available.

Dorsey Run, Hammond Branch, and Rocky Gorge Watersheds
Benthic Macroinvertebrate Data
2009

14HB-1-07-2009

Subphylum/ Class	Order	Family	Genus	Final ID	Note[1]	# of Org	FFG[2]	Habit[3]	Tolerance Value[4]
Insecta	Trichoptera	Hydropsychidae	Cheumatopsyche	Cheumatopsyche	I	1	Filterer	cn	6.5
Crustacea	Amphipoda	Crangonyctidae	Crangonyx	Crangonyx	U	59	Collector	sp	6.7
Insecta	Diptera	Chironomidae	Diplocladius	Diplocladius	I	1	Collector	sp	5.9
Clitellata	Haplotaxida	Enchytraeidae	not identified	Enchytraeidae	U	1	Collector	bu	9.1
Gastropoda	Basommatophora	Lymnaeidae	Fossaria	Fossaria	U	2	Scraper	cb	6.9
Insecta	Diptera	Chironomidae	Hydrobaenus	Hydrobaenus	I	28	Scraper	sp	7.2
Insecta	Trichoptera	Lepidostomatidae	Lepidostoma	Lepidostoma	I	2	Shredder	cb	0
Insecta	Trichoptera	Limnephilidae	not identified	Limnephilidae	I	4	Shredder	cb	3.1
Clitellata	Haplotaxida	not identified	not identified	Lumbricina	U	10	Collector	bu	10
Insecta	Diptera	Chironomidae	not identified	Orthocladiinae	P	1	Collector	bu	7.6
Insecta	Diptera	Chironomidae	not identified	Orthocladiinae	I	1	Collector	bu	7.6
Insecta	Diptera	Chironomidae	Orthocladius	Orthocladius	I	3	Collector	sp	9.2
Insecta	Diptera	Simuliidae	Simulium	Simulium	I	1	Filterer	cn	5.7
Insecta	Diptera	Tipulidae	Tipula	Tipula	I	1	Shredder	bu	6.7

1 Life Stage, I - Immature, P- Pupa, A - Adult; 2 Functional Feeding Group; 3 Primary habit or form of locomotion, includes bu - burrower, cn - clinger, cb - climber, sk - skater, sp - sprawler; 4 Tolerance Values, based on Hilsenhoff, modified for Maryland; na idicates information for the particular taxa was not available.

Dorsey Run, Hammond Branch, and Rocky Gorge Watersheds
Benthic Macroinvertebrate Data
2009

14HB-1-08-2009

Subphylum/ Class	Order	Family	Genus	Final ID	Note[1]	# of Org	FFG[2]	Habit[3]	Tolerance Value[4]
Insecta	Diptera	Tipulidae	Antocha	Antocha	I	1	Collector	cn	8
Insecta	Trichoptera	Hydropsychidae	Ceratopsyche	Ceratopsyche	I	4	Filterer	cn	5
Insecta	Trichoptera	Hydropsychidae	Cheumatopsyche	Cheumatopsyche	I	46	Filterer	cn	6.5
Insecta	Trichoptera	Philopotamidae	Chimarra	Chimarra	I	6	Filterer	cn	4.4
Insecta	Diptera	Chironomidae	Cricotopus	Cricotopus	I	1	Shredder	cn	9.6
Insecta	Diptera	Chironomidae	Hydrobaenus	Hydrobaenus	I	8	Scraper	sp	7.2
Insecta	Trichoptera	Hydropsychidae	Hydropsyche	Hydropsyche	I	11	Filterer	cn	7.5
Insecta	Trichoptera	Hydroptilidae	Hydroptila	Hydroptila	I	3	Scraper	cn	6
Insecta	Diptera	Chironomidae	Krenopelopia	Krenopelopia	I	1	Predator	sp	6.6
Clitellata	Haplotaxida	not identified	not identified	Lumbricina	U	1	Collector	bu	10
Insecta	Ephemeroptera	Heptageniidae	Maccaffertium	Maccaffertium	I	1	Scraper	cn	2.6
Insecta	Diptera	Chironomidae	Microtendipes	Microtendipes	I	1	Filterer	cn	4.9
Insecta	Diptera	Chironomidae	Nanocladius	Nanocladius	I	2	Collector	sp	7.6
Insecta	Trichoptera	Uenoidae	Neophylax	Neophylax	I	4	Scraper	cn	2.7
Insecta	Diptera	Chironomidae	Orthocladius	Orthocladius	I	5	Collector	sp	9.2
Insecta	Diptera	Chironomidae	Orthocladius	Orthocladius	P	2	Collector	sp	9.2
Insecta	Coleoptera	Dryopidae	Oulimnius	Oulimnius	I	3	Scraper	cn	2.7
Bivalvia	Veneroida	Pisidiidae	Pisidium	Pisidium	U	1	Filterer	bu	5.7
Insecta	Diptera	Chironomidae	Polypedilum	Polypedilum	P	1	Shredder	cb	6.3
Insecta	Diptera	Chironomidae	Polypedilum	Polypedilum	I	6	Shredder	cb	6.3
Insecta	Coleoptera	Elmidae	Stenelmis	Stenelmis	I	3	Scraper	cn	7.1
Insecta	Diptera	Chironomidae	not identified	Tanytarsini	I	1	Filterer	na	3.5
Insecta	Diptera	Tipulidae	not identified	Tipulidae	I	1	Predator	bu	4.8
Insecta	Trichoptera	not identified	not identified	Trichoptera	P	1	na	na	4.6
Clitellata	Haplotaxida	Tubificidae	not identified	Tubificidae	U	2	Collector	cn	8.4
Insecta	Diptera	Chironomidae	Tvetenia	Tvetenia	I	2	Collector	sp	5.1

1 Life Stage, I - Immature, P- Pupa, A - Adult; 2 Functional Feeding Group; 3 Primary habit or form of locomotion, includes bu - burrower, cn - clinger, cb - climber, sk - skater, sp - sprawler; 4 Tolerance Values, based on Hilsenhoff, modified for Maryland; na idicates information for the particular taxa was not available.

Dorsey Run, Hammond Branch, and Rocky Gorge Watersheds
Benthic Macroinvertebrate Data
2009

14HB-1-09-2009

Subphylum/ Class	Order	Family	Genus	Final ID	Note[1]	# of Org	FFG[2]	Habit[3]	Tolerance Value[4]
Insecta	Diptera	Tipulidae	Antocha	Antocha	I	3	Collector	cn	8
Insecta	Trichoptera	Hydropsychidae	Ceratopsyche	Ceratopsyche	I	1	Filterer	cn	5
Insecta	Trichoptera	Hydropsychidae	Cheumatopsyche	Cheumatopsyche	I	2	Filterer	cn	6.5
Insecta	Trichoptera	Philopotamidae	Chimarra	Chimarra	I	1	Filterer	cn	4.4
Insecta	Diptera	Chironomidae	Cladotanytarsus	Cladotanytarsus	I	1	Filterer	-	6.6
Insecta	Diptera	Empididae	Clinocera	Clinocera	I	2	Predator	cn	7.4
Insecta	Diptera	Chironomidae	Corynoneura	Corynoneura	I	2	Collector	sp	4.1
Insecta	Diptera	Chironomidae	Cricotopus	Cricotopus	I	4	Shredder	cn	9.6
Insecta	Diptera	Chironomidae	Diamesa	Diamesa	I	3	Collector	sp	8.5
Insecta	Diptera	Chironomidae	Diamesa	Diamesa	P	2	Collector	sp	8.5
Insecta	Diptera	Empididae	Hemerodromia	Hemerodromia	I	1	Predator	sp	7.9
Insecta	Trichoptera	Hydropsychidae	Hydropsyche	Hydropsyche	I	13	Filterer	cn	7.5
Insecta	Trichoptera	Hydroptilidae	Hydroptila	Hydroptila	I	3	Scraper	cn	6
Insecta	Trichoptera	Hydroptilidae	Leucotrichia	Leucotrichia	I	1	Scraper	cn	5
Insecta	Ephemeroptera	Heptageniidae	Maccaffertium	Maccaffertium	I	1	Scraper	cn	2.6
Insecta	Coleoptera	Dryopidae	Macronychus	Macronychus	I	1	Scraper	cn	6.8
Insecta	Coleoptera	Elmidae	Microcylloepus	Microcylloepus	I	2	Collector	cn	4.8
Insecta	Diptera	Chironomidae	Micropsectra	Micropsectra	I	2	Collector	cb	2.1
Insecta	Diptera	Chironomidae	not identified	Orthocladiinae	I	1	Collector	bu	7.6
Insecta	Diptera	Chironomidae	not identified	Orthocladiinae	P	1	Collector	bu	7.6
Insecta	Diptera	Chironomidae	Orthocladius	Orthocladius	I	43	Collector	sp	9.2
Insecta	Diptera	Chironomidae	Orthocladius	Orthocladius	P	2	Collector	sp	9.2
Insecta	Diptera	Chironomidae	Parametriocnemus	Parametriocnemus	P	1	Collector	sp	4.6
Insecta	Diptera	Chironomidae	Parametriocnemus	Parametriocnemus	I	1	Collector	sp	4.6
Insecta	Diptera	Chironomidae	Paratanytarsus	Paratanytarsus	I	1	Collector	sp	7.7
Turbellaria	Tricladida	Planariidae	Planaria	Planaria	U	3	Predator	sp	8.4
Insecta	Trichoptera	Polycentropodidae	Polycentropus	Polycentropus	I	1	Filterer	cn	1.1
Insecta	Diptera	Simuliidae	Prosimulium	Prosimulium	I	1	Filterer	cn	2.4
Enopla	Hoplonemertea	Tetrastemmatidae	Prostoma	Prostoma	U	1	Predator	na	7.3
Insecta	Diptera	Chironomidae	Rheotanytarsus	Rheotanytarsus	I	1	Filterer	cn	7.2
Insecta	Diptera	Simuliidae	Simulium	Simulium	I	1	Filterer	cn	5.7
Insecta	Plecoptera	Taeniopterygidae	Taeniopteryx	Taeniopteryx	I	1	Shredder	sp	4.8
Insecta	Diptera	Chironomidae	not identified	Tanypodinae	I	1	Predator	sp	7.5
Insecta	Diptera	Chironomidae	Tanytarsus	Tanytarsus	I	1	Filterer	cb	4.9
Clitellata	Haplotaxida	Tubificidae	not identified	Tubificidae	U	7	Collector	cn	8.4
Insecta	Diptera	Chironomidae	Tvetenia	Tvetenia	P	1	Collector	sp	5.1

1 Life Stage, I - Immature, P- Pupa, A - Adult; 2 Functional Feeding Group; 3 Primary habit or form of locomotion, includes bu - burrower, cn - clinger, cb - climber, sk - skater, sp - sprawler; 4 Tolerance Values, based on Hilsenhoff, modified for Maryland; na idicates information for the particular taxa was not available.

Dorsey Run, Hammond Branch, and Rocky Gorge Watersheds
Benthic Macroinvertebrate Data
2009

14HB-1-10-2009

Subphylum/ Class	Order	Family	Genus	Final ID	Note[1]	# of Org	FFG[2]	Habit[3]	Tolerance Value[4]
Insecta	Coleoptera	Elmidae	Ancyronyx	Ancyronyx	A	2	Scraper	cn	7.8
Insecta	Diptera	Tipulidae	Antocha	Antocha	I	4	Collector	cn	8
Insecta	Diptera	Chironomidae	Brillia	Brillia	I	1	Shredder	bu	7.4
Insecta	Trichoptera	Hydropsychidae	Cheumatopsyche	Cheumatopsyche	I	19	Filterer	cn	6.5
Insecta	Trichoptera	Philopotamidae	Chimarra	Chimarra	I	1	Filterer	cn	4.4
Insecta	Diptera	Chironomidae	not identified	Chironomini	I	1	Collector	bu	5.9
Insecta	Diptera	Chironomidae	Corynoneura	Corynoneura	I	1	Collector	sp	4.1
Insecta	Diptera	Chironomidae	Cricotopus	Cricotopus	I	2	Shredder	cn	9.6
Insecta	Diptera	Chironomidae	Diamesa	Diamesa	I	5	Collector	sp	8.5
Insecta	Diptera	Chironomidae	Dicrotendipes	Dicrotendipes	I	1	Collector	bu	9
Insecta	Diptera	Chironomidae	Eukiefferiella	Eukiefferiella	I	1	Collector	sp	6.1
Insecta	Diptera	Chironomidae	Hydrobaenus	Hydrobaenus	I	4	Scraper	sp	7.2
Insecta	Trichoptera	Hydropsychidae	Hydropsyche	Hydropsyche	I	5	Filterer	cn	7.5
Insecta	Diptera	Chironomidae	Micropsectra	Micropsectra	I	1	Collector	cb	2.1
Insecta	Diptera	Chironomidae	not identified	Orthocladiinae	P	1	Collector	bu	7.6
Insecta	Diptera	Chironomidae	not identified	Orthocladiinae	I	7	Collector	bu	7.6
Insecta	Diptera	Chironomidae	Orthocladius	Orthocladius	I	26	Collector	sp	9.2
Insecta	Diptera	Chironomidae	Orthocladius	Orthocladius	P	3	Collector	sp	9.2
Insecta	Diptera	Chironomidae	Parakiefferiella	Parakiefferiella	I	1	Collector	sp	2.1
Insecta	Diptera	Chironomidae	Parametriocnemus	Parametriocnemus	I	1	Collector	sp	4.6
Insecta	Diptera	Chironomidae	Paratanytarsus	Paratanytarsus	I	1	Collector	sp	7.7
Insecta	Plecoptera	Perlidae	not identified	Perlidae	I	1	Predator	cn	2.2
Insecta	Diptera	Chironomidae	Polypedilum	Polypedilum	I	5	Shredder	cb	6.3
Insecta	Diptera	Simuliidae	Prosimulium	Prosimulium	I	2	Filterer	cn	2.4
Insecta	Diptera	Chironomidae	Rheocricotopus	Rheocricotopus	I	1	Collector	sp	6.2
Insecta	Diptera	Chironomidae	Rheotanytarsus	Rheotanytarsus	I	2	Filterer	cn	7.2
Insecta	Diptera	Chironomidae	Rheotanytarsus	Rheotanytarsus	P	1	Filterer	cn	7.2
Insecta	Diptera	Chironomidae	Sympotthastia	Sympotthastia	I	1	Collector	sp	8.2
Insecta	Diptera	Chironomidae	not identified	Tanytarsini	I	2	Filterer	na	3.5
Insecta	Diptera	Chironomidae	Tanytarsus	Tanytarsus	I	6	Filterer	cb	4.9
Insecta	Diptera	Chironomidae	Tvetenia	Tvetenia	I	1	Collector	sp	5.1

1 Life Stage, I - Immature, P- Pupa, A - Adult; 2 Functional Feeding Group; 3 Primary habit or form of locomotion, includes bu - burrower, cn - clinger, cb - climber, sk - skater, sp - sprawler; 4 Tolerance Values, based on Hilsenhoff, modified for Maryland; na idicates information for the particular taxa was not available.

Dorsey Run, Hammond Branch, and Rocky Gorge Watersheds
Benthic Macroinvertebrate Data
2009

14HB-1-10-2009-QC

Subphylum/ Class	Order	Family	Genus	Final ID	Note[1]	# of Org	FFG[2]	Habit[3]	Tolerance Value[4]
Insecta	Trichoptera	Hydropsychidae	Ceratopsyche	Ceratopsyche	I	2	Filterer	cn	5
Insecta	Trichoptera	Hydropsychidae	Cheumatopsyche	Cheumatopsyche	I	15	Filterer	cn	6.5
Insecta	Diptera	Chironomidae	Corynoneura	Corynoneura	I	2	Collector	sp	4.1
Insecta	Diptera	Chironomidae	Cricotopus	Cricotopus	I	1	Shredder	cn	9.6
Insecta	Diptera	Chironomidae	Diamesa	Diamesa	I	5	Collector	sp	8.5
Insecta	Diptera	Chironomidae	Diplocladius	Diplocladius	I	1	Collector	sp	5.9
Insecta	Diptera	Chironomidae	Hydrobaenus	Hydrobaenus	I	2	Scraper	sp	7.2
Insecta	Trichoptera	Hydropsychidae	Hydropsyche	Hydropsyche	I	1	Filterer	cn	7.5
Insecta	Diptera	Chironomidae	not identified	Orthocladiinae	P	1	Collector	bu	7.6
Insecta	Diptera	Chironomidae	not identified	Orthocladiinae	I	2	Collector	bu	7.6
Insecta	Diptera	Chironomidae	Orthocladius	Orthocladius	I	59	Collector	sp	9.2
Insecta	Diptera	Chironomidae	Parakiefferiella	Parakiefferiella	I	2	Collector	sp	2.1
Insecta	Diptera	Chironomidae	Polypedilum	Polypedilum	I	1	Shredder	cb	6.3
Insecta	Diptera	Chironomidae	Rheocricotopus	Rheocricotopus	I	5	Collector	sp	6.2
Insecta	Diptera	Chironomidae	Rheotanytarsus	Rheotanytarsus	I	4	Filterer	cn	7.2
Insecta	Diptera	Chironomidae	Sympotthastia	Sympotthastia	I	1	Collector	sp	8.2
Insecta	Diptera	Chironomidae	Tanytarsus	Tanytarsus	I	1	Filterer	cb	4.9
Insecta	Diptera	Chironomidae	Thienemanniella	Thienemanniella	I	1	Collector	sp	5.1
Clitellata	Haplotaxida	Tubificidae	not identified	Tubificidae	U	6	Collector	cn	8.4
Insecta	Diptera	Chironomidae	Tvetenia	Tvetenia	I	1	Collector	sp	5.1

1 Life Stage, I - Immature, P- Pupa, A - Adult; 2 Functional Feeding Group; 3 Primary habit or form of locomotion, includes bu - burrower, cn - clinger, cb - climber, sk - skater, sp - sprawler; 4 Tolerance Values, based on Hilsenhoff, modified for Maryland; na idicates information for the particular taxa was not available.

Dorsey Run, Hammond Branch, and Rocky Gorge Watersheds
Benthic Macroinvertebrate Data
2009

Subphylum/ Class	Order	Family	Genus	Final ID	Note[1]	# of Org	FFG[2]	Habit[3]	Tolerance Value[4]
Insecta	Trichoptera	Hydropsychidae	Cheumatopsyche	Cheumatopsyche	I	17	Filterer	cn	6.5
Insecta	Trichoptera	Philopotamidae	Chimarra	Chimarra	I	11	Filterer	cn	4.4
Insecta	Diptera	Chironomidae	Corynoneura	Corynoneura	I	1	Collector	sp	4.1
Insecta	Diptera	Chironomidae	Cricotopus	Cricotopus	I	2	Shredder	cn	9.6
Insecta	Diptera	Chironomidae	Cryptochironomus	Cryptochironomus	I	1	Predator	sp	7.6
Insecta	Diptera	Empididae	Hemerodromia	Hemerodromia	I	1	Predator	sp	7.9
Insecta	Diptera	Chironomidae	Hydrobaenus	Hydrobaenus	I	3	Scraper	sp	7.2
Insecta	Trichoptera	Hydropsychidae	Hydropsyche	Hydropsyche	I	2	Filterer	cn	7.5
Insecta	Diptera	Tipulidae	Limonia	Limonia	I	1	Shredder	bu	4.8
Insecta	Diptera	Chironomidae	not identified	Orthocladiinae	I	2	Collector	bu	7.6
Insecta	Diptera	Chironomidae	Orthocladius	Orthocladius	I	62	Collector	sp	9.2
Insecta	Diptera	Chironomidae	Parametriocnemus	Parametriocnemus	I	4	Collector	sp	4.6
Turbellaria	Tricladida	Planariidae	Planaria	Planaria	U	1	Predator	sp	8.4
Insecta	Coleoptera	Elmidae	Stenelmis	Stenelmis	I	1	Scraper	cn	7.1
Insecta	Diptera	Chironomidae	Sympotthastia	Sympotthastia	I	2	Collector	sp	8.2
Insecta	Diptera	Chironomidae	not identified	Tanytarsini	I	1	Filterer	na	3.5
Insecta	Diptera	Chironomidae	Tanytarsus	Tanytarsus	I	1	Filterer	cb	4.9
Insecta	Diptera	Chironomidae	Tvetenia	Tvetenia	I	2	Collector	sp	5.1

1 Life Stage, I - Immature, P- Pupa, A - Adult; 2 Functional Feeding Group; 3 Primary habit or form of locomotion, includes bu - burrower, cn - clinger, cb - climber, sk - skater, sp - sprawler; 4 Tolerance Values, based on Hilsenhoff, modified for Maryland; na idicates information for the particular taxa was not available.

Dorsey Run, Hammond Branch, and Rocky Gorge Watersheds
Benthic Macroinvertebrate Data
2009

Subphylum/ Class	Order	Family	Genus	Final ID	Note[1]	# of Org	FFG[2]	Habit[3]	Tolerance Value[4]
Insecta	Trichoptera	Hydropsychidae	Cheumatopsyche	Cheumatopsyche	I	2	Filterer	cn	6.5
Insecta	Diptera	Empididae	Clinocera	Clinocera	I	3	Predator	cn	7.4
Hexapoda	Collembola	not identified	not identified	Collembola	A	1	Collector	sp	6
Insecta	Diptera	Ceratopogonidae	Dasyhelea	Dasyhelea	I	1	Collector	sp	3.6
Insecta	Diptera	Chironomidae	Diamesa	Diamesa	I	12	Collector	sp	8.5
Insecta	Diptera	Empididae	Hemerodromia	Hemerodromia	I	1	Predator	sp	7.9
Insecta	Diptera	Chironomidae	Hydrobaenus	Hydrobaenus	I	26	Scraper	sp	7.2
Insecta	Trichoptera	Hydropsychidae	Hydropsyche	Hydropsyche	I	1	Filterer	cn	7.5
Clitellata	Haplotaxida	not identified	not identified	Lumbricina	U	1	Collector	bu	10
Insecta	Coleoptera	Elmidae	Optioservus	Optioservus	A	2	Scraper	cn	5.4
Insecta	Diptera	Chironomidae	Orthocladius	Orthocladius	I	10	Collector	sp	9.2
Insecta	Coleoptera	Elmidae	Stenelmis	Stenelmis	I	1	Scraper	cn	7.1
Insecta	Diptera	Chironomidae	Sympotthastia	Sympotthastia	I	43	Collector	sp	8.2
Insecta	Diptera	Chironomidae	Sympotthastia	Sympotthastia	P	12	Collector	sp	8.2
Clitellata	Haplotaxida	Tubificidae	not identified	Tubificidae	U	2	Collector	cn	8.4

1 Life Stage, I - Immature, P- Pupa, A - Adult; 2 Functional Feeding Group; 3 Primary habit or form of locomotion, includes bu - burrower, cn - clinger, cb - climber, sk - skater, sp - sprawler; 4 Tolerance Values, based on Hilsenhoff, modified for Maryland; na idicates information for the particular taxa was not available.

Dorsey Run, Hammond Branch, and Rocky Gorge Watersheds
Benthic Macroinvertebrate Data
2009

15DR-1-03-2009

Subphylum/ Class	Order	Family	Genus	Final ID	Note[1]	# of Org	FFG[2]	Habit[3]	Tolerance Value[4]
Crustacea	Isopoda	Asellidae	Caecidotea	Caecidotea	U	5	Collector	sp	2.6
Insecta	Trichoptera	Philopotamidae	Chimarra	Chimarra	I	1	Filterer	cn	4.4
Insecta	Diptera	Chironomidae	not identified	Chironomini	I	4	Collector	bu	5.9
Hexapoda	Collembola	not identified	not identified	Collembola	A	2	Collector	sp	6
Crustacea	Amphipoda	Crangonyctidae	Crangonyx	Crangonyx	U	1	Collector	sp	6.7
Insecta	Diptera	Chironomidae	Cricotopus	Cricotopus	I	16	Shredder	cn	9.6
Insecta	Diptera	Chironomidae	Cryptochironomus	Cryptochironomus	I	5	Predator	sp	7.6
Insecta	Diptera	Chironomidae	Dicrotendipes	Dicrotendipes	I	5	Collector	bu	9
Insecta	Diptera	not identified	not identified	Diptera	P	1	na	na	6
Clitellata	Haplotaxida	Enchytraeidae	not identified	Enchytraeidae	I	4	Collector	bu	9.1
Insecta	Coleoptera	Melyridae	not identified	Melyridae	I	1	No data	-	na
Insecta	Diptera	Chironomidae	Natarsia	Natarsia	I	4	Predator	sp	6.6
Insecta	Diptera	Chironomidae	Orthocladius	Orthocladius	I	11	Collector	sp	9.2
Insecta	Diptera	Chironomidae	Paratanytarsus	Paratanytarsus	I	4	Collector	sp	7.7
Insecta	Diptera	Chironomidae	Phaenopsectra	Phaenopsectra	I	4	Collector	cn	8.7
Insecta	Diptera	Chironomidae	Polypedilum	Polypedilum	I	13	Shredder	cb	6.3
Insecta	Diptera	Chironomidae	Rheotanytarsus	Rheotanytarsus	I	3	Filterer	cn	7.2
Insecta	Diptera	Chironomidae	Thienemannimyia	Thienemannimyia	I	6	Predator	sp	6.7
Clitellata	Haplotaxida	Tubificidae	not identified	Tubificidae	U	24	Collector	cn	8.4
Insecta	Diptera	Chironomidae	Tvetenia	Tvetenia	I	3	Collector	sp	5.1

1 Life Stage, I - Immature, P- Pupa, A - Adult; 2 Functional Feeding Group; 3 Primary habit or form of locomotion, includes bu - burrower, cn - clinger, cb - climber, sk - skater, sp - sprawler; 4 Tolerance Values, based on Hilsenhoff, modified for Maryland; na idicates information for the particular taxa was not available.

Dorsey Run, Hammond Branch, and Rocky Gorge Watersheds
Benthic Macroinvertebrate Data
2009

Subphylum/ Class	Order	Family	Genus	Final ID	Note[1]	# of Org	FFG[2]	Habit[3]	Tolerance Value[4]
Insecta	Diptera	Chironomidae	Ablabesmyia	Ablabesmyia	I	5	Predator	sp	8.1
Insecta	Odonata	Coenagrionidae	Argia	Argia	I	1	Predator	cn	9.3
Insecta	Diptera	Chironomidae	Hydrobaenus	Hydrobaenus	I	32	Scraper	sp	7.2
Insecta	Diptera	Chironomidae	Orthocladius	Orthocladius	I	23	Collector	sp	9.2
Insecta	Diptera	Chironomidae	Paratanytarsus	Paratanytarsus	I	7	Collector	sp	7.7
Insecta	Diptera	Chironomidae	Polypedilum	Polypedilum	I	3	Shredder	cb	6.3
Insecta	Diptera	Chironomidae	Sympotthastia	Sympotthastia	P	3	Collector	sp	8.2
Insecta	Diptera	Chironomidae	Sympotthastia	Sympotthastia	I	20	Collector	sp	8.2
Insecta	Diptera	Chironomidae	Tanytarsus	Tanytarsus	I	5	Filterer	cb	4.9
Clitellata	Haplotaxida	Tubificidae	not identified	Tubificidae	U	7	Collector	cn	8.4

1 Life Stage, I - Immature, P- Pupa, A - Adult; 2 Functional Feeding Group; 3 Primary habit or form of locomotion, includes bu - burrower, cn - clinger, cb - climber, sk - skater, sp - sprawler; 4 Tolerance Values, based on Hilsenhoff, modified for Maryland; na idicates information for the particular taxa was not available.

Dorsey Run, Hammond Branch, and Rocky Gorge Watersheds
Benthic Macroinvertebrate Data
2009

15DR-1-05-2009

Subphylum/ Class	Order	Family	Genus	Final ID	Note[1]	# of Org	FFG[2]	Habit[3]	Tolerance Value[4]
Insecta	Odonata	Coenagrionidae	Argia	Argia	I	3	Predator	cn	9.3
Insecta	Coleoptera	Hydrophilidae	Berosus	Berosus	I	1	Collector	sw	4.1
Insecta	Diptera	Ceratopogonidae	not identified	Ceratopogonidae	I	1	Predator	sp	3.6
Insecta	Diptera	Chironomidae	not identified	Chironomini	I	1	Collector	bu	5.9
Insecta	Diptera	Chironomidae	Cricotopus	Cricotopus	I	1	Shredder	cn	9.6
Insecta	Diptera	Chironomidae	Cryptotendipes	Cryptotendipes	I	2	Collector	sp	6.6
Insecta	Diptera	Ceratopogonidae	Culicoides	Culicoides	I	1	Predator	bu	5.9
Insecta	Diptera	Chironomidae	Dicrotendipes	Dicrotendipes	I	1	Collector	bu	9
Insecta	Diptera	Chironomidae	Hydrobaenus	Hydrobaenus	I	26	Scraper	sp	7.2
Clitellata	Haplotaxida	not identified	not identified	Lumbricina	U	1	Collector	bu	10
Gastropoda	Basommatophora	Planorbidae	Menetus	Menetus	I	2	Scraper	cb	7.6
Clitellata	Haplotaxida	Naididae	not identified	Naididae	U	1	Collector	bu	9.1
Insecta	Diptera	Chironomidae	Orthocladius	Orthocladius	I	8	Collector	sp	9.2
Insecta	Diptera	Chironomidae	Paratanytarsus	Paratanytarsus	I	3	Collector	sp	7.7
Insecta	Coleoptera	Haliplidae	Peltodytes	Peltodytes	A	1	Shredder	cb	8.9
Insecta	Diptera	Chironomidae	Phaenopsectra	Phaenopsectra	I	2	Collector	cn	8.7
Insecta	Diptera	Chironomidae	Polypedilum	Polypedilum	I	2	Shredder	cb	6.3
Insecta	Coleoptera	Elmidae	Stenelmis	Stenelmis	I	1	Scraper	cn	7.1
Insecta	Diptera	Chironomidae	not identified	Tanypodinae	P	2	Predator	sp	7.5
Insecta	Diptera	Chironomidae	not identified	Tanytarsini	I	1	Filterer	na	3.5
Insecta	Diptera	Chironomidae	Thienemannimyia	Thienemannimyia	I	5	Predator	sp	6.7
Insecta	Diptera	Tipulidae	Tipula	Tipula	I	1	Shredder	bu	6.7
Clitellata	Haplotaxida	Tubificidae	not identified	Tubificidae	U	22	Collector	cn	8.4
Insecta	Diptera	Chironomidae	Zavrelimyia	Zavrelimyia	I	4	Predator	sp	5.3
Insecta	Diptera	Chironomidae	Zavrelimyia	Zavrelimyia	P	1	Predator	sp	5.3

1 Life Stage, I - Immature, P- Pupa, A - Adult; 2 Functional Feeding Group; 3 Primary habit or form of locomotion, includes bu - burrower, cn - clinger, cb - climber, sk - skater, sp - sprawler; 4 Tolerance Values, based on Hilsenhoff, modified for Maryland; na idicates information for the particular taxa was not available.

Dorsey Run, Hammond Branch, and Rocky Gorge Watersheds
Benthic Macroinvertebrate Data
2009

15DR-1-06-2009

Subphylum/ Class	Order	Family	Genus	Final ID	Note[1]	# of Org	FFG[2]	Habit[3]	Tolerance Value[4]
Insecta	Diptera	Tipulidae	Antocha	Antocha	I	2	Collector	cn	8
Insecta	Diptera	Empididae	Chelifera	Chelifera	I	1	Predator	sp	7.1
Insecta	Trichoptera	Hydropsychidae	Cheumatopsyche	Cheumatopsyche	I	1	Filterer	cn	6.5
Insecta	Trichoptera	Philopotamidae	Chimarra	Chimarra	I	7	Filterer	cn	4.4
Insecta	Diptera	Empididae	Clinocera	Clinocera	I	2	Predator	cn	7.4
Insecta	Diptera	Ceratopogonidae	Dasyhelea	Dasyhelea	I	1	Collector	sp	3.6
Insecta	Diptera	Chironomidae	Diamesa	Diamesa	I	10	Collector	sp	8.5
Not Identified	not identified	not identified	not identified	Nematoda	U	5	Parasite	na	na
Insecta	Diptera	Chironomidae	not identified	Orthocladiinae	I	5	Collector	bu	7.6
Insecta	Diptera	Chironomidae	Orthocladius	Orthocladius	I	59	Collector	sp	9.2
Insecta	Diptera	Chironomidae	Rheocricotopus	Rheocricotopus	I	4	Collector	sp	6.2
Insecta	Diptera	Chironomidae	Rheotanytarsus	Rheotanytarsus	I	5	Filterer	cn	7.2
Insecta	Coleoptera	Elmidae	Stenelmis	Stenelmis	A	1	Scraper	cn	7.1
Insecta	Diptera	Chironomidae	Sympotthastia	Sympotthastia	P	1	Collector	sp	8.2
Insecta	Diptera	Chironomidae	Sympotthastia	Sympotthastia	I	11	Collector	sp	8.2
Insecta	Diptera	Tipulidae	Tipula	Tipula	I	1	Shredder	bu	6.7

1 Life Stage, I - Immature, P- Pupa, A - Adult; 2 Functional Feeding Group; 3 Primary habit or form of locomotion, includes bu - burrower, cn - clinger, cb - climber, sk - skater, sp - sprawler; 4 Tolerance Values, based on Hilsenhoff, modified for Maryland; na idicates information for the particular taxa was not available.

Dorsey Run, Hammond Branch, and Rocky Gorge Watersheds
Benthic Macroinvertebrate Data
2009

Subphylum/ Class	Order	Family	Genus	Final ID	Note[1]	# of Org	FFG[2]	Habit[3]	Tolerance Value[4]
Hexapoda	Collembola	not identified	not identified	Collembola	U	1	Collector	sp	6
Insecta	Diptera	Ephydridae	not identified	Ephydridae	I	1	Collector	bu	6
Insecta	Diptera	Chironomidae	Hydrobaenus	Hydrobaenus	I	45	Scraper	sp	7.2
Clitellata	Haplotaxida	not identified	not identified	Lumbricina	U	1	Collector	bu	10
Clitellata	Lumbriculada	Lumbriculidae	not identified	Lumbriculidae	U	3	Collector	bu	6.6
Insecta	Diptera	Chironomidae	Orthocladius	Orthocladius	I	14	Collector	sp	9.2
Insecta	Coleoptera	Dryopidae	Oulimnius	Oulimnius	I	1	Scraper	cn	2.7
Bivalvia	Veneroida	Pisidiidae	Pisidium	Pisidium	U	1	Filterer	bu	5.7
Insecta	Diptera	Chironomidae	Polypedilum	Polypedilum	I	3	Shredder	cb	6.3
Insecta	Diptera	Chironomidae	Sympotthastia	Sympotthastia	P	1	Collector	sp	8.2
Insecta	Diptera	Chironomidae	Sympotthastia	Sympotthastia	I	27	Collector	sp	8.2
Insecta	Diptera	Chironomidae	Thienemannimyia	Thienemannimyia	I	3	Predator	sp	6.7
Clitellata	Haplotaxida	Tubificidae	not identified	Tubificidae	U	9	Collector	cn	8.4

1 Life Stage, I - Immature, P- Pupa, A - Adult; 2 Functional Feeding Group; 3 Primary habit or form of locomotion, includes bu - burrower, cn - clinger, cb - climber, sk - skater, sp - sprawler; 4 Tolerance Values, based on Hilsenhoff, modified for Maryland; na idicates information for the particular taxa was not available.

Dorsey Run, Hammond Branch, and Rocky Gorge Watersheds
Benthic Macroinvertebrate Data
2009

Subphylum/ Class	Order	Family	Genus	Final ID	Note[1]	# of Org	FFG[2]	Habit[3]	Tolerance Value[4]
Insecta	Diptera	Ceratopogonidae	not identified	Ceratopogonidae	I	1	Predator	sp	3.6
Insecta	Trichoptera	Philopotamidae	Chimarra	Chimarra	I	1	Filterer	cn	4.4
Insecta	Diptera	Chironomidae	not identified	Chironomidae	P	1	Collector	na	6.6
Insecta	Diptera	Chironomidae	Hydrobaenus	Hydrobaenus	I	23	Scraper	sp	7.2
Insecta	Diptera	Chironomidae	Orthocladius	Orthocladius	P	4	Collector	sp	9.2
Insecta	Diptera	Chironomidae	Orthocladius	Orthocladius	I	19	Collector	sp	9.2
Insecta	Diptera	Chironomidae	Parametriocnemus	Parametriocnemus	P	1	Collector	sp	4.6
Insecta	Diptera	Chironomidae	Paratanytarsus	Paratanytarsus	I	3	Collector	sp	7.7
Insecta	Diptera	Chironomidae	Polypedilum	Polypedilum	I	4	Shredder	cb	6.3
Insecta	Diptera	Chironomidae	Rheocricotopus	Rheocricotopus	I	3	Collector	sp	6.2
Insecta	Diptera	Chironomidae	Sympotthastia	Sympotthastia	I	7	Collector	sp	8.2
Insecta	Diptera	Chironomidae	Sympotthastia	Sympotthastia	P	3	Collector	sp	8.2
Insecta	Diptera	Chironomidae	Tanytarsus	Tanytarsus	I	16	Filterer	cb	4.9
Insecta	Diptera	Chironomidae	Tribelos	Tribelos	I	8	Collector	bu	7
Clitellata	Haplotaxida	Tubificidae	not identified	Tubificidae	U	9	Collector	cn	8.4
Insecta	Diptera	Chironomidae	Tvetenia	Tvetenia	P	1	Collector	sp	5.1
Insecta	Diptera	Chironomidae	Tvetenia	Tvetenia	I	2	Collector	sp	5.1

1 Life Stage, I - Immature, P- Pupa, A - Adult; 2 Functional Feeding Group; 3 Primary habit or form of locomotion, includes bu - burrower, cn - clinger, cb - climber, sk - skater, sp - sprawler; 4 Tolerance Values, based on Hilsenhoff, modified for Maryland; na idicates information for the particular taxa was not available.

Dorsey Run, Hammond Branch, and Rocky Gorge Watersheds
Benthic Macroinvertebrate Data
2009

15DR-1-09-2009

Subphylum/ Class	Order	Family	Genus	Final ID	Note[1]	# of Org	FFG[2]	Habit[3]	Tolerance Value[4]
Insecta	Diptera	Chironomidae	Ablabesmyia	Ablabesmyia	I	3	Predator	sp	8.1
Insecta	Diptera	Chironomidae	Brillia	Brillia	I	4	Shredder	bu	7.4
Insecta	Diptera	Chironomidae	Brillia	Brillia	P	1	Shredder	bu	7.4
Crustacea	Isopoda	Asellidae	Caecidotea	Caecidotea	U	1	Collector	sp	2.6
Insecta	Diptera	Ceratopogonidae	not identified	Ceratopogonidae	I	1	Predator	sp	3.6
Insecta	Diptera	Chironomidae	not identified	Chironomidae	P	1	Collector	na	6.6
Insecta	Diptera	Chironomidae	Cricotopus	Cricotopus	I	17	Shredder	cn	9.6
Insecta	Diptera	Chironomidae	Cricotopus	Cricotopus	P	3	Shredder	cn	9.6
Clitellata	Haplotaxida	Enchytraeidae	not identified	Enchytraeidae	U	4	Collector	bu	9.1
Insecta	Odonata	Gomphidae	not identified	Gomphidae	I	1	Predator	bu	2.2
Crustacea	Amphipoda	Hyalellidae	Hyalella	Hyalella	I	3	Shredder	sp	4.2
Insecta	Diptera	Chironomidae	Hydrobaenus	Hydrobaenus	I	11	Scraper	sp	7.2
Clitellata	Haplotaxida	not identified	not identified	Lumbricina	U	5	Collector	bu	10
Not Identified	not identified	not identified	not identified	Nematoda	U	1	Parasite	na	na
Insecta	Diptera	Chironomidae	Paratanytarsus	Paratanytarsus	I	10	Collector	sp	7.7
Insecta	Diptera	Chironomidae	Polypedilum	Polypedilum	I	10	Shredder	cb	6.3
Enopla	Hoplonemertea	Tetrastemmatidae	Prostoma	Prostoma	U	1	Predator	na	7.3
Insecta	Diptera	Chironomidae	Rheocricotopus	Rheocricotopus	I	3	Collector	sp	6.2
Insecta	Diptera	Chironomidae	Rheotanytarsus	Rheotanytarsus	I	4	Filterer	cn	7.2
Insecta	Diptera	Chironomidae	Thienemannimyia	Thienemannimyia	I	10	Predator	sp	6.7
Clitellata	Haplotaxida	Tubificidae	not identified	Tubificidae	U	17	Collector	cn	8.4

1 Life Stage, I - Immature, P- Pupa, A - Adult; 2 Functional Feeding Group; 3 Primary habit or form of locomotion, includes bu - burrower, cn - clinger, cb - climber, sk - skater, sp - sprawler; 4 Tolerance Values, based on Hilsenhoff, modified for Maryland; na idicates information for the particular taxa was not available.

Dorsey Run, Hammond Branch, and Rocky Gorge Watersheds
Benthic Macroinvertebrate Data
2009

15DR-1-09-2009-QC

Subphylum/ Class	Order	Family	Genus	Final ID	Note[1]	# of Org	FFG[2]	Habit[3]	Tolerance Value[4]
Insecta	Diptera	Chironomidae	Ablabesmyia	Ablabesmyia	I	5	Predator	sp	8.1
Insecta	Odonata	Coenagrionidae	Argia	Argia	I	1	Predator	cn	9.3
Insecta	Diptera	Empididae	Clinocera	Clinocera	I	1	Predator	cn	7.4
Insecta	Odonata	Coenagrionidae	not identified	Coenagrionidae	I	1	Predator	cb	9
Insecta	Diptera	Chironomidae	Conchapelopia	Conchapelopia	I	3	Predator	sp	6.1
Insecta	Diptera	Chironomidae	Cricotopus	Cricotopus	I	12	Shredder	cn	9.6
Insecta	Diptera	Chironomidae	Cricotopus	Cricotopus	P	1	Shredder	cn	9.6
Insecta	Diptera	Chironomidae	Cryptochironomus	Cryptochironomus	I	8	Predator	sp	7.6
Clitellata	Haplotaxida	Enchytraeidae	not identified	Enchytraeidae	U	3	Collector	bu	9.1
Insecta	Coleoptera	Dryopidae	Helichus	Helichus	A	1	Scraper	cn	6.4
Crustacea	Amphipoda	Hyalellidae	Hyalella	Hyalella	U	3	Shredder	sp	4.2
Clitellata	Haplotaxida	not identified	not identified	Lumbricina	U	6	Collector	bu	10
Gastropoda	Basommatophora	Planorbidae	Menetus	Menetus	U	2	Scraper	cb	7.6
Insecta	Diptera	Chironomidae	Nanocladius	Nanocladius	I	4	Collector	sp	7.6
Insecta	Diptera	Chironomidae	Orthocladius	Orthocladius	I	6	Collector	sp	9.2
Insecta	Diptera	Chironomidae	Paratanytarsus	Paratanytarsus	P	1	Collector	sp	7.7
Insecta	Diptera	Chironomidae	Rheocricotopus	Rheocricotopus	I	4	Collector	sp	6.2
Insecta	Diptera	Chironomidae	Rheotanytarsus	Rheotanytarsus	I	2	Filterer	cn	7.2
Insecta	Diptera	Chironomidae	Thienemannimyia	Thienemannimyia	I	13	Predator	sp	6.7
Clitellata	Haplotaxida	Tubificidae	not identified	Tubificidae	U	32	Collector	cn	8.4

1 Life Stage, I - Immature, P- Pupa, A - Adult; 2 Functional Feeding Group; 3 Primary habit or form of locomotion, includes bu - burrower, cn - clinger, cb - climber, sk - skater, sp - sprawler; 4 Tolerance Values, based on Hilsenhoff, modified for Maryland; na idicates information for the particular taxa was not available.

Dorsey Run, Hammond Branch, and Rocky Gorge Watersheds
Benthic Macroinvertebrate Data
2009

Subphylum/ Class	Order	Family	Genus	Final ID	Note[1]	# of Org	FFG[2]	Habit[3]	Tolerance Value[4]
Insecta	Diptera	Ceratopogonidae	not identified	Ceratopogonidae	I	1	Predator	sp	3.6
Insecta	Diptera	Chironomidae	Cricotopus	Cricotopus	P	3	Shredder	cn	9.6
Insecta	Diptera	Chironomidae	Cricotopus	Cricotopus	I	76	Shredder	cn	9.6
Clitellata	Haplotaxida	Enchytraeidae	not identified	Enchytraeidae	U	1	Collector	bu	9.1
Gastropoda	not identified	not identified	not identified	Gastropoda	U	1	Scraper	cb	na
Clitellata	Haplotaxida	not identified	not identified	Lumbricina	U	10	Collector	bu	10
Insecta	Diptera	Chironomidae	not identified	Orthocladiinae	P	1	Collector	bu	7.6
Insecta	Diptera	Chironomidae	Orthocladius	Orthocladius	I	11	Collector	sp	9.2
Insecta	Diptera	Chironomidae	Polypedilum	Polypedilum	I	1	Shredder	cb	6.3
Insecta	Diptera	Chironomidae	Rheocricotopus	Rheocricotopus	I	1	Collector	sp	6.2
Insecta	Diptera	Chironomidae	Thienemannimyia	Thienemannimyia	I	2	Predator	sp	6.7
Clitellata	Haplotaxida	Tubificidae	not identified	Tubificidae	U	3	Collector	cn	8.4

1 Life Stage, I - Immature, P- Pupa, A - Adult; 2 Functional Feeding Group; 3 Primary habit or form of locomotion, includes bu - burrower, cn - clinger, cb - climber, sk - skater, sp - sprawler; 4 Tolerance Values, based on Hilsenhoff, modified for Maryland; na idicates information for the particular taxa was not available.

Appendix D: Habitat Assessment Data

Site ID	DATE	CA	CFS	CS	ESC	E	FR	PSC	PV	SD	VD	BSL	BSR	VPL	VPR	RZL	RZR	Total	Percent	Narrative Rating
Rocky Gorge PSU																		**123**	**62**	**Partially Supporting**
09RG-1-01-2009	3/17/2009	16	12	-	9	8	14	-	-	5	13	4	4	4	4	10	9	112	56.0	Non-supporting
09RG-1-02-2009	3/17/2009	14	12	-	13	14	15	-	-	14	10	5	5	5	5	2	2	116	58.0	Non-supporting
09RG-1-03-2009	3/30/2009	20	12	-	13	9	14	-	-	7	10	2	6	3	6	10	5	117	58.5	Non-supporting
09RG-1-04A-2009	3/25/2009	15	14	-	13	13	18	-	-	12	14	9	6	9	7	10	3	143	71.5	Partially Supporting
09RG-1-04A-2009 QC	3/25/2009	19	11	-	11	10	19	-	-	11	10	8	6	9	7	10	4	135	67.5	Partially Supporting
09RG-4-01-2009	3/30/2009	19	20	-	14	5	5	-	-	9	10	5	2	7	3	10	10	119	59.5	Non-supporting
09RG-4-02A-2009	3/25/2009	13	18	7	15	11	8	8	11	11	16	9	2	9	3	8	3	117	58.5	Non-supporting
09RG-4-03-2009	3/25/2009	15	19	8	13	7	6	9	12	10	13	7	6	8	7	6	2	122	61.0	Partially Supporting
09RG-4-04-2009	3/27/2009	16	20	-	15	11	10			10	10	6	2	5	4	2	9	120	60.0	Non-supporting
09RG-4-04A-2009	3/30/2009	12	19	-	14	11	8			12	15	6	6	6	6	8	8	131	65.5	Partially Supporting
09RG-4-06A-2009	3/27/2009	16	20	-	15	11	5			10	10	7	7	8	8	10	10	137	68.5	Partially Supporting
Hammond Branch PSU																		**126**	**63**	**Partially Supporting**
14HB-1-01-2009	3/13/2009	11	20	-	5	1	0	-	-	5	6	4	4	4	4	3	9	76	38.0	Non-supporting
14HB-1-02-2009	3/13/2009	16	12	-	12	8	5	-	-	5	12	3	4	4	5	3	9	98	49.0	Non-supporting
14HB-1-03-2009	3/12/2009	15	15	-	15	15	14	-	-	13	16	8	4	8	5	8	6	142	71.0	Partially Supporting
14HB-1-04-2009	3/13/2009	15	16	-	16	14	15	-	-	14	15	10	9	9	9	8	9	159	79.5	Supporting
14HB-1-05-2009	3/16/2009	15	10	-	11	10	14	-	-	7	14	2	4	2	4	10	8	111	55.5	Non-supporting
14HB-1-06-2009	3/12/2009	20	14	-	12	15	17	-	-	14	16	8	8	9	9	10	7	159	79.5	Supporting
14HB-1-07-2009	3/17/2009	20	10	-	9	12	12	-	-	10	10	4	4	4	4	9	10	118	59.0	Non-supporting
14HB-1-08-2009	3/16/2009	19	13	-	13	13	16	-	-	11	15	3	5	4	6	2	10	130	65.0	Partially Supporting
14HB-1-09-2009	3/12/2009	15	14	-	14	15	16	-	-	13	15	8	5	9	7	4	8	143	71.5	Partially Supporting
14HB-1-10-2009	3/16/2009	14	13	-	11	10	15	-	-	9	15	4	3	5	4	8	8	119	59.5	Non-supporting
14HB-1-10-2009 QC	3/16/2009	16	14	-	12	10	14	-	-	9	15	4	3	5	4	8	7	121	60.5	Partially Supporting
Dorsey Run PSU																		**107**	**54**	**Non-supporting**
15DR-1-01-2009	3/20/2009	19	13	-	10	8	15	-	-	11	14	7	6	7	6	2	8	126	63.0	Partially Supporting
15DR-1-02-2009	3/24/2009	15	13	-	9	10	13	-	-	9	10	6	7	6	7	8	7	120	60.0	Non-supporting
15DR-1-03-2009	3/18/2009	11	14	6	10	6	6	7	9	6	12	6	6	5	5	3	3	91	45.5	Non-supporting
15DR-1-04-2009	3/24/2009	9	15	-	5	7	5	-	-	8	11	5	6	4	5	5	5	90	45.0	Non-supporting
15DR-1-05-2009	3/18/2009	5	13	2	5	12	8	7	6	10	9	6	10	3	0	3	0	70	35.0	Non-supporting
15DR-1-06-2009	3/20/2009	19	12	-	11	9	16	-	-	11	10	4	6	5	7	10	9	129	64.5	Partially Supporting
15DR-1-07-2009	3/27/2009	15	9	-	10	7	13	-	-	5	9	7	8	8	9	8	6	114	57.0	Non-supporting
15DR-1-08-2009	3/24/2009	15	14	-	12	10	14	-	-	8	12	6	5	7	6	6	8	123	61.5	Partially Supporting
15DR-1-09-2009	3/18/2009	19	11	8	11	7	6	7	11	8	13	5	3	5	5	10	10	113	56.5	Non-supporting
15DR-1-09-2009 QC	3/18/2009	20	11	8	11	11	14	7	11	8	13	5	3	6	5	10	10	115	57.5	Non-supporting
15DR-1-10-2009	3/20/2009	15	9	7	7	7	12	8	8	6	13	4	5	4	5	8	8	94	47.0	Non-supporting

CA - Channel alteration
CFS - Channel Flow Status
CS - Channel Sinuosity
ESC - Epifaunal substrate / available cover
E - Embeddeddness
FR - Frequency of riffles
PSC - Pool Substrate Characterization
PV - Pool Variability
SD - Sediment /deposition
VD - Velocity /depth
BSL - Bank Stability (left)
BSR - Bank Stability (right)
VPR - Vegetative Protection (right)
VPL - Vegetative Protection (left)
RZL - Riparian Zone (left)
RZR - Riparian Zone (right)
Total - Total Score (200 highest possible)
Percent - (Total/200)

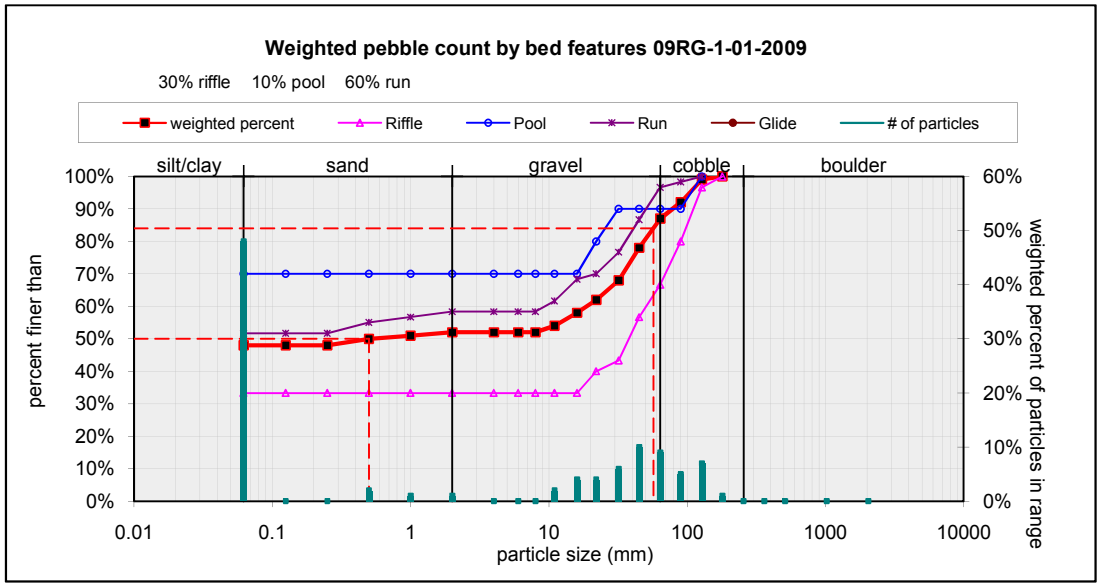
Classification Scoring and Narrative Rating

≥90%	Comparable to Reference
75.1-89.9%	Supporting
60.1-75.0%	Partially Supporting
≤60%	Non-supporting

Appendix E: Geomorphologic Data

Site ID	Mean depth (dbkf) (ft)	Bankfull width (Wbkf) (ft)	Bankfull cross-sectional area (Abkf) (ft2)	Width/Depth ratio (Wbkf/dbkf)	Width of flood-prone area (Wfpa) (ft)	Entrenchment Ratio (Wfpa/Wbkf)	Slope (water surface, percent)	Valley Length (feet)	Sinuosity (stream length/valley length)	Median particle size, reach (D50) (mm)	Dominant particle size class	Percent dominant particle size	Channel Type
Rocky Gorge													
09RG-1-01-2009	1.0	22.0	22.6	21.4	31.4	1.4	0.62	240	1.03	0.50	silt/clay	48%	F4
09RG-1-02-2009	0.5	10.3	4.8	22.2	17.3	1.7	2.60	230	1.07	12.00	gravel	37%	B4c
09RG-1-03-2009	1.0	15.7	15.6	15.9	66.0	4.2	1.80	150	1.64	0.16	gravel	35%	C5
09RG-1-04A-2009	1.5	14.5	21.5	9.7	21.0	1.5	3.50	215	1.14	32.00	gravel	38%	B4
09RG-4-01-2009	2.2	89.3	192.4	41.4	400.0	4.5	0.16	246	1.00	6.40	gravel	51%	C4
09RG-4-02A-2009	2.8	64.8	182.0	23.1	85.0	1.3	0.60	246	1.00	0.91	gravel	39%	F4
09RG-4-03-2009	2.9	72.6	212.2	24.8	250.0	3.4	0.04	246	1.00	1.00	sand	45%	C4
09RG-4-04-2009	2.8	72.4	205.4	25.5	76.3	1.1	0.44	246	1.00	15.00	gravel	40%	F4
09RG-4-04A-2009	3.9	86.3	339.1	22.0	350.0	4.1	0.18	246	1.00	1.10	gravel	32%	C4
09RG-4-06A-2009	2.8	99.1	273.8	35.8	119.1	1.2	0.01	246	1.00	0.06	silt/clay	75%	F6
Hammond Branch													
14HB-1-01-2009	2.6	32.5	83.9	12.6	42.8	1.3	0.01	240	1.03	0.06	sand	50%	F5
14HB-1-02-2009	1.5	25.8	38.4	17.3	66.0	2.6	0.15	246	1.00	6.50	gravel	55%	C4
14HB-1-03-2009	1.8	33.2	61.1	18.1	62.0	1.9	0.39	208	1.18	44.00	gravel	45%	C4
14HB-1-04-2009	2.2	26.4	58.4	11.9	139.0	5.3	0.54	228	1.08	100.00	cobble	46%	C3
14HB-1-05-2009	0.9	24.6	21.2	28.4	27.2	1.1	0.44	240	1.03	30.00	gravel	66%	F4
14HB-1-06-2009	1.6	47.8	75.9	30.1	103.0	2.2	2.90	219	1.12	61.00	cobble	33%	B3
14HB-1-07-2009	0.3	8.6	2.8	26.7	10.0	1.2	1.10	184	1.34	12.00	gravel	53%	F4
14HB-1-08-2009	1.8	23.5	41.6	13.3	175.0	7.4	0.72	223	1.10	27.00	gravel	72%	C4
14HB-1-09-2009	1.3	36.2	47.6	27.5	5.0	0.1	1.20	242	1.02	42.00	gravel	49%	F4
14HB-1-10-2009	1.7	18.5	30.6	11.2	22.5	1.2	0.71	230	1.07	17.00	sand	35%	F4
Dorsey Run													
15DR-1-01-2009	1.2	23.1	28.6	18.7	60	2.6	0.87	231	1.06	39.00	gravel	48%	C4
15DR-1-02-2009	1.5	11.7	17.2	8.0	90.0	7.7	0.98	211	1.17	10.00	gravel	56%	C4
15DR-1-03-2009	1.3	26.5	35.3	19.8	29.7	1.1	0.33	240	1.03	0.43	sand	59%	F5
15DR-1-04-2009	1.3	18.5	23.9	14.3	27.0	1.5	0.01	230	1.07	1.20	sand	6%	F5
15DR-1-05-2009	1.0	7.6	7.7	7.4	20.2	2.7	0.79	240	1.03	38.00	gravel	35%	F4
15DR-1-06-2009	1.4	25.3	35.1	18.2	90.0	3.6	1.30	237	1.04	38.00	gravel	51%	C4
15DR-1-07-2009	0.6	13.8	8.4	22.6	71.0	5.2	1.10	216	1.14	6.00	gravel	54%	C4
15DR-1-08-2009	1.4	14.2	19.8	10.2	175.0	12.3	0.35	220	1.12	9.20	gravel	65%	C4
15DR-1-09-2009	2.0	27.6	55.8	13.6	200.0	7.2	0.20	220	1.12	0.36	sand	58%	C5
15DR-1-10-2009	1.6	29.4	47.1	18.3	200.0	6.8	0.46	237	1.04	14.00	gravel	63%	C4

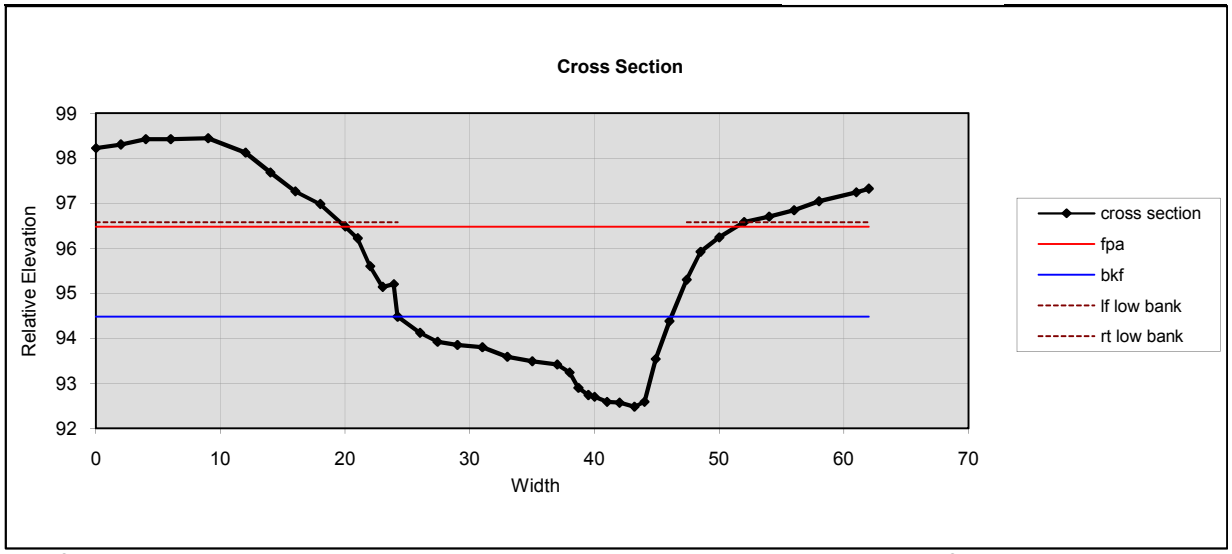
09RG-1-01-2009



Size (mm)	
D16	0.062
D35	0.062
D50	0.5
D65	27
D84	57
D95	100

Size Distribution	
mean	1.9
dispersion	61.0
skewness	0.3

Type	
silt/clay	48%
sand	4%
gravel	35%
cobble	13%
boulder	0%
bedrock	



Bankfull Dimensions	
22.6	x-section area (ft.sq.)
22.0	width (ft)
1.0	mean depth (ft)
2.0	max depth (ft)
22.9	wetted perimeter (ft)
1.0	hydraulic radius (ft)
21.4	width-depth ratio

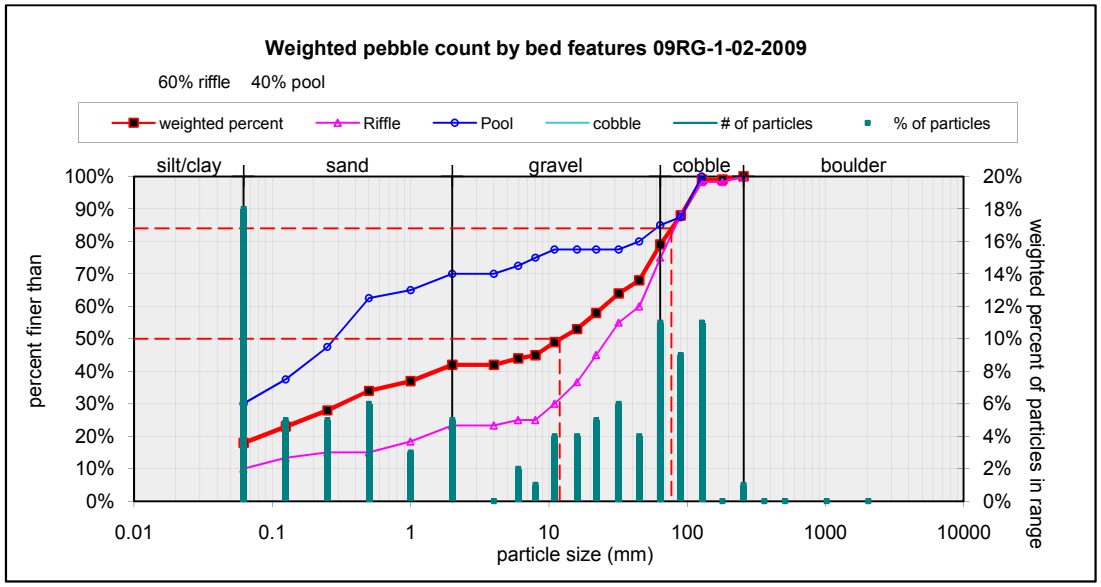
Flood Dimensions	
31.4	Width flood prone area (ft)
1.4	entrenchment ratio
4.1	low bank height (ft)
2.1	low bank height ratio

Flow Resistance	
0.042	Manning's roughness

Bankfull Flow	
2.8	velocity (ft/s)
62.5	discharge rate (cfs)
0.6	channel slope (%)

Sinuosity	Channel Type
1.03	F4

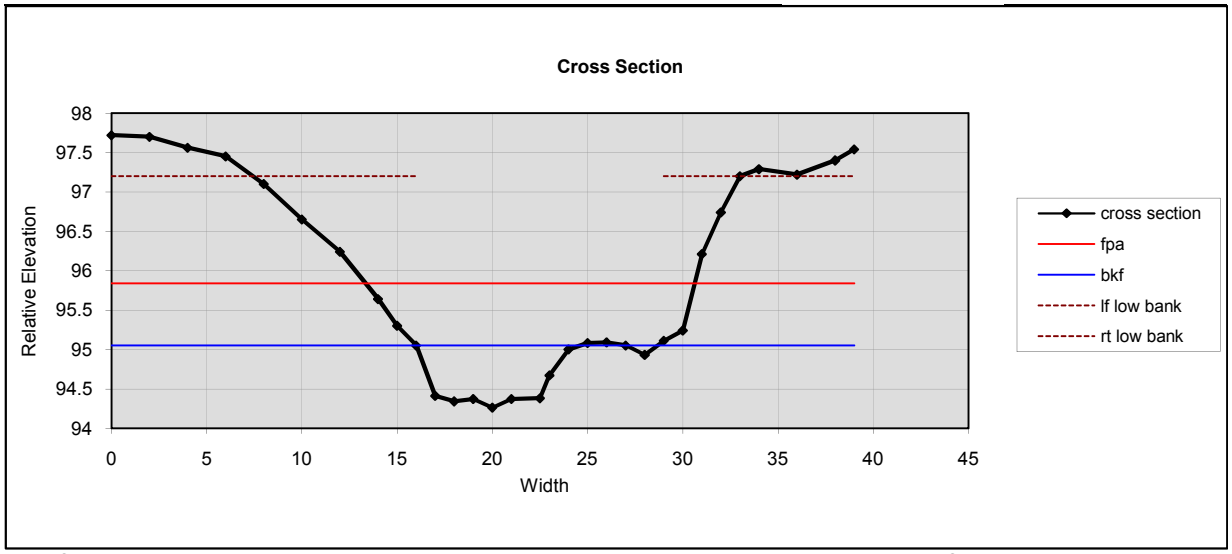
09RG-1-02-2009



Size (mm)	
D16	0.062
D35	0.63
D50	12
D65	35
D84	77
D95	110

Size Distribution	
mean	2.2
dispersion	100.0
skewness	-0.4

Type	
silt/clay	18%
sand	24%
gravel	37%
cobble	21%
boulder	0%
bedrock	



Bankfull Dimensions	
4.8	x-section area (ft.sq.)
10.3	width (ft)
0.5	mean depth (ft)
0.8	max depth (ft)
10.6	wetted perimeter (ft)
0.4	hydraulic radius (ft)
22.2	width-depth ratio

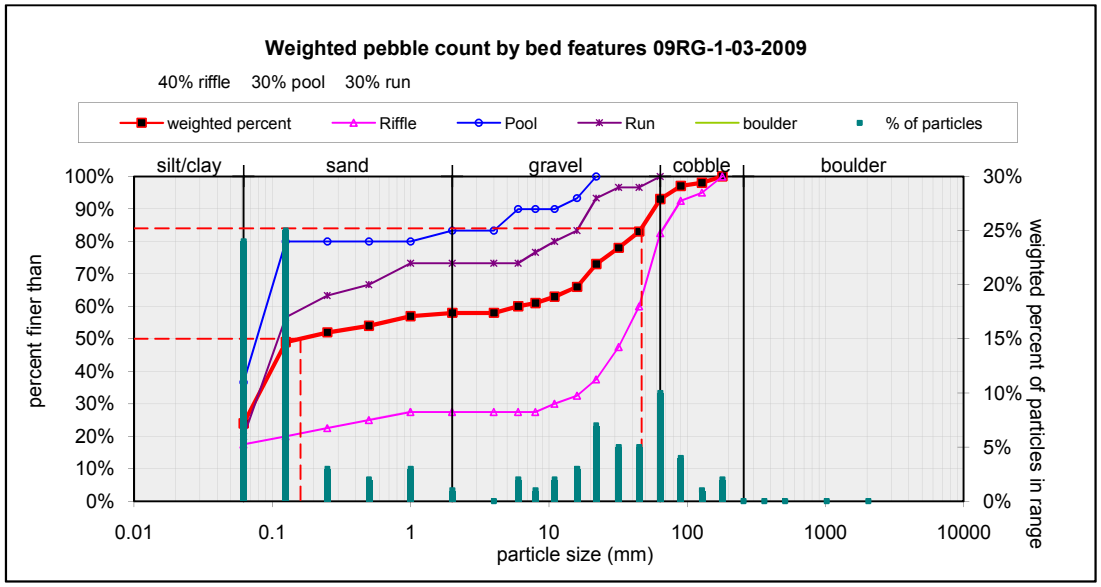
Flood Dimensions	
17.3	Width flood prone area (ft)
1.7	entrenchment ratio
2.9	low bank height (ft)
3.7	low bank height ratio

Flow Resistance	
0.050	Manning's roughness

Bankfull Flow	
2.8	velocity (ft/s)
13.5	discharge rate (cfs)
2.6	channel slope (%)

Sinuosity	Channel Type
1.07	B4c

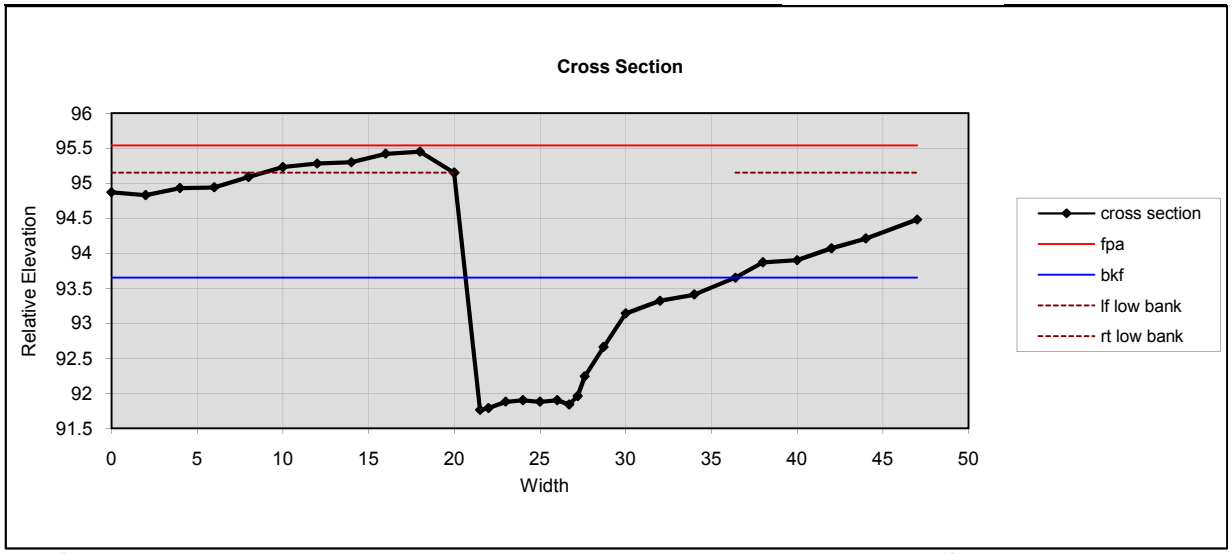
09RG-1-03-2009



Size (mm)	
D16	0.062
D35	0.084
D50	0.16
D65	14
D84	47
D95	76

Size Distribution	
mean	1.7
dispersion	148.2
skewness	0.6

Type	
silt/clay	24%
sand	34%
gravel	35%
cobble	7%
boulder	0%
bedrock	



Bankfull Dimensions	
15.6	x-section area (ft.sq.)
15.7	width (ft)
1.0	mean depth (ft)
1.9	max depth (ft)
17.3	wetted perimeter (ft)
0.9	hydraulic radius (ft)
15.9	width-depth ratio

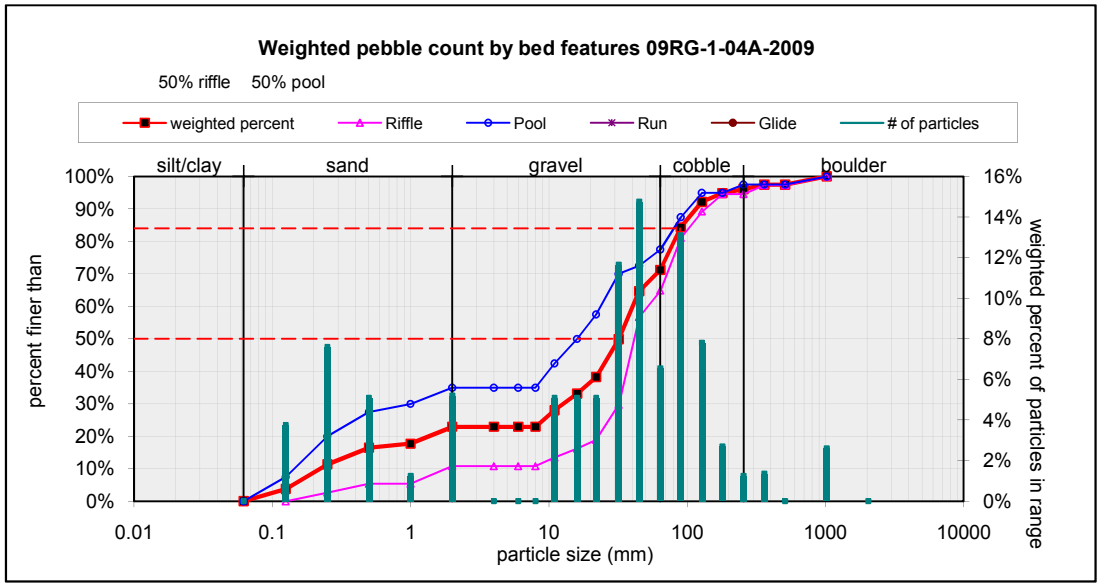
Flood Dimensions	
66.0	Width flood prone area (ft)
4.2	entrenchment ratio
3.4	low bank height (ft)
1.8	low bank height ratio

Flow Resistance	
0.037	Manning's roughness

Bankfull Flow	
5.1	velocity (ft/s)
78.6	discharge rate (cfs)
1.8	channel slope (%)

Sinuosity	Channel Type
1.64	C5

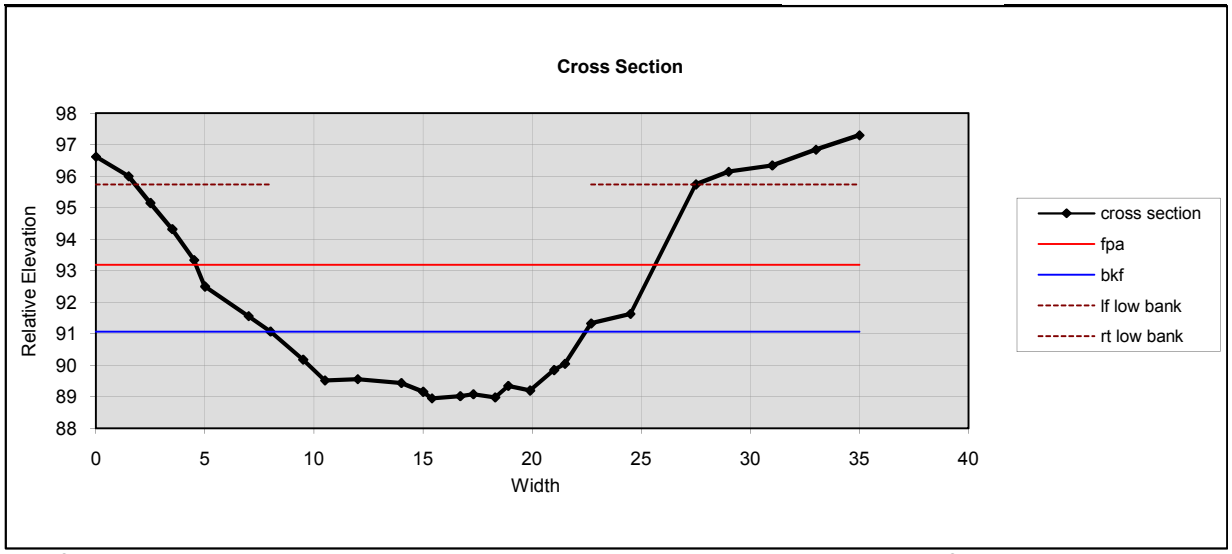
09RG-1-04A-2009



Size (mm)	
D16	0.47
D35	18
D50	32
D65	46
D84	89
D95	190

Size Distribution	
mean	6.5
dispersion	35.4
skewness	-0.5

Type	
silt/clay	0%
sand	18%
gravel	38%
cobble	20%
boulder	3%
bedrock	26%



Bankfull Dimensions	
21.5	x-section area (ft.sq.)
14.5	width (ft)
1.5	mean depth (ft)
2.1	max depth (ft)
15.8	wetted perimeter (ft)
1.4	hydraulic radius (ft)
9.7	width-depth ratio

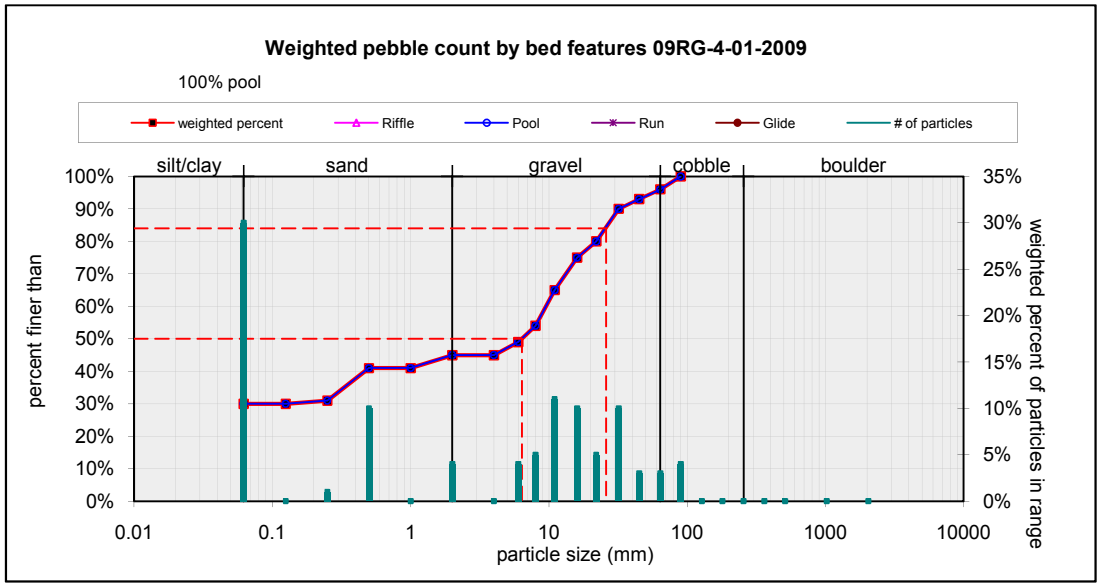
Flood Dimensions	
21.0	Width flood prone area (ft)
1.5	entrenchment ratio
6.8	low bank height (ft)
3.2	low bank height ratio

Flow Resistance	
0.041	Manning's roughness

Bankfull Flow	
8.4	velocity (ft/s)
181.4	discharge rate (cfs)
3.5	channel slope (%)

Sinuosity	Channel Type
1.14	B4

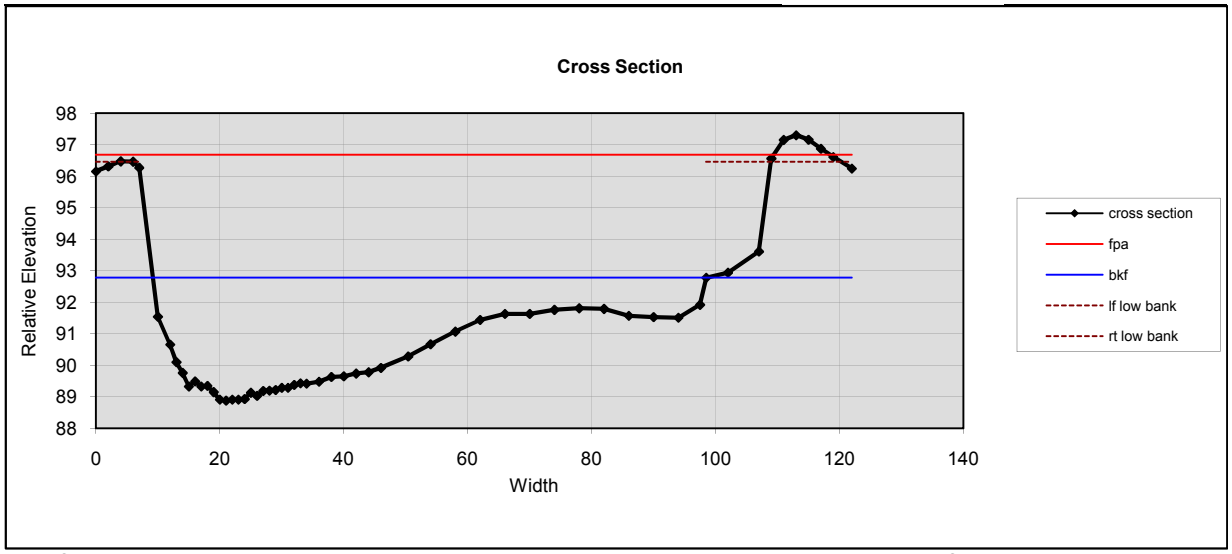
09RG-4-01-2009



Size (mm)	
D16	0.062
D35	0.33
D50	6.4
D65	11
D84	26
D95	57

Size Distribution	
mean	1.3
dispersion	53.6
skewness	-0.4

Type	
silt/clay	30%
sand	15%
gravel	51%
cobble	4%
boulder	0%
bedrock	



Bankfull Dimensions	
192.4	x-section area (ft.sq.)
89.3	width (ft)
2.2	mean depth (ft)
3.9	max depth (ft)
91.0	wetted perimeter (ft)
2.1	hydraulic radius (ft)
41.4	width-depth ratio

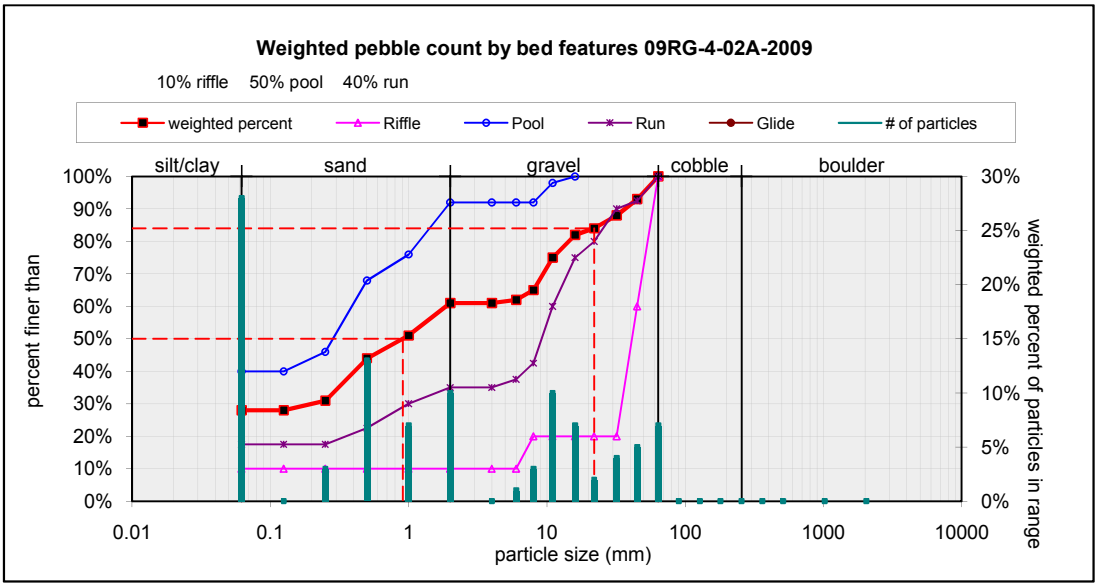
Flood Dimensions	
400.0	Width flood prone area (ft)
4.5	entrenchment ratio
7.6	low bank height (ft)
1.9	low bank height ratio

Flow Resistance	
0.026	Manning's roughness

Bankfull Flow	
3.8	velocity (ft/s)
722.1	discharge rate (cfs)
0.2	channel slope (%)

Sinuosity	Channel Type
1.00	C4

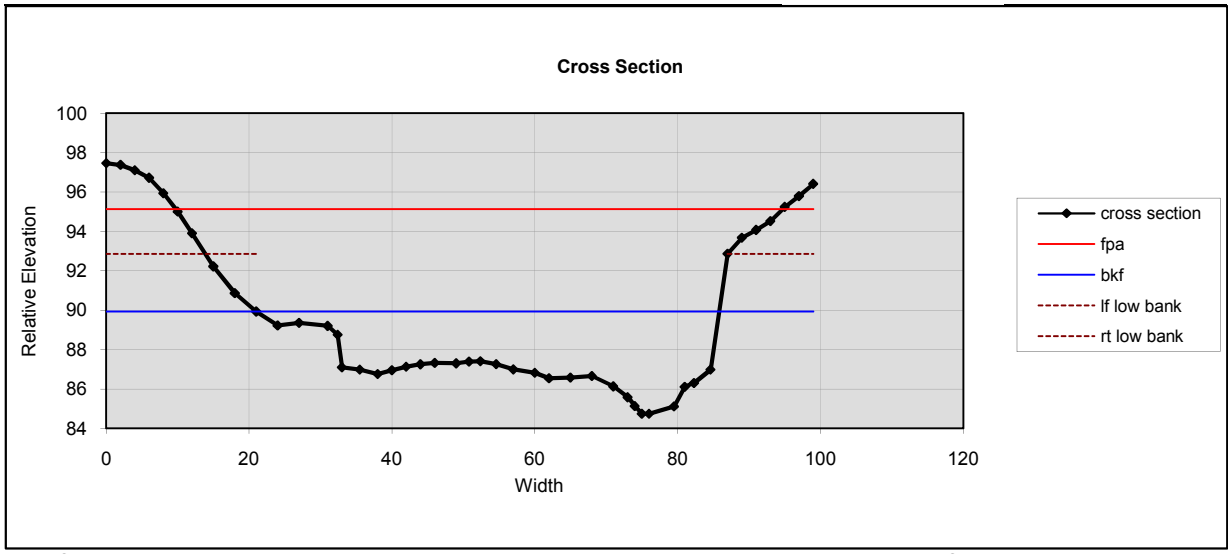
09RG-4-02A-2009



Size (mm)	
D16	0.062
D35	0.31
D50	0.91
D65	8
D84	22
D95	50

Size Distribution	
mean	1.2
dispersion	19.4
skewness	0.1

Type	
silt/clay	28%
sand	33%
gravel	39%
cobble	0%
boulder	0%
bedrock	



Bankfull Dimensions	
182.0	x-section area (ft.sq.)
64.8	width (ft)
2.8	mean depth (ft)
5.2	max depth (ft)
68.9	wetted perimeter (ft)
2.6	hydraulic radius (ft)
23.1	width-depth ratio

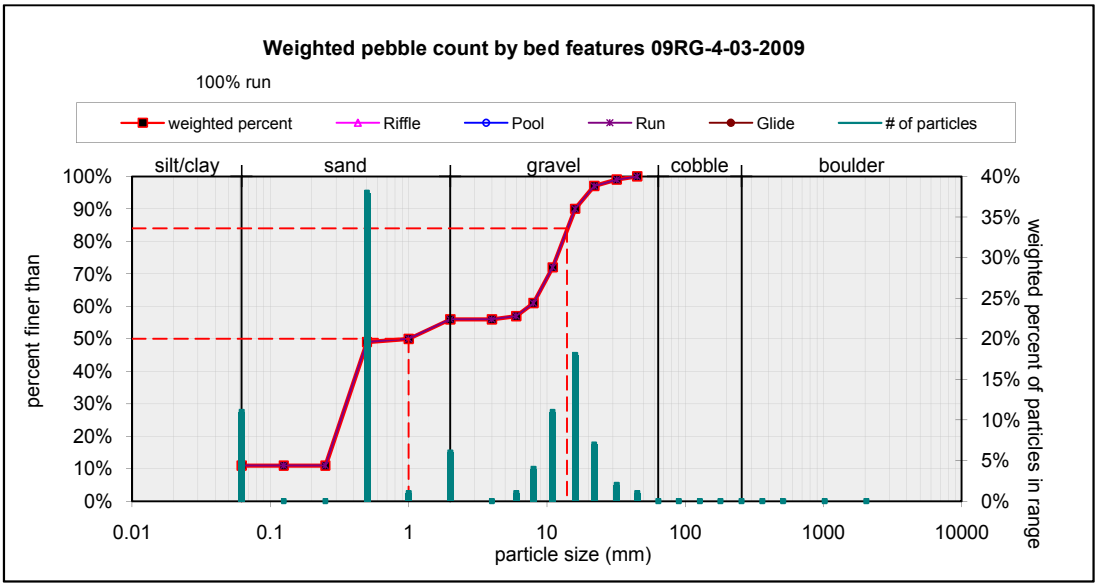
Flood Dimensions	
85.0	Width flood prone area (ft)
1.3	entrenchment ratio
8.1	low bank height (ft)
1.6	low bank height ratio

Flow Resistance	
0.031	Manning's roughness

Bankfull Flow	
7.2	velocity (ft/s)
1308.4	discharge rate (cfs)
0.6	channel slope (%)

Sinuosity	Channel Type
1.00	F4

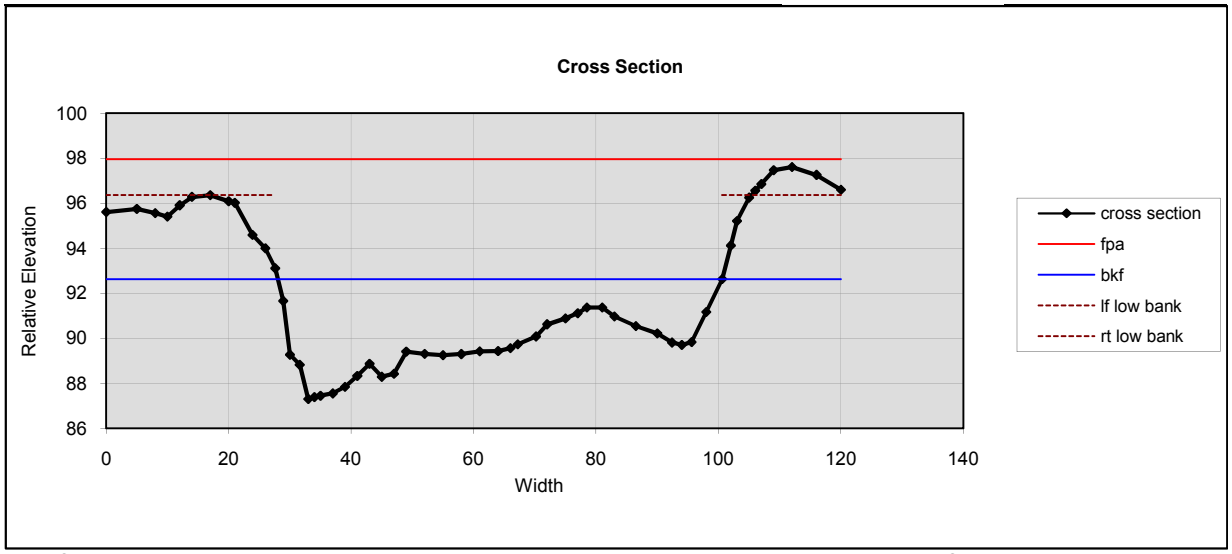
09RG-4-03-2009



Size (mm)	
D16	0.27
D35	0.39
D50	1
D65	9
D84	14
D95	20

Size Distribution	
mean	1.9
dispersion	8.9
skewness	0.2

Type	
silt/clay	11%
sand	45%
gravel	44%
cobble	0%
boulder	0%
bedrock	



Bankfull Dimensions	
212.2	x-section area (ft.sq.)
72.6	width (ft)
2.9	mean depth (ft)
5.3	max depth (ft)
76.8	wetted perimeter (ft)
2.8	hydraulic radius (ft)
24.8	width-depth ratio

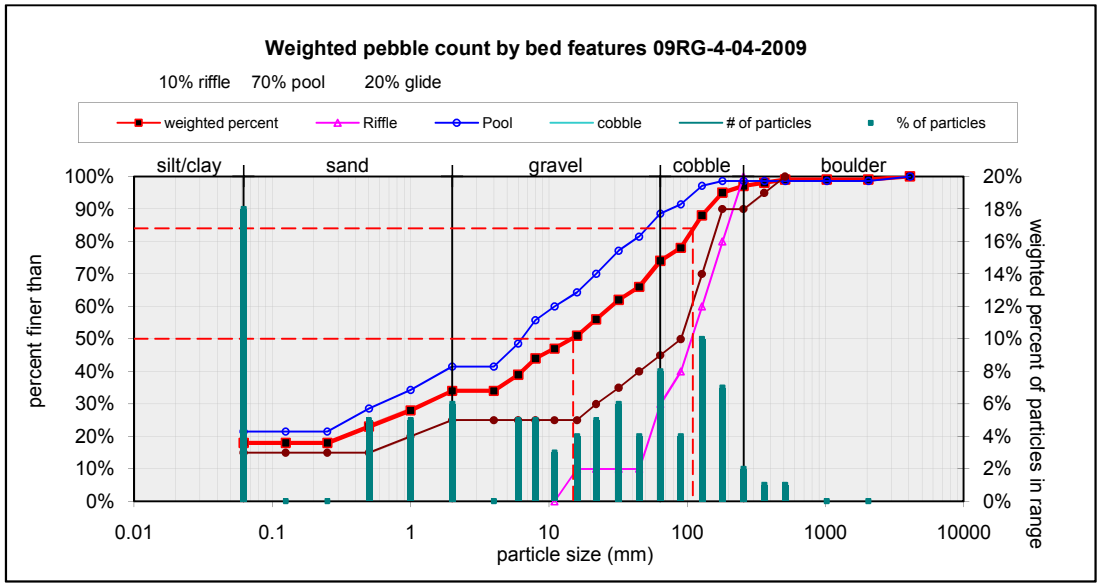
Flood Dimensions	
250.0	Width flood prone area (ft)
3.4	entrenchment ratio
9.1	low bank height (ft)
1.7	low bank height ratio

Flow Resistance	
0.023	Manning's roughness

Bankfull Flow	
2.7	velocity (ft/s)
565.6	discharge rate (cfs)
0.043	channel slope (%)

Sinuosity	Channel Type
1.00	C4

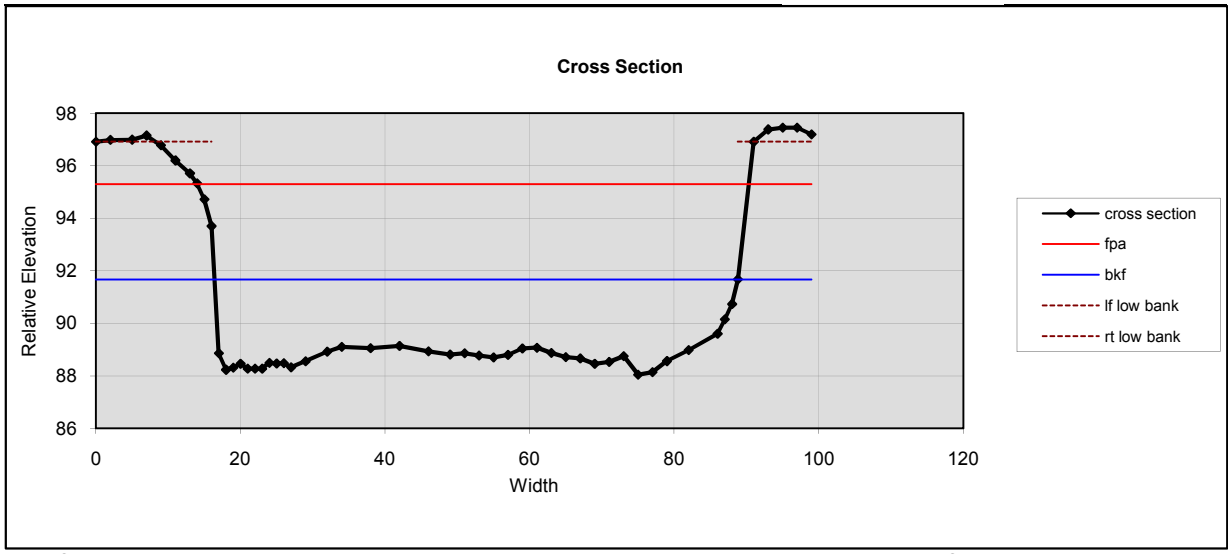
09RG-4-04-2009



Size (mm)	
D16	0.062
D35	4.3
D50	15
D65	41
D84	110
D95	180

Size Distribution	
mean	2.6
dispersion	124.6
skewness	-0.4

Type	
silt/clay	18%
sand	16%
gravel	40%
cobble	23%
boulder	3%
bedrock	



Bankfull Dimensions	
205.4	x-section area (ft.sq.)
72.4	width (ft)
2.8	mean depth (ft)
3.6	max depth (ft)
76.0	wetted perimeter (ft)
2.7	hydraulic radius (ft)
25.5	width-depth ratio

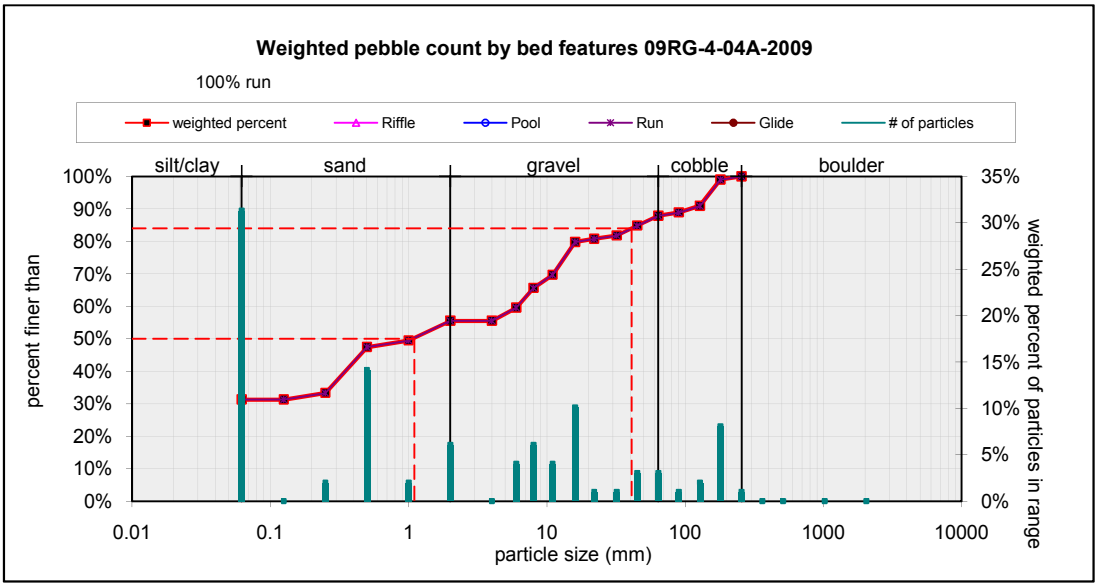
Flood Dimensions	
76.3	Width flood prone area (ft)
1.1	entrenchment ratio
8.9	low bank height (ft)
2.4	low bank height ratio

Flow Resistance	
0.046	Manning's roughness

Bankfull Flow	
4.2	velocity (ft/s)
861.0	discharge rate (cfs)
0.4	channel slope (%)

Sinuosity	Channel Type
1.00	F4

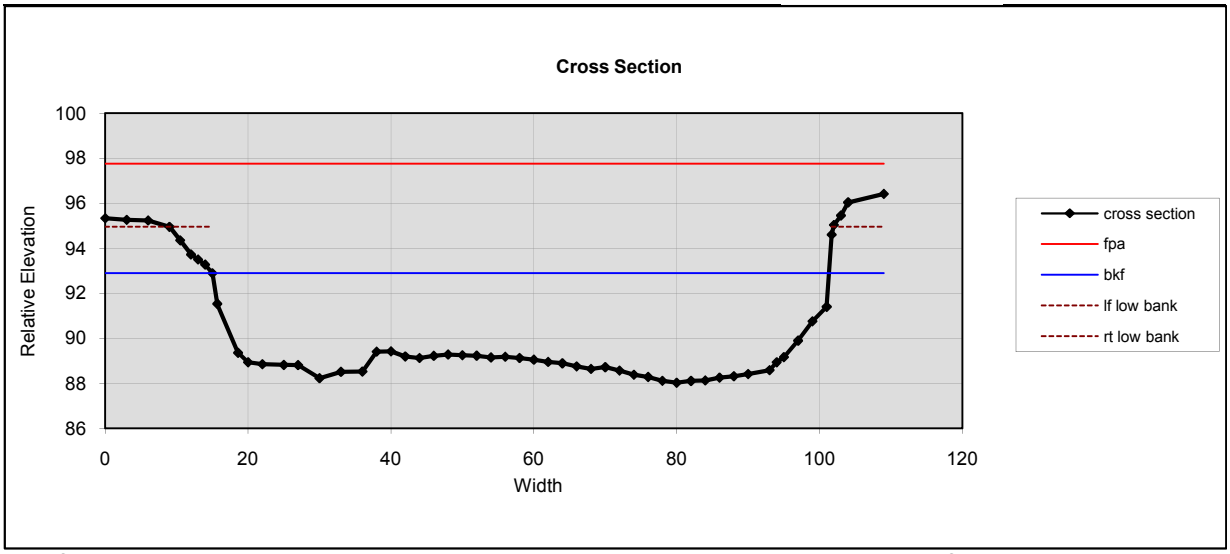
09RG-4-04A-2009



Size (mm)	
D16	0.062
D35	0.27
D50	1.1
D65	7.8
D84	41
D95	150

Size Distribution	
mean	1.6
dispersion	27.5
skewness	0.1

Type	
silt/clay	31%
sand	24%
gravel	32%
cobble	12%
boulder	0%
bedrock	1%



Bankfull Dimensions	
339.1	x-section area (ft.sq.)
86.3	width (ft)
3.9	mean depth (ft)
4.9	max depth (ft)
90.0	wetted perimeter (ft)
3.8	hydraulic radius (ft)
22.0	width-depth ratio

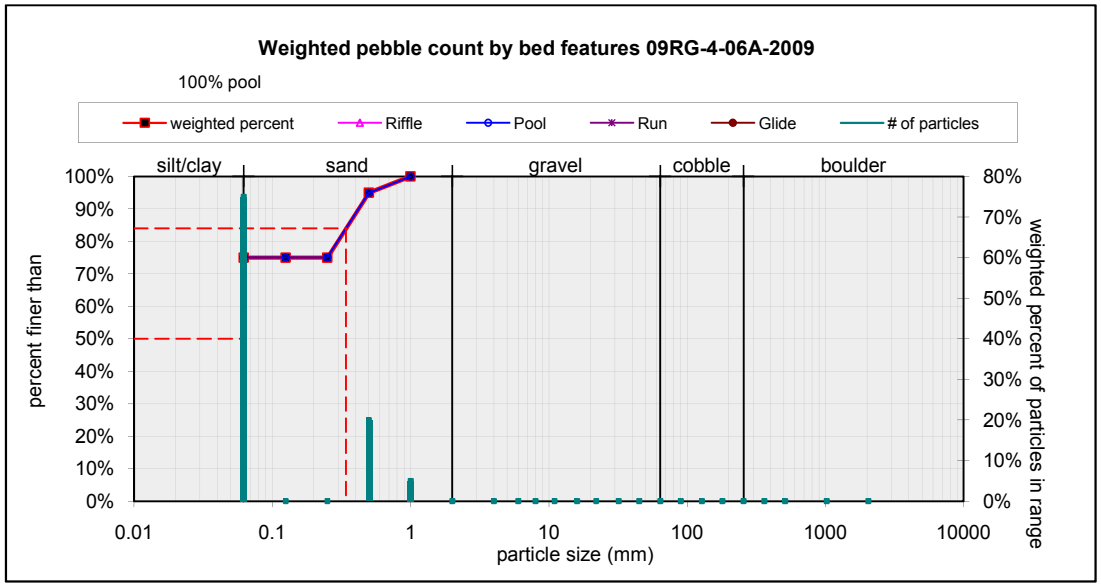
Flood Dimensions	
350.0	Width flood prone area (ft)
4.1	entrenchment ratio
6.9	low bank height (ft)
1.4	low bank height ratio

Flow Resistance	
0.029	Manning's roughness

Bankfull Flow	
5.3	velocity (ft/s)
1806.6	discharge rate (cfs)
0.2	channel slope (%)

Sinuosity	Channel Type
1.00	C4

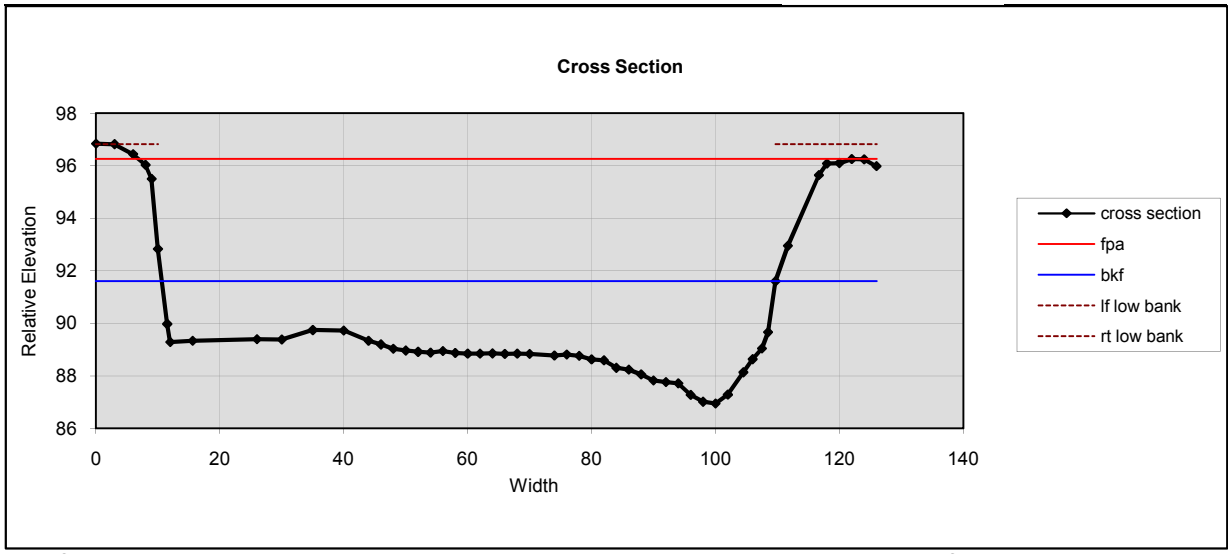
09RG-4-06A-2009



Size (mm)	
D16	0.062
D35	0.062
D50	0.062
D65	0.062
D84	0.34
D95	0.5

Size Distribution	
mean	0.1
dispersion	3.2
skewness	0.4

Type	
silt/clay	75%
sand	25%
gravel	0%
cobble	0%
boulder	0%
bedrock	



Bankfull Dimensions	
273.8	x-section area (ft.sq.)
99.1	width (ft)
2.8	mean depth (ft)
4.7	max depth (ft)
102.1	wetted perimeter (ft)
2.7	hydraulic radius (ft)
35.8	width-depth ratio

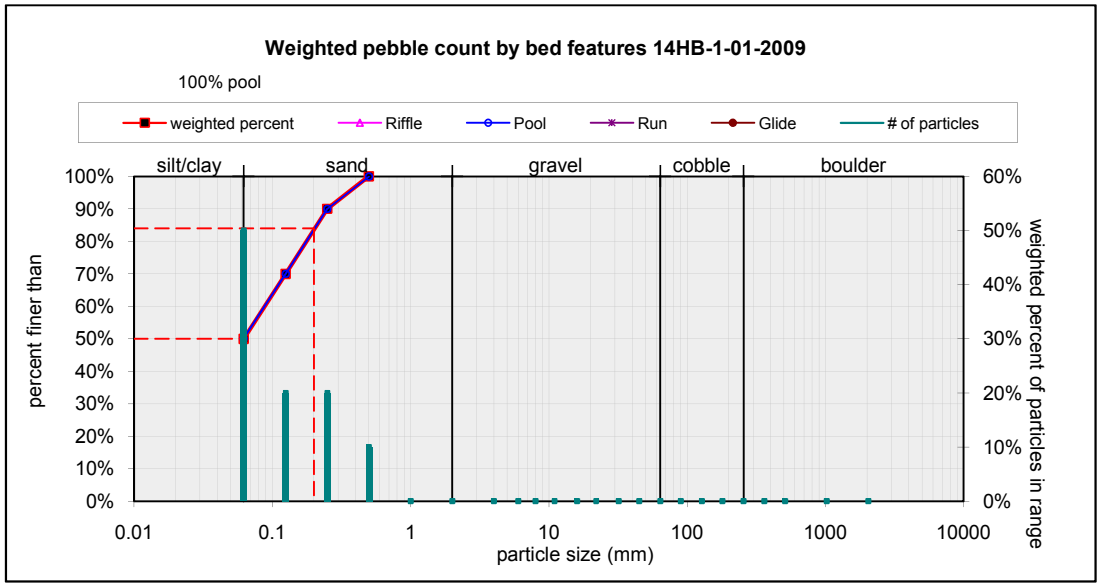
Flood Dimensions	
119.1	Width flood prone area (ft)
1.2	entrenchment ratio
9.9	low bank height (ft)
2.1	low bank height ratio

Flow Resistance	
0.014	Manning's roughness

Bankfull Flow	
0.7	velocity (ft/s)
182.9	discharge rate (cfs)
0.0	channel slope (%)

Sinuosity	Channel Type
1.00	F6

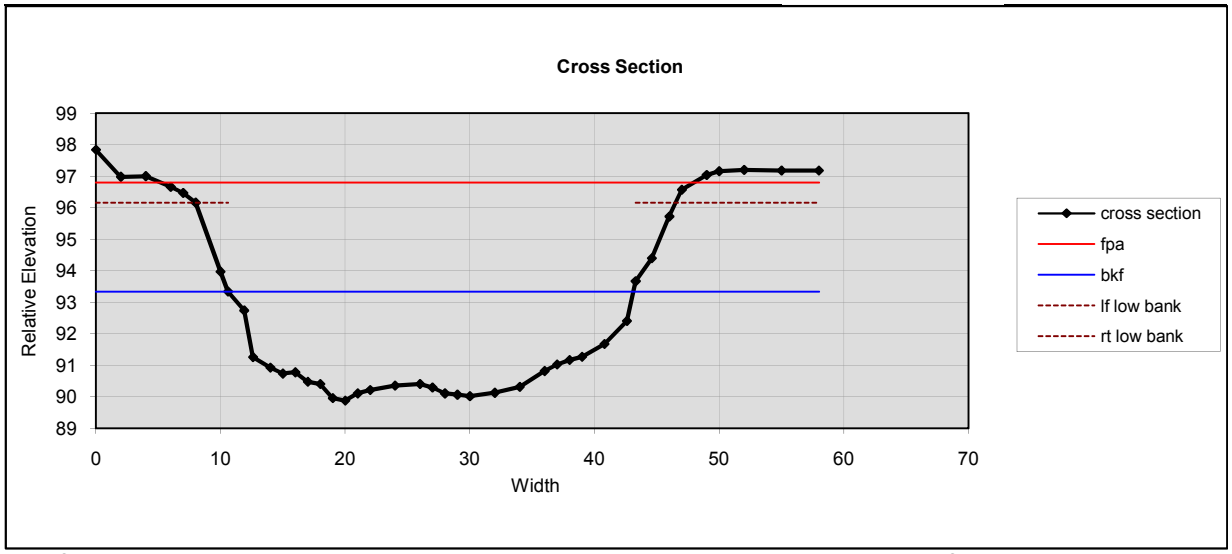
14HB-1-01-2009



Size (mm)	
D16	0.062
D35	0.062
D50	0.062
D65	0.1
D84	0.2
D95	0.35

Size Distribution	
mean	0.1
dispersion	2.1
skewness	0.4

Type	
silt/clay	50%
sand	50%
gravel	0%
cobble	0%
boulder	0%
bedrock	



Bankfull Dimensions	
83.9	x-section area (ft.sq.)
32.5	width (ft)
2.6	mean depth (ft)
3.5	max depth (ft)
34.7	wetted perimeter (ft)
2.4	hydraulic radius (ft)
12.6	width-depth ratio

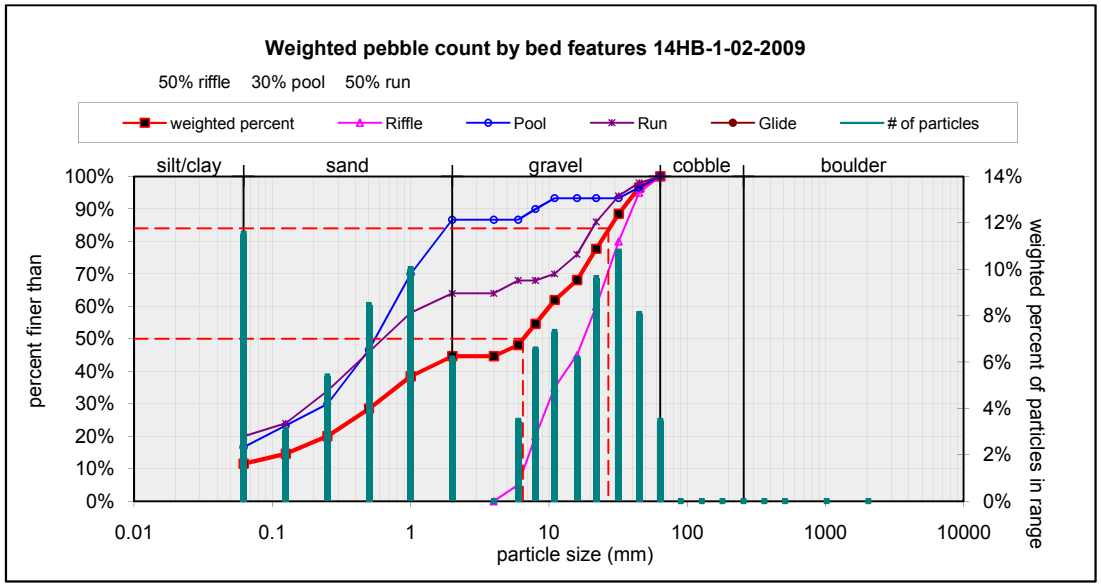
Flood Dimensions	
42.8	Width flood prone area (ft)
1.3	entrenchment ratio
6.3	low bank height (ft)
1.8	low bank height ratio

Flow Resistance	
0.013	Manning's roughness

Bankfull Flow	
2.5	velocity (ft/s)
207.4	discharge rate (cfs)
0.0	channel slope (%)

Sinuosity	Channel Type
1.03	F5

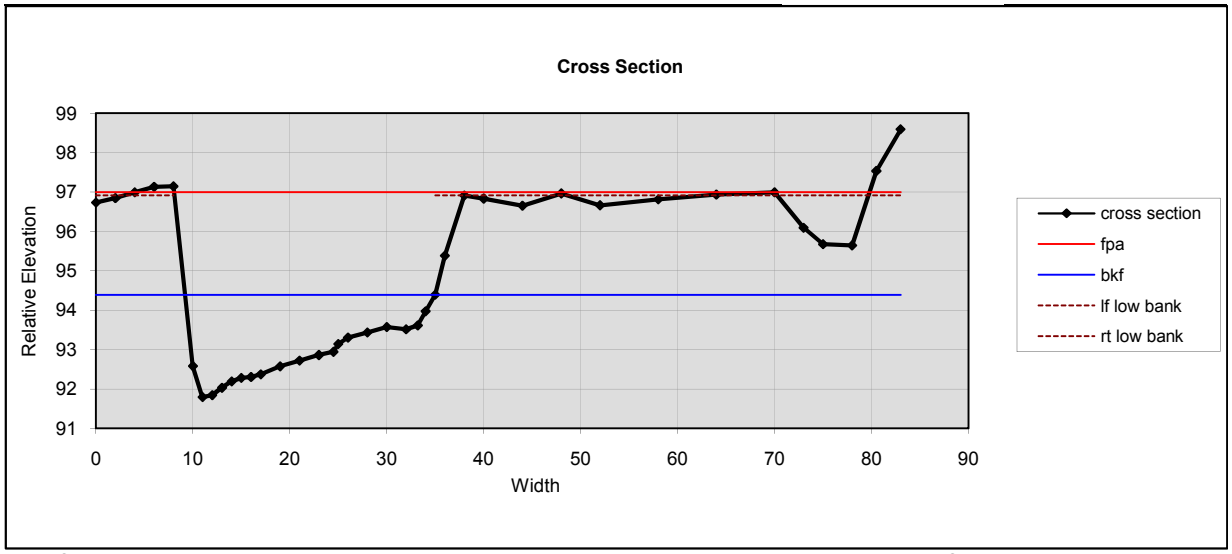
14HB-1-02-2009



Size (mm)	
D16	0.15
D35	0.79
D50	6.5
D65	13
D84	27
D95	42

Size Distribution	
mean	2.0
dispersion	23.7
skewness	-0.3

Type	
silt/clay	12%
sand	33%
gravel	55%
cobble	0%
boulder	0%
bedrock	



Bankfull Dimensions	
38.4	x-section area (ft.sq.)
25.8	width (ft)
1.5	mean depth (ft)
2.6	max depth (ft)
27.5	wetted perimeter (ft)
1.4	hydraulic radius (ft)
17.3	width-depth ratio

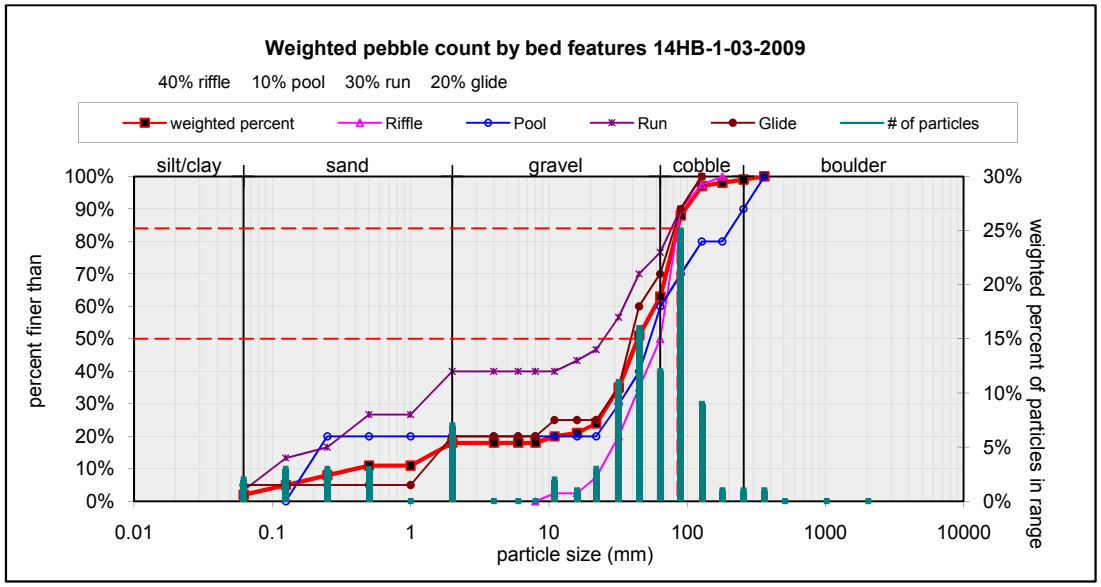
Flood Dimensions	
66.0	Width flood prone area (ft)
2.6	entrenchment ratio
5.1	low bank height (ft)
2.0	low bank height ratio

Flow Resistance	
0.029	Manning's roughness

Bankfull Flow	
2.5	velocity (ft/s)
95.6	discharge rate (cfs)
0.2	channel slope (%)

Sinuosity	Channel Type
---	C4

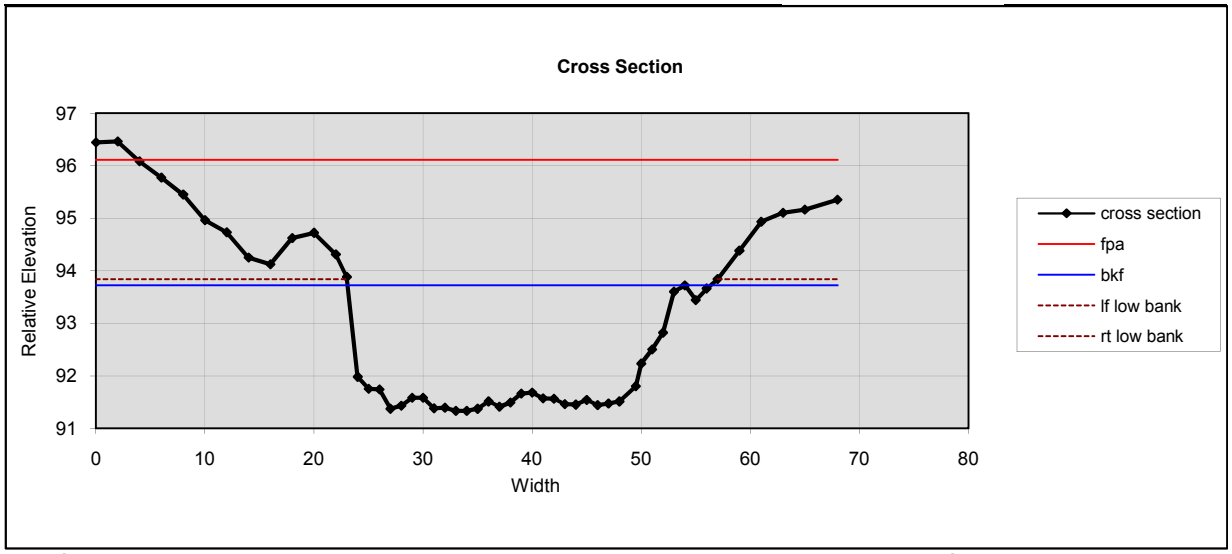
14HB-1-03-2009



Size (mm)	
D16	1.6
D35	32
D50	44
D65	66
D84	85
D95	120

Size Distribution	
mean	11.7
dispersion	14.7
skewness	-0.4

Type	
silt/clay	2%
sand	16%
gravel	45%
cobble	36%
boulder	1%
bedrock	



Bankfull Dimensions	
61.1	x-section area (ft.sq.)
33.2	width (ft)
1.8	mean depth (ft)
2.4	max depth (ft)
35.1	wetted perimeter (ft)
1.7	hydraulic radius (ft)
18.1	width-depth ratio

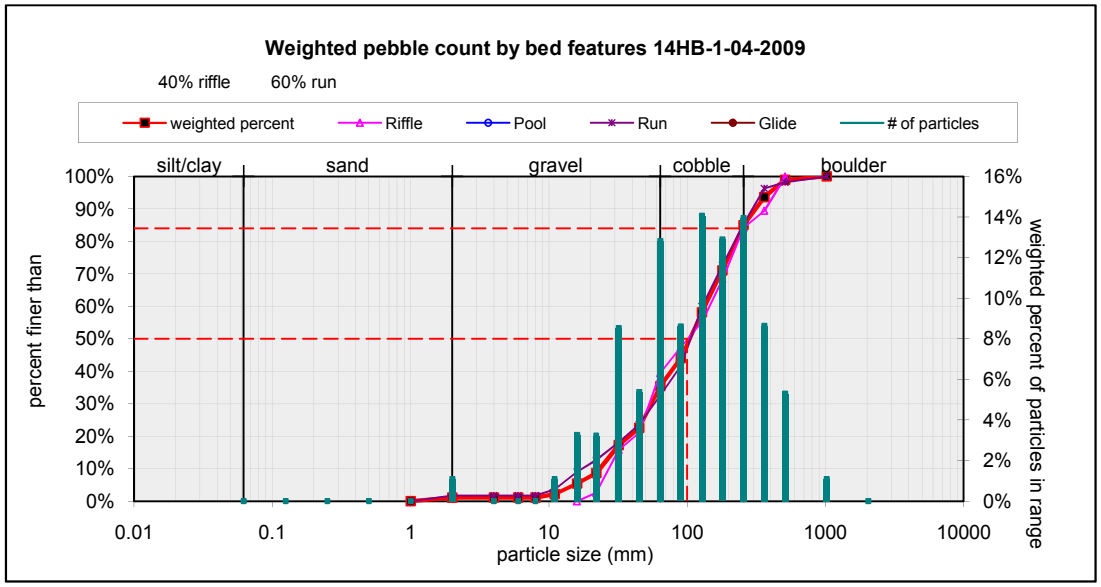
Flood Dimensions	
62.0	Width flood prone area (ft)
1.9	entrenchment ratio
2.5	low bank height (ft)
1.1	low bank height ratio

Flow Resistance	
0.038	Manning's roughness

Bankfull Flow	
3.6	velocity (ft/s)
219.2	discharge rate (cfs)
0.4	channel slope (%)

Sinuosity	Channel Type
1.18	C4

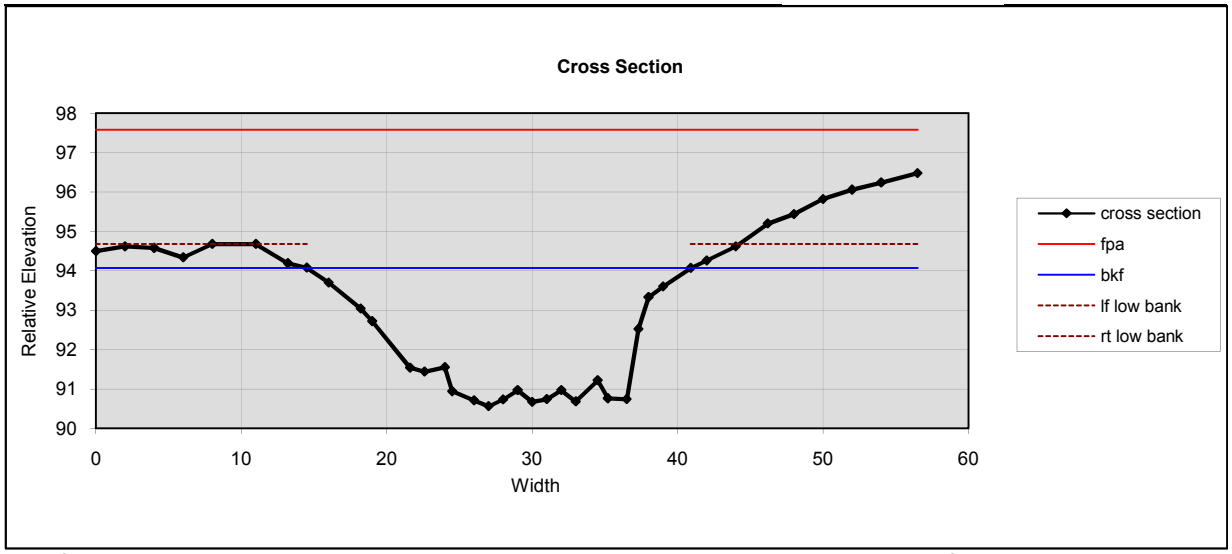
14HB-1-04-2009



Size (mm)	
D16	30
D35	63
D50	100
D65	150
D84	250
D95	400

Size Distribution	
mean	86.6
dispersion	2.9
skewness	-0.1

Type	
silt/clay	0%
sand	1%
gravel	32%
cobble	46%
boulder	14%
bedrock	5%



Bankfull Dimensions	
58.4	x-section area (ft.sq.)
26.4	width (ft)
2.2	mean depth (ft)
3.5	max depth (ft)
29.2	wetted perimeter (ft)
2.0	hydraulic radius (ft)
11.9	width-depth ratio

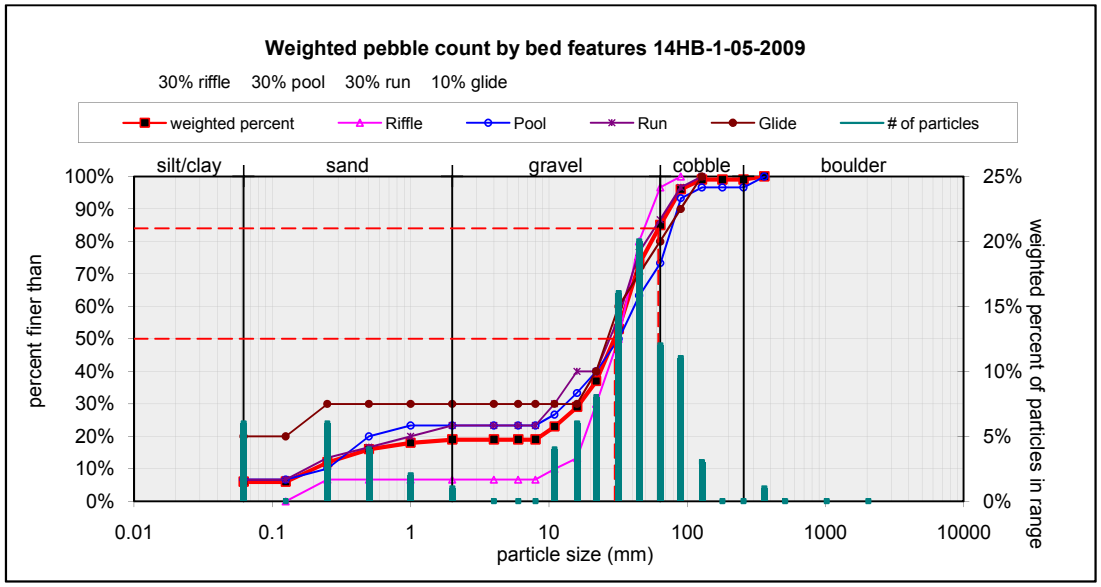
Flood Dimensions	
139.0	Width flood prone area (ft)
5.3	entrenchment ratio
4.1	low bank height (ft)
1.2	low bank height ratio

Flow Resistance	
0.053	Manning's roughness

Bankfull Flow	
3.3	velocity (ft/s)
191.2	discharge rate (cfs)
0.5	channel slope (%)

Sinuosity	Channel Type
1.08	C3

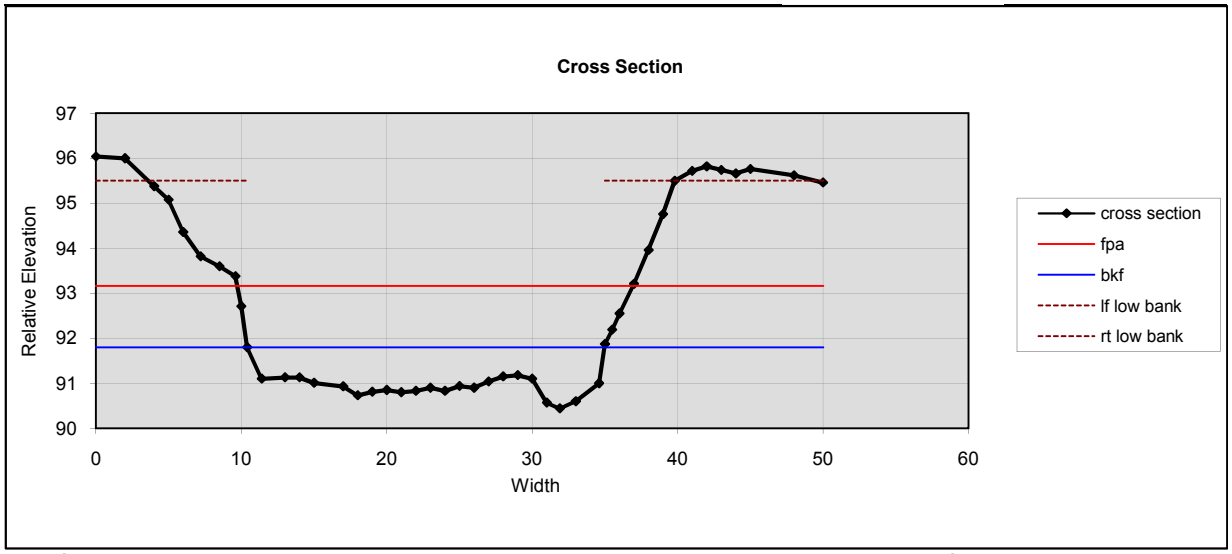
14HB-1-05-2009



Size (mm)	
D16	0.5
D35	20
D50	30
D65	39
D84	62
D95	87

Size Distribution	
mean	5.6
dispersion	31.0
skewness	-0.5

Type	
silt/clay	6%
sand	13%
gravel	66%
cobble	14%
boulder	1%
bedrock	



Bankfull Dimensions	
21.2	x-section area (ft.sq.)
24.6	width (ft)
0.9	mean depth (ft)
1.4	max depth (ft)
25.6	wetted perimeter (ft)
0.8	hydraulic radius (ft)
28.4	width-depth ratio

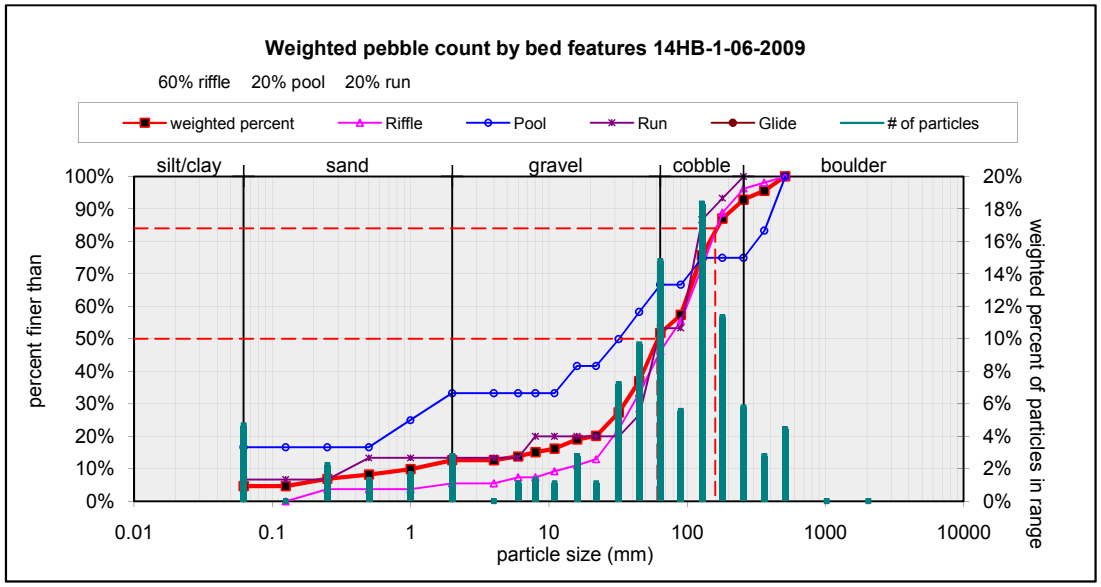
Flood Dimensions	
27.2	Width flood prone area (ft)
1.1	entrenchment ratio
5.1	low bank height (ft)
3.7	low bank height ratio

Flow Resistance	
0.035	Manning's roughness

Bankfull Flow	
2.5	velocity (ft/s)
53.6	discharge rate (cfs)
0.4	channel slope (%)

Sinuosity	Channel Type
1.03	F4

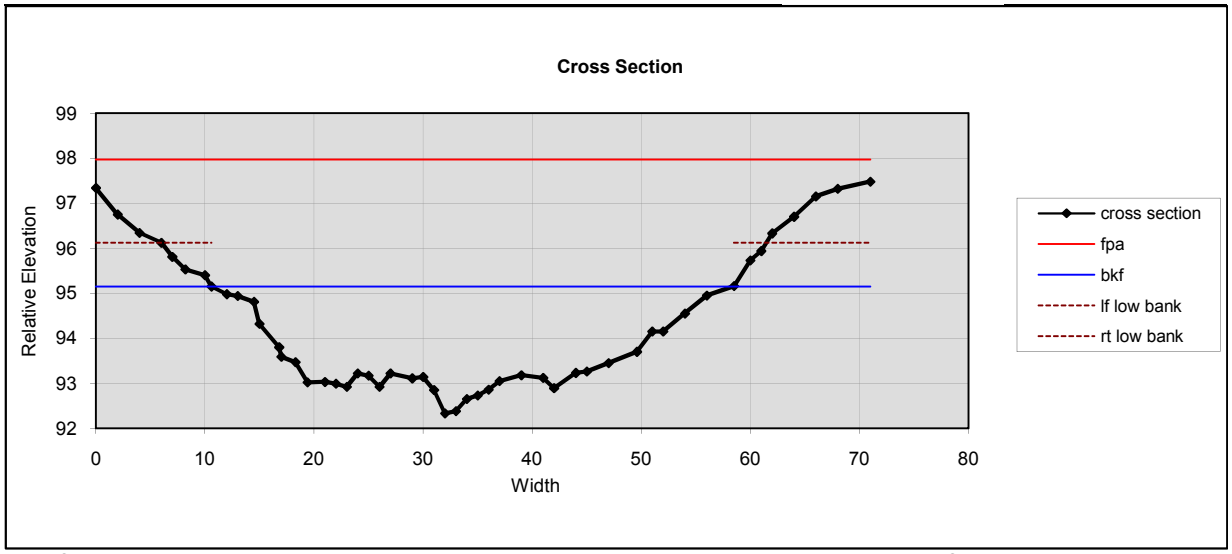
14HB-1-06-2009



Size (mm)	
D16	10
D35	42
D50	61
D65	100
D84	160
D95	340

Size Distribution	
mean	40.0
dispersion	4.4
skewness	-0.2

Type	
silt/clay	4%
sand	6%
gravel	31%
cobble	33%
boulder	6%
bedrock	10%



Bankfull Dimensions	
75.9	x-section area (ft.sq.)
47.8	width (ft)
1.6	mean depth (ft)
2.8	max depth (ft)
48.9	wetted perimeter (ft)
1.6	hydraulic radius (ft)
30.1	width-depth ratio

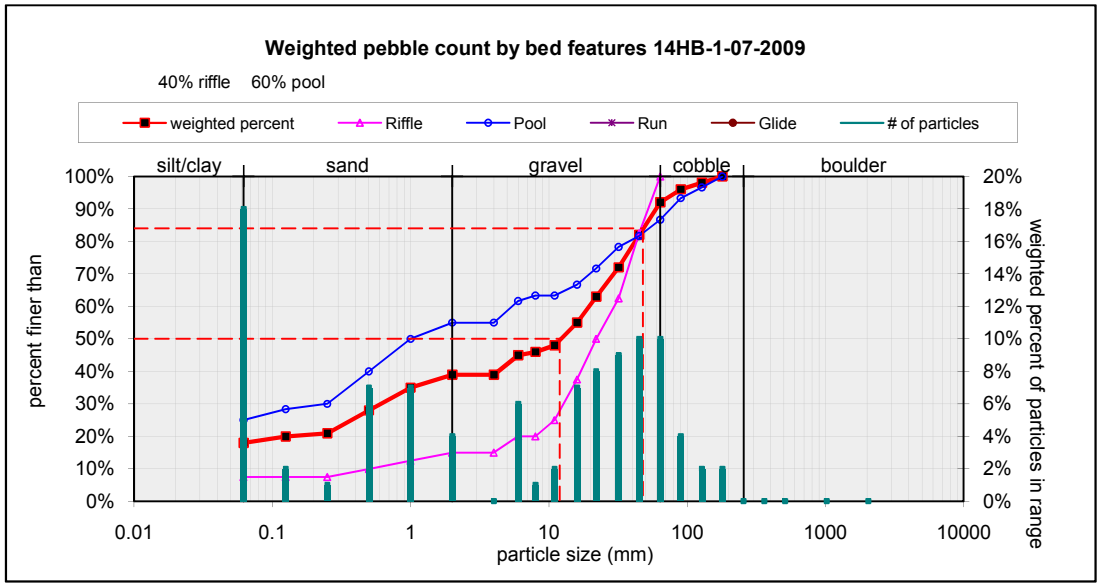
Flood Dimensions	
103.0	Width flood prone area (ft)
2.2	entrenchment ratio
3.8	low bank height (ft)
1.3	low bank height ratio

Flow Resistance	
0.047	Manning's roughness

Bankfull Flow	
7.3	velocity (ft/s)
554.0	discharge rate (cfs)
2.9	channel slope (%)

Sinuosity	Channel Type
1.12	B3

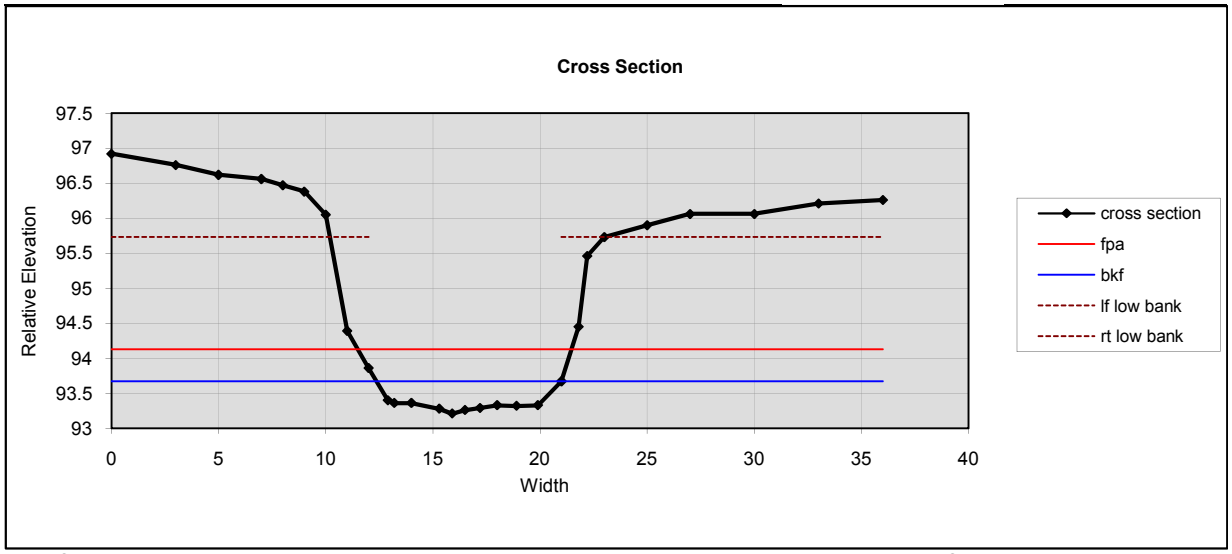
14HB-1-07-2009



Size (mm)	
D16	0.062
D35	1
D50	12
D65	24
D84	48
D95	83

Size Distribution	
mean	1.7
dispersion	98.8
skewness	-0.5

Type	
silt/clay	18%
sand	21%
gravel	53%
cobble	8%
boulder	0%
bedrock	



Bankfull Dimensions	
2.8	x-section area (ft.sq.)
8.6	width (ft)
0.3	mean depth (ft)
0.5	max depth (ft)
8.8	wetted perimeter (ft)
0.3	hydraulic radius (ft)
26.7	width-depth ratio

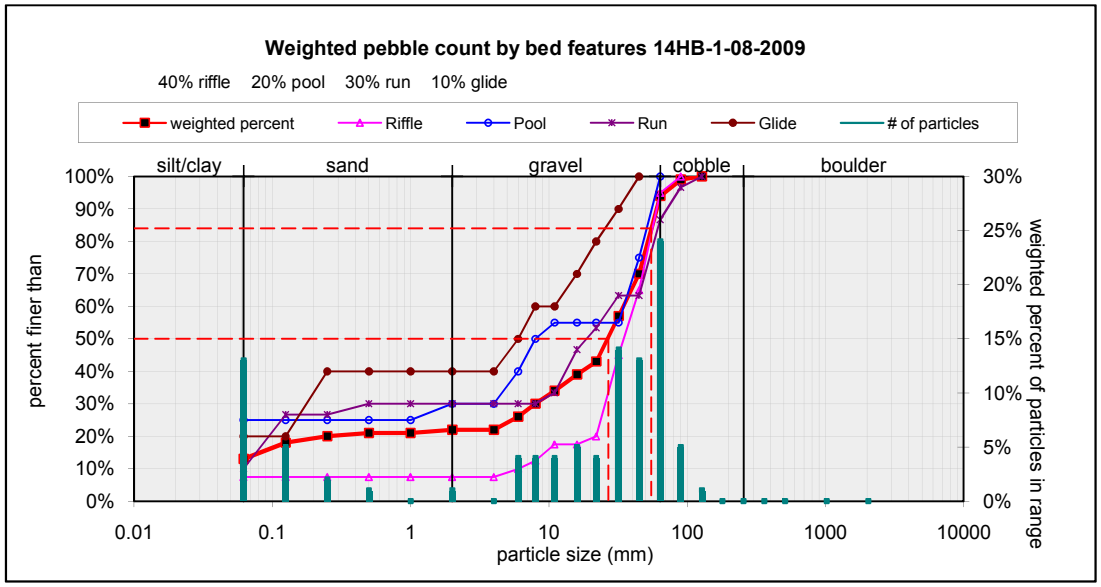
Flood Dimensions	
10.0	Width flood prone area (ft)
1.2	entrenchment ratio
2.5	low bank height (ft)
5.5	low bank height ratio

Flow Resistance	
0.043	Manning's roughness

Bankfull Flow	
1.7	velocity (ft/s)
4.7	discharge rate (cfs)
1.1	channel slope (%)

Sinuosity	Channel Type
1.34	F4

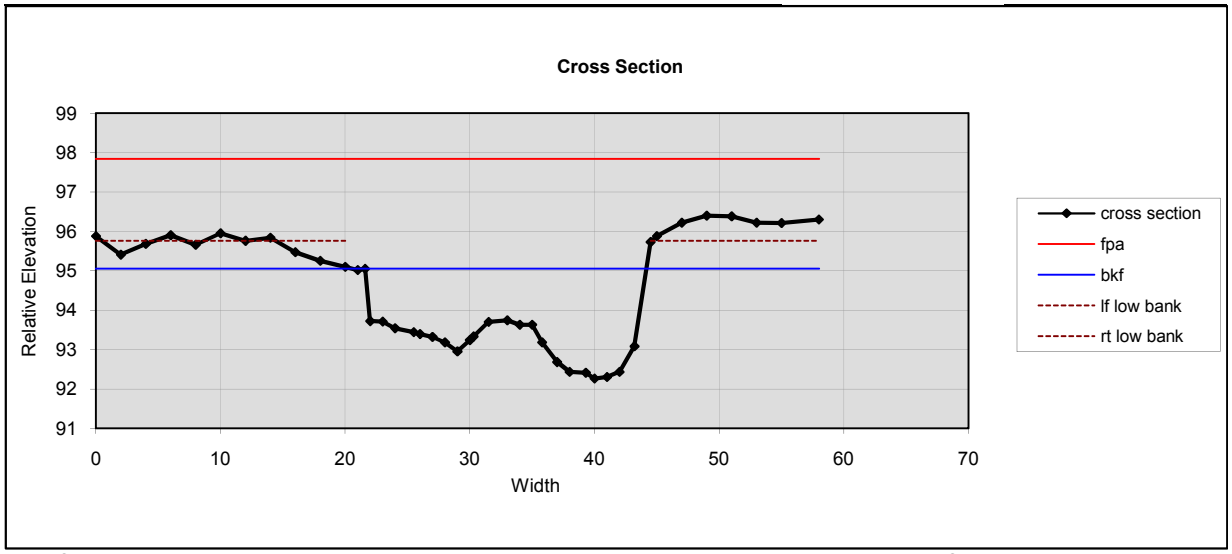
14HB-1-08-2009



Size (mm)	
D16	0.094
D35	12
D50	27
D65	39
D84	55
D95	69

Size Distribution	
mean	2.3
dispersion	144.6
skewness	-0.6

Type	
silt/clay	13%
sand	9%
gravel	72%
cobble	6%
boulder	0%
bedrock	



Bankfull Dimensions	
41.6	x-section area (ft.sq.)
23.5	width (ft)
1.8	mean depth (ft)
2.8	max depth (ft)
26.4	wetted perimeter (ft)
1.6	hydraulic radius (ft)
13.3	width-depth ratio

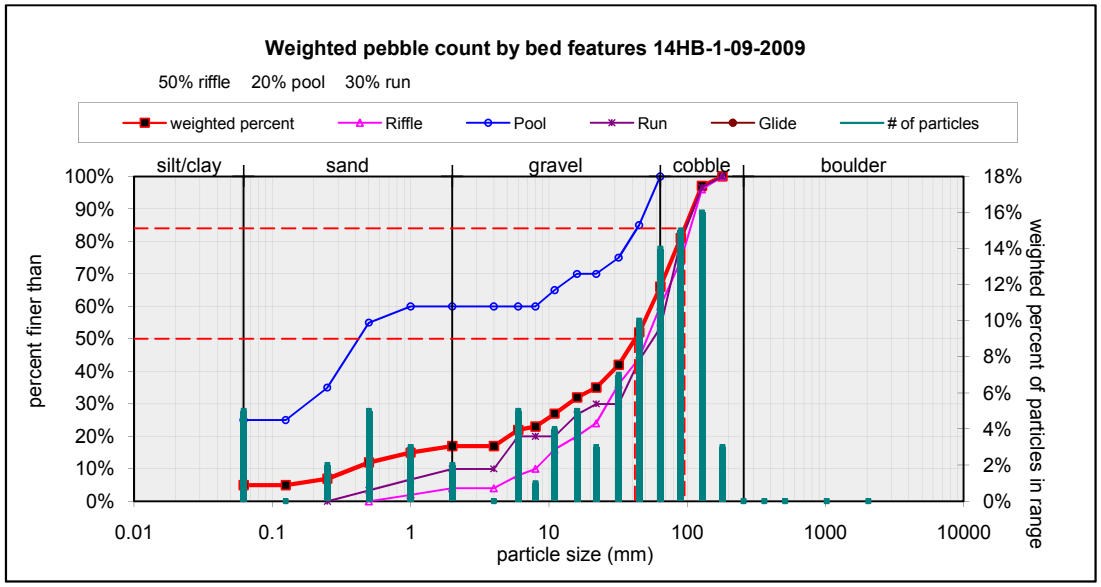
Flood Dimensions	
175.0	Width flood prone area (ft)
7.4	entrenchment ratio
3.5	low bank height (ft)
1.3	low bank height ratio

Flow Resistance	
0.033	Manning's roughness

Bankfull Flow	
5.3	velocity (ft/s)
219.0	discharge rate (cfs)
0.7	channel slope (%)

Sinuosity	Channel Type
1.10	C4

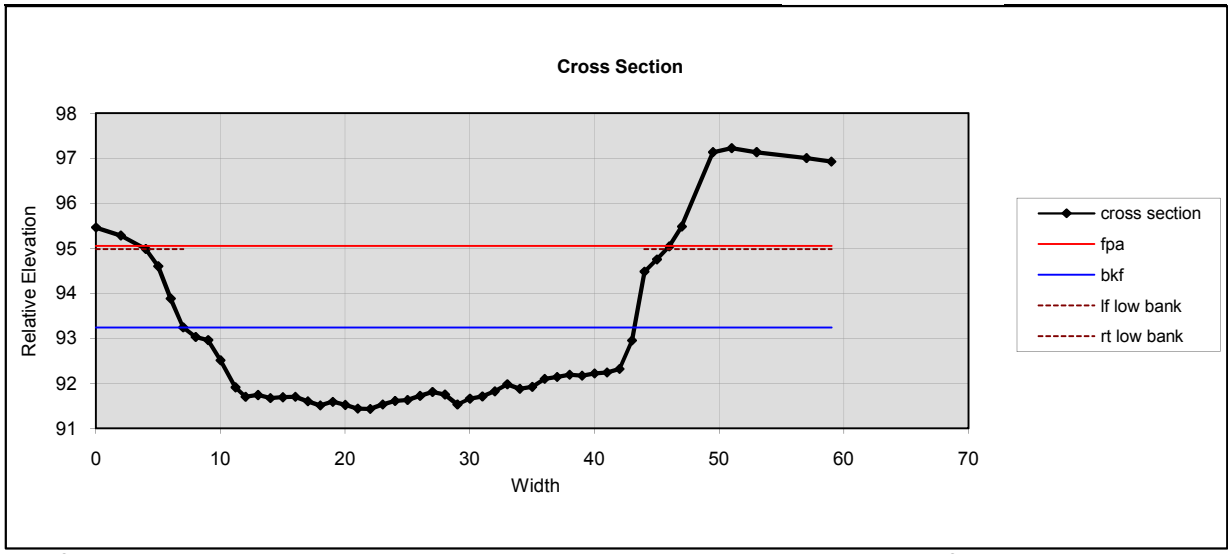
14HB-1-09-2009



Size (mm)	
D16	1.4
D35	22
D50	42
D65	62
D84	96
D95	120

Size Distribution	
mean	11.6
dispersion	16.1
skewness	-0.4

Type	
silt/clay	5%
sand	12%
gravel	49%
cobble	34%
boulder	0%
bedrock	



Bankfull Dimensions	
47.6	x-section area (ft.sq.)
36.2	width (ft)
1.3	mean depth (ft)
1.8	max depth (ft)
36.9	wetted perimeter (ft)
1.3	hydraulic radius (ft)
27.5	width-depth ratio

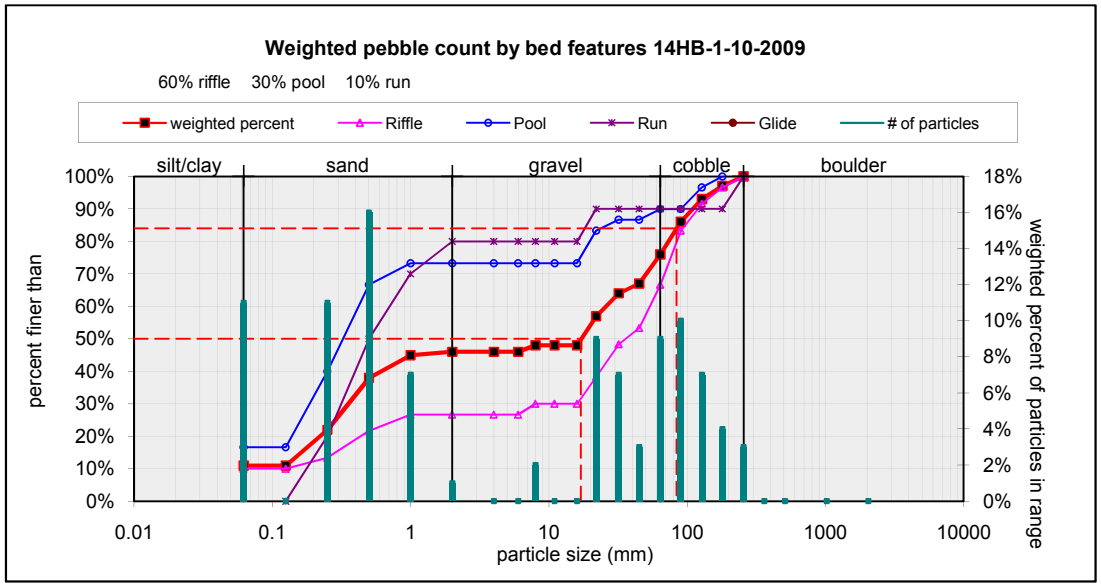
Flood Dimensions	
5.0	Width flood prone area (ft)
0.1	entrenchment ratio
3.6	low bank height (ft)
2.0	low bank height ratio

Flow Resistance	
0.043	Manning's roughness

Bankfull Flow	
4.5	velocity (ft/s)
212.2	discharge rate (cfs)
1.2	channel slope (%)

Sinuosity	Channel Type
1.02	F4

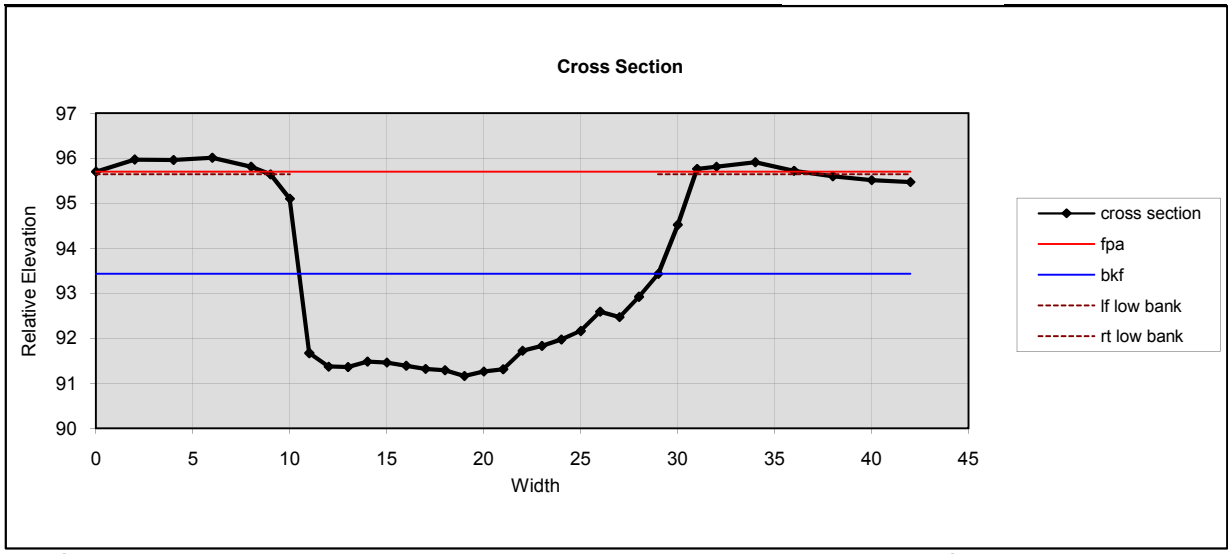
14HB-1-10-2009



Size (mm)	
D16	0.17
D35	0.44
D50	17
D65	36
D84	84
D95	150

Size Distribution	
mean	3.8
dispersion	52.5
skewness	-0.4

Type	
silt/clay	11%
sand	35%
gravel	30%
cobble	24%
boulder	0%
bedrock	



Bankfull Dimensions	
30.6	x-section area (ft.sq.)
18.5	width (ft)
1.7	mean depth (ft)
2.3	max depth (ft)
20.3	wetted perimeter (ft)
1.5	hydraulic radius (ft)
11.2	width-depth ratio

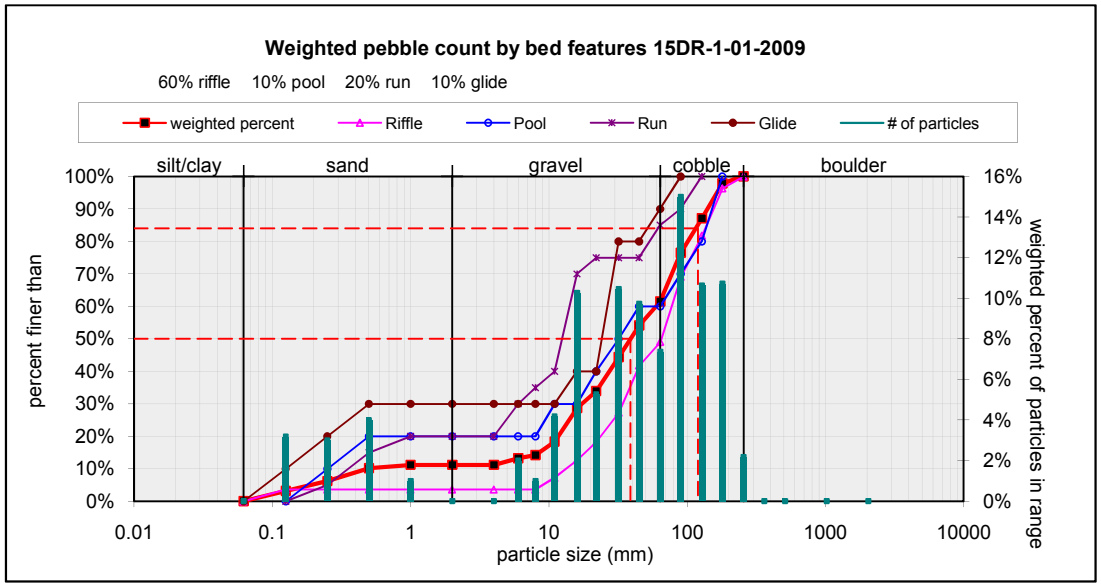
Flood Dimensions	
22.5	Width flood prone area (ft)
1.2	entrenchment ratio
4.5	low bank height (ft)
2.0	low bank height ratio

Flow Resistance	
0.039	Manning's roughness

Bankfull Flow	
4.2	velocity (ft/s)
128.9	discharge rate (cfs)
0.7	channel slope (%)

Sinuosity	Channel Type
1.07	F4

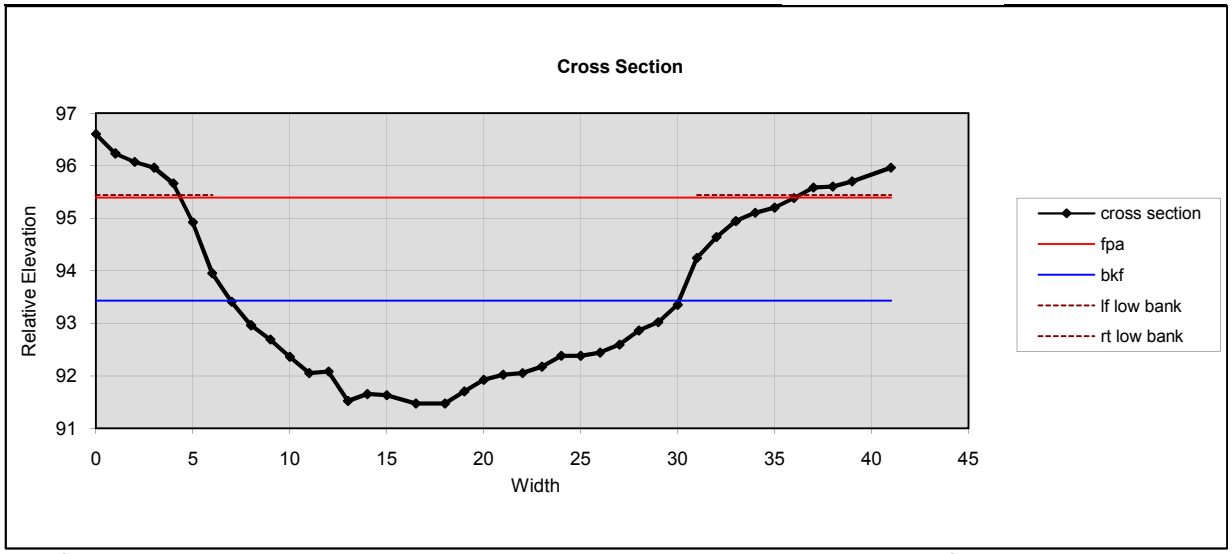
15DR-1-01-2009



Size (mm)	
D16	9.2
D35	23
D50	39
D65	69
D84	120
D95	160

Size Distribution	
mean	33.2
dispersion	3.7
skewness	-0.1

Type	
silt/clay	0%
sand	11%
gravel	48%
cobble	37%
boulder	0%
bedrock	8%



Bankfull Dimensions	
28.6	x-section area (ft.sq.)
23.1	width (ft)
1.2	mean depth (ft)
2.0	max depth (ft)
23.8	wetted perimeter (ft)
1.2	hydraulic radius (ft)
18.7	width-depth ratio

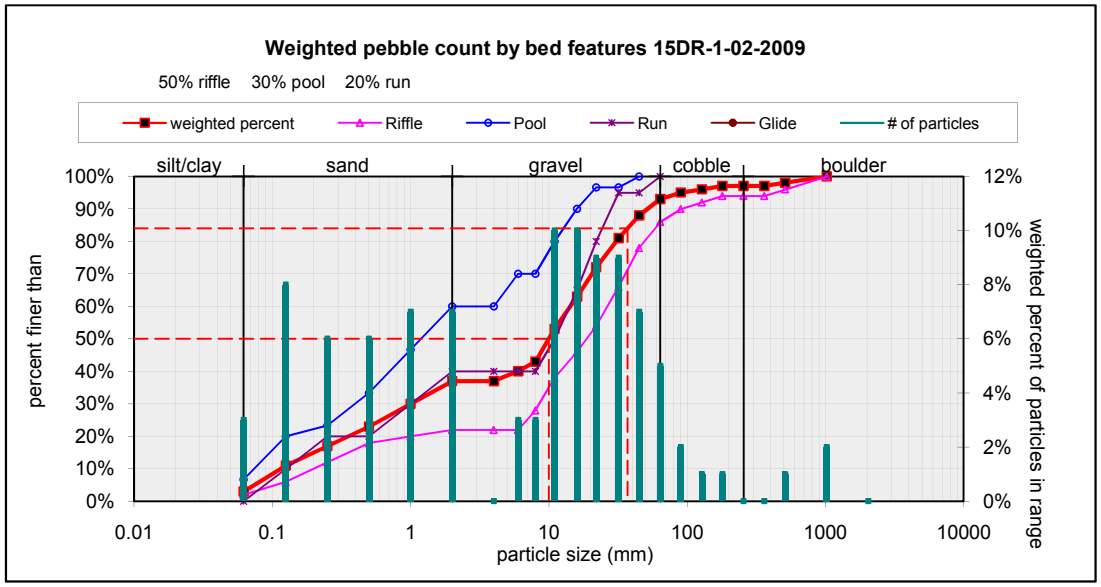
Flood Dimensions	
60.0	Width flood prone area (ft)
2.6	entrenchment ratio
4.0	low bank height (ft)
2.0	low bank height ratio

Flow Resistance	
0.046	Manning's roughness

Bankfull Flow	
3.4	velocity (ft/s)
97.2	discharge rate (cfs)
0.9	channel slope (%)

Sinuosity	Channel Type
1.06	C4

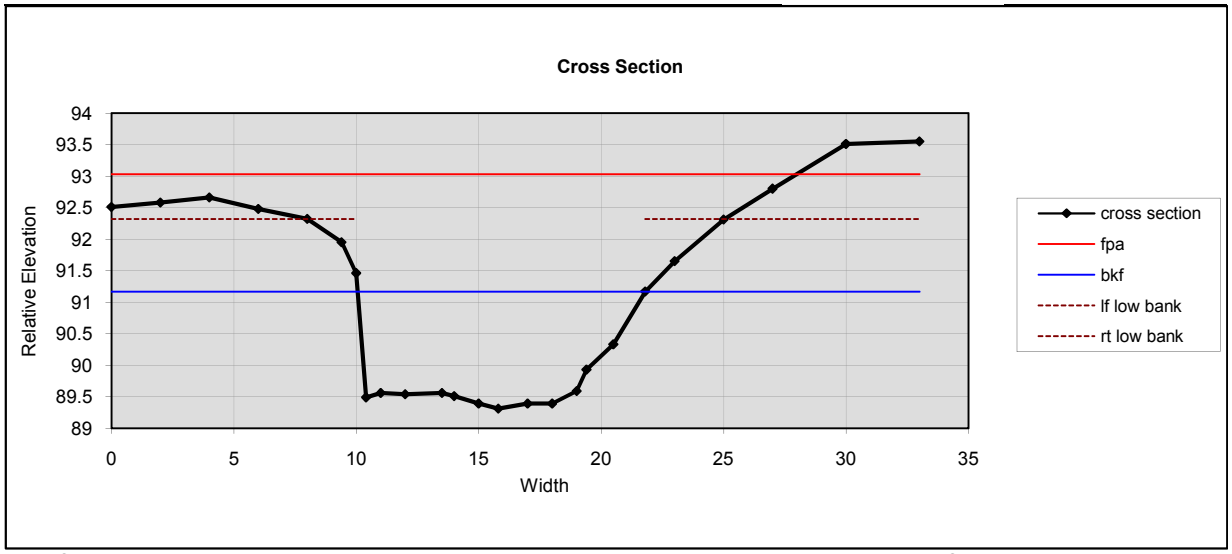
15DR-1-02-2009



Size (mm)	
D16	0.22
D35	1.6
D50	10
D65	17
D84	37
D95	90

Size Distribution	
mean	2.9
dispersion	24.6
skewness	-0.4

Type	
silt/clay	3%
sand	34%
gravel	56%
cobble	4%
boulder	3%
bedrock	



Bankfull Dimensions	
17.2	x-section area (ft.sq.)
11.7	width (ft)
1.5	mean depth (ft)
1.9	max depth (ft)
13.6	wetted perimeter (ft)
1.3	hydraulic radius (ft)
8.0	width-depth ratio

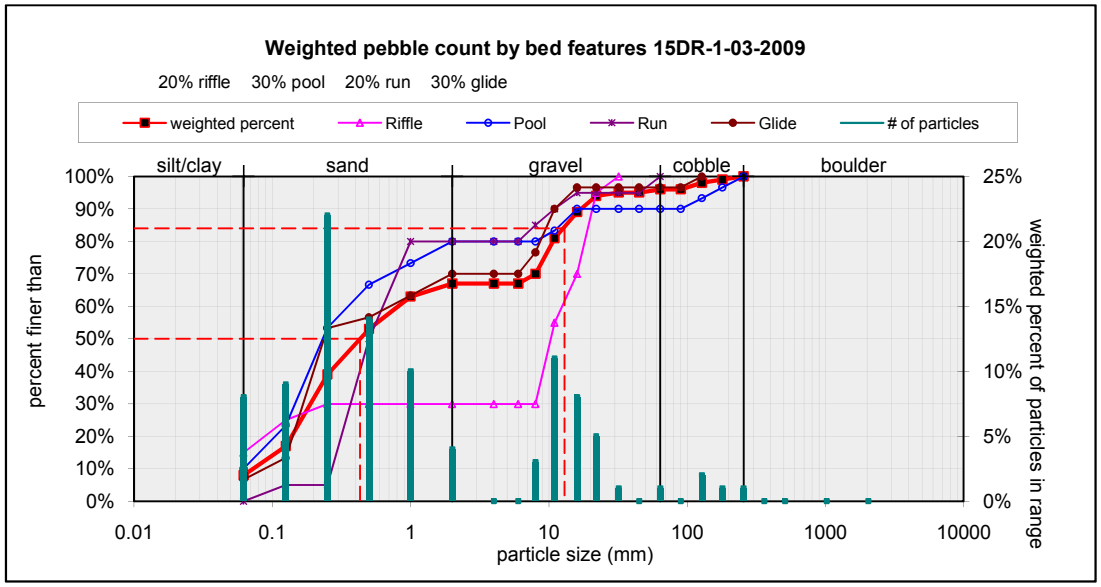
Flood Dimensions	
90.0	Width flood prone area (ft)
7.7	entrenchment ratio
3.0	low bank height (ft)
1.6	low bank height ratio

Flow Resistance	
0.035	Manning's roughness

Bankfull Flow	
5.0	velocity (ft/s)
85.7	discharge rate (cfs)
1.0	channel slope (%)

Sinuosity	Channel Type
1.17	C4

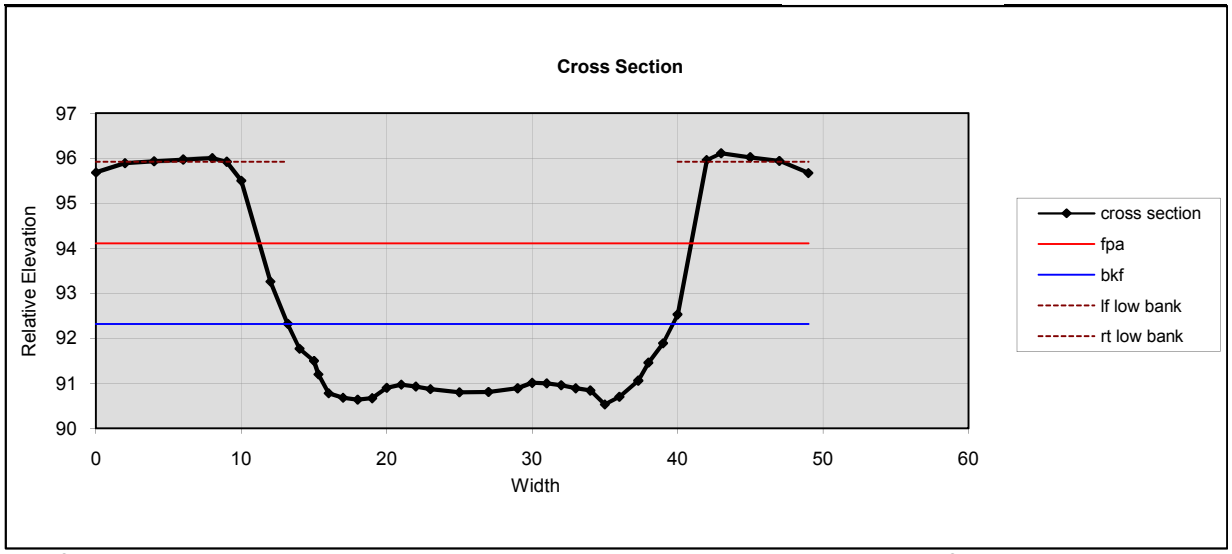
15DR-1-03-2009



Size (mm)	
D16	0.12
D35	0.22
D50	0.43
D65	1.4
D84	13
D95	#N/A

Size Distribution	
mean	1.2
dispersion	16.9
skewness	0.3

Type	
silt/clay	8%
sand	59%
gravel	29%
cobble	4%
boulder	0%
bedrock	



Bankfull Dimensions	
35.3	x-section area (ft.sq.)
26.5	width (ft)
1.3	mean depth (ft)
1.8	max depth (ft)
27.4	wetted perimeter (ft)
1.3	hydraulic radius (ft)
19.8	width-depth ratio

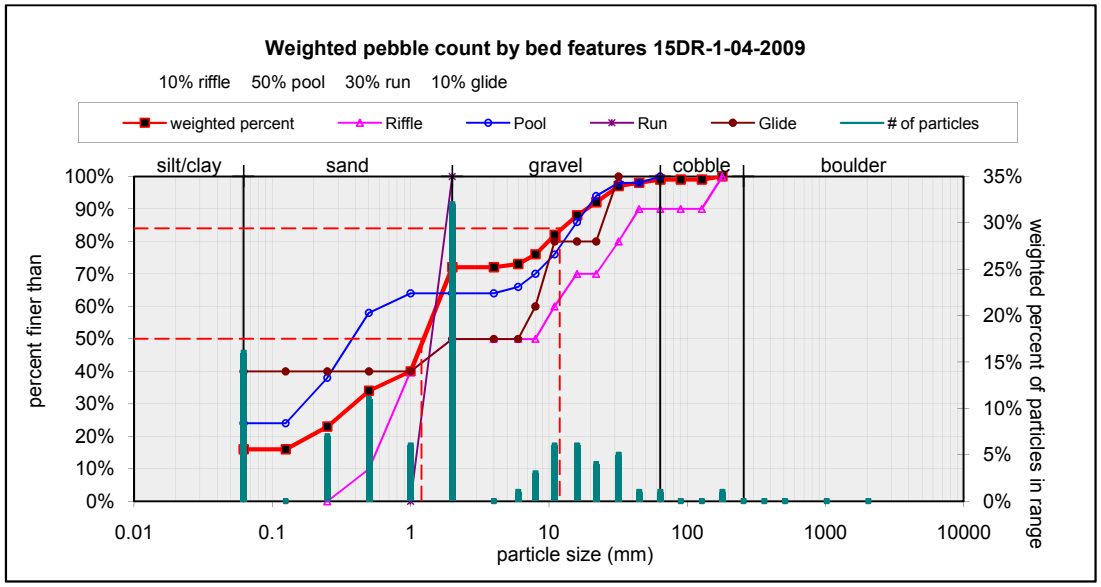
Flood Dimensions	
29.7	Width flood prone area (ft)
1.1	entrenchment ratio
5.4	low bank height (ft)
3.0	low bank height ratio

Flow Resistance	
0.026	Manning's roughness

Bankfull Flow	
4.0	velocity (ft/s)
139.8	discharge rate (cfs)
0.3	channel slope (%)

Sinuosity	Channel Type
1.03	F5

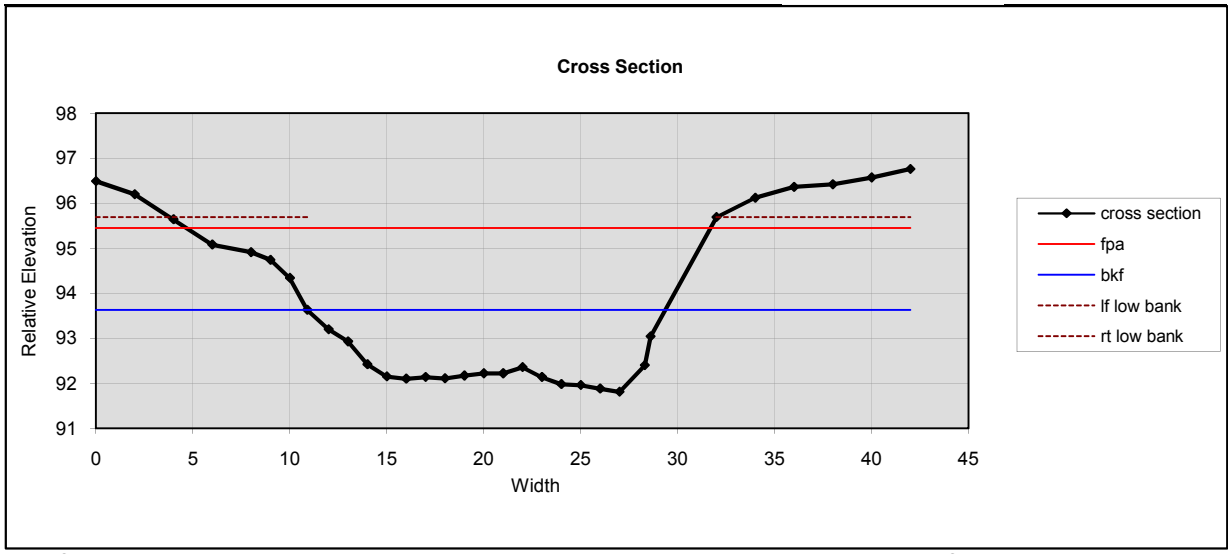
15DR-1-04-2009



Size (mm)	
D16	0.062
D35	0.56
D50	1.2
D65	1.7
D84	12
D95	28

Size Distribution	
mean	0.9
dispersion	14.7
skewness	-0.1

Type	
silt/clay	2%
sand	6%
gravel	3%
cobble	0%
boulder	0%
bedrock	



Bankfull Dimensions	
23.9	x-section area (ft.sq.)
18.5	width (ft)
1.3	mean depth (ft)
1.8	max depth (ft)
19.5	wetted perimeter (ft)
1.2	hydraulic radius (ft)
14.3	width-depth ratio

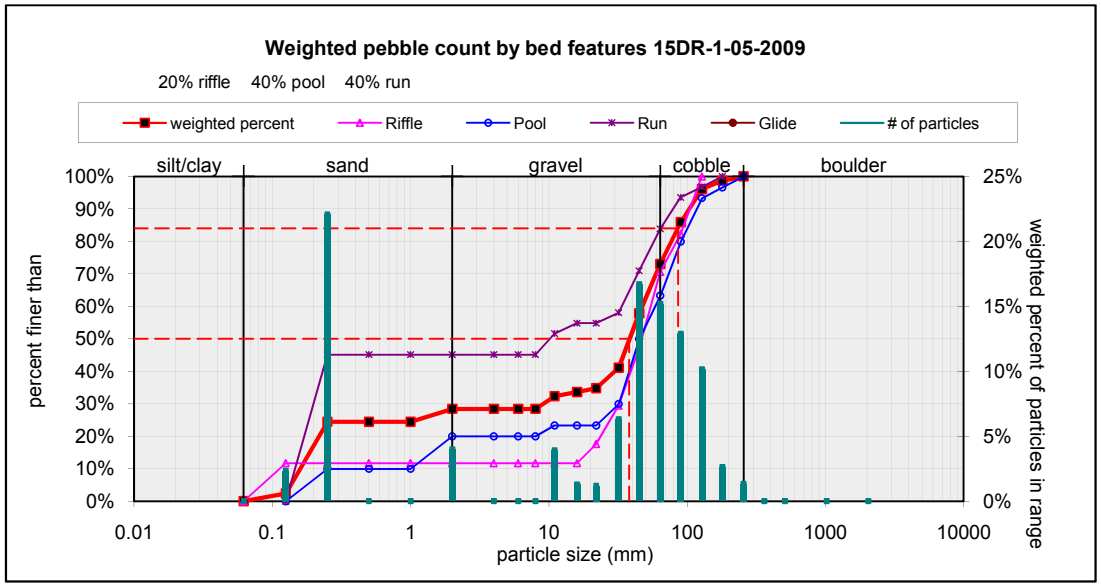
Flood Dimensions	
27.0	Width flood prone area (ft)
1.5	entrenchment ratio
3.9	low bank height (ft)
2.1	low bank height ratio

Flow Resistance	
0.030	Manning's roughness

Bankfull Flow	
0.5	velocity (ft/s)
11.0	discharge rate (cfs)
0.0	channel slope (%)

Sinuosity	Channel Type
1.07	F5

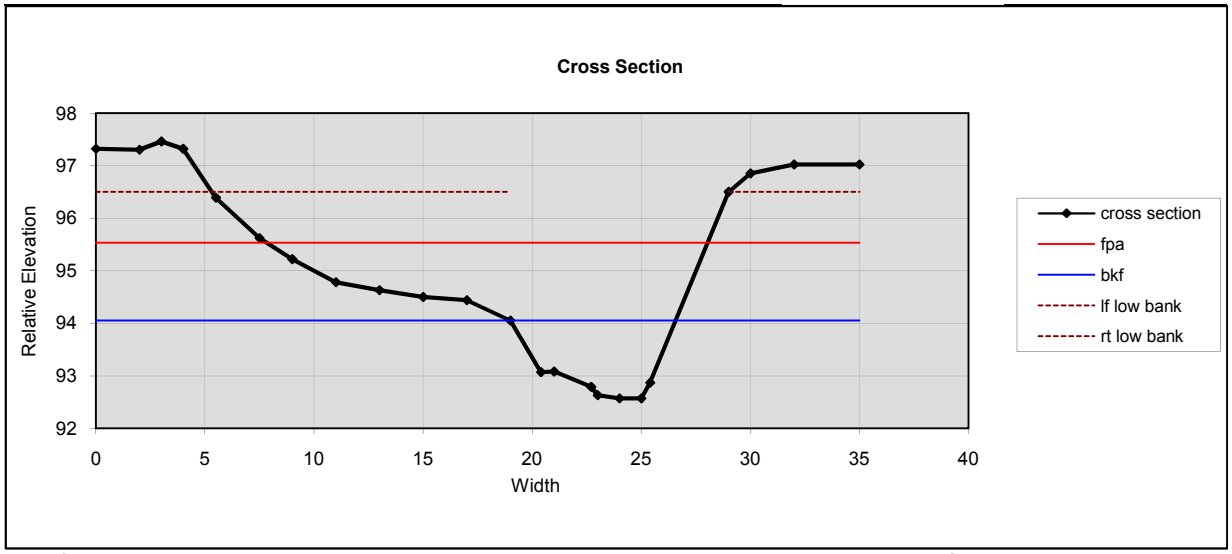
15DR-1-05-2009



Size (mm)	
D16	0.19
D35	22
D50	38
D65	53
D84	86
D95	120

Size Distribution	
mean	4.0
dispersion	101.1
skewness	-0.6

Type	
silt/clay	0%
sand	22%
gravel	35%
cobble	21%
boulder	0%
bedrock	



Bankfull Dimensions	
7.7	x-section area (ft.sq.)
7.6	width (ft)
1.0	mean depth (ft)
1.5	max depth (ft)
8.5	wetted perimeter (ft)
0.9	hydraulic radius (ft)
7.4	width-depth ratio

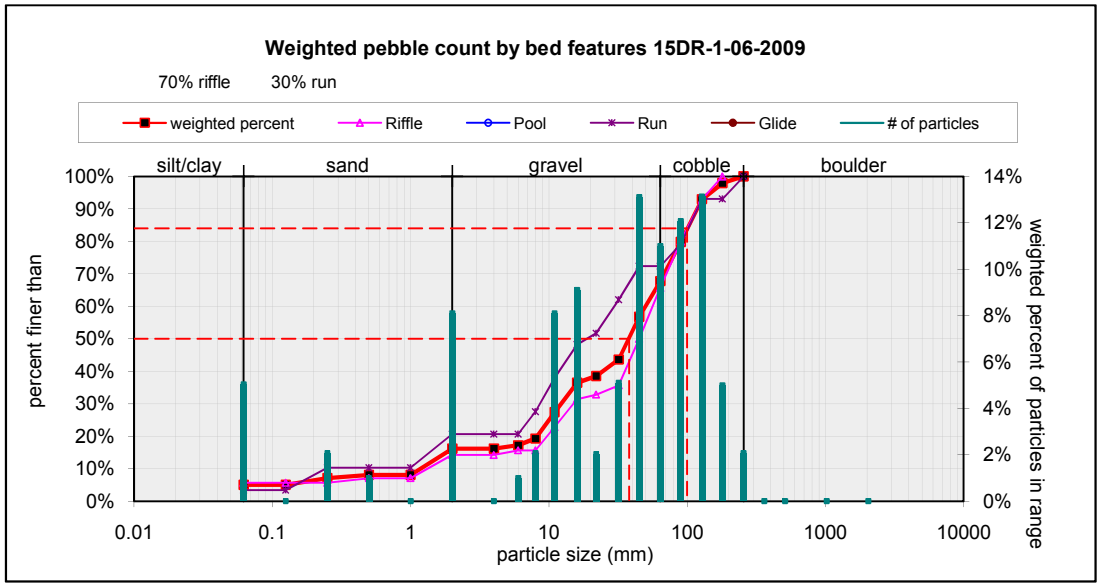
Flood Dimensions	
20.2	Width flood prone area (ft)
2.7	entrenchment ratio
3.9	low bank height (ft)
2.7	low bank height ratio

Flow Resistance	
0.043	Manning's roughness

Bankfull Flow	
2.9	velocity (ft/s)
22.2	discharge rate (cfs)
0.8	channel slope (%)

Sinuosity	Channel Type
1.03	F4

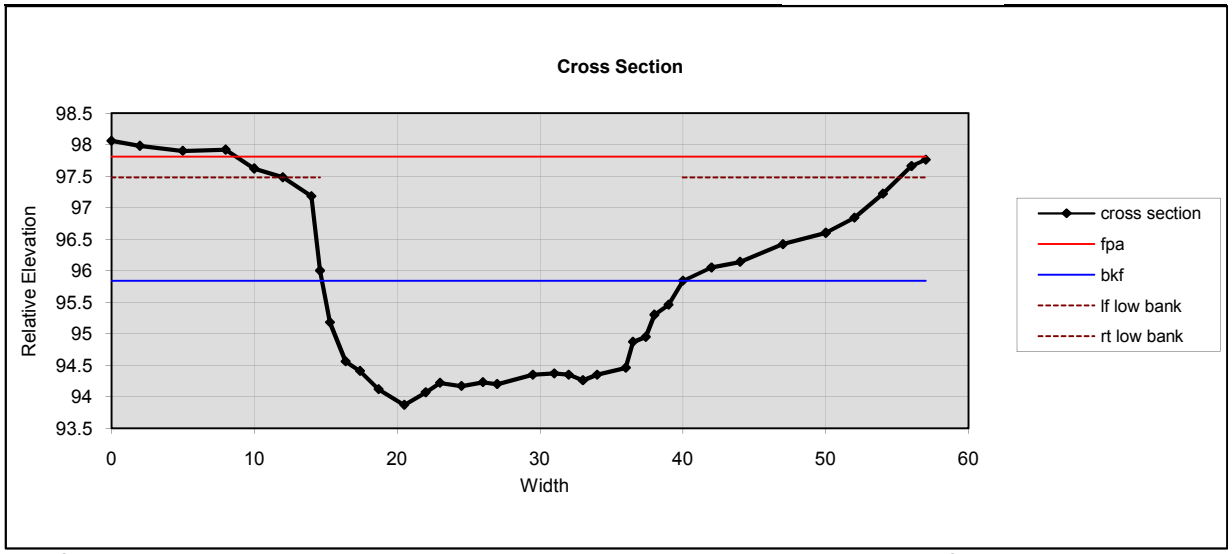
15DR-1-06-2009



Size (mm)	
D16	2
D35	15
D50	38
D65	59
D84	100
D95	150

Size Distribution	
mean	14.1
dispersion	10.8
skewness	-0.3

Type	
silt/clay	5%
sand	11%
gravel	51%
cobble	32%
boulder	0%
bedrock	



Bankfull Dimensions	
35.1	x-section area (ft.sq.)
25.3	width (ft)
1.4	mean depth (ft)
2.0	max depth (ft)
26.2	wetted perimeter (ft)
1.3	hydraulic radius (ft)
18.2	width-depth ratio

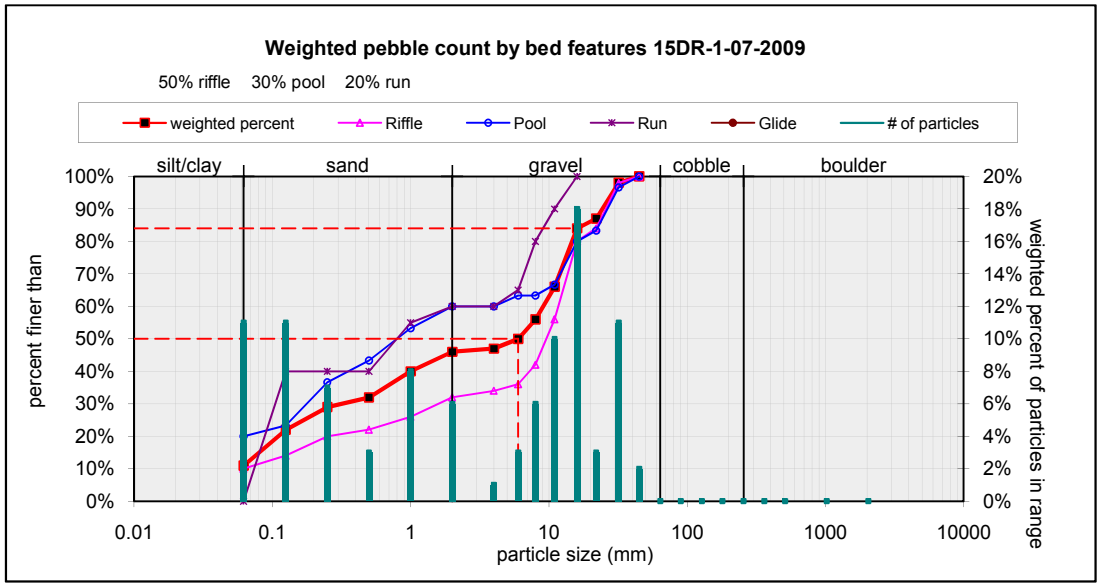
Flood Dimensions	
90.0	Width flood prone area (ft)
3.6	entrenchment ratio
3.6	low bank height (ft)
1.8	low bank height ratio

Flow Resistance	
0.041	Manning's roughness

Bankfull Flow	
5.0	velocity (ft/s)
176.1	discharge rate (cfs)
1.3	channel slope (%)

Sinuosity	Channel Type
1.04	C4

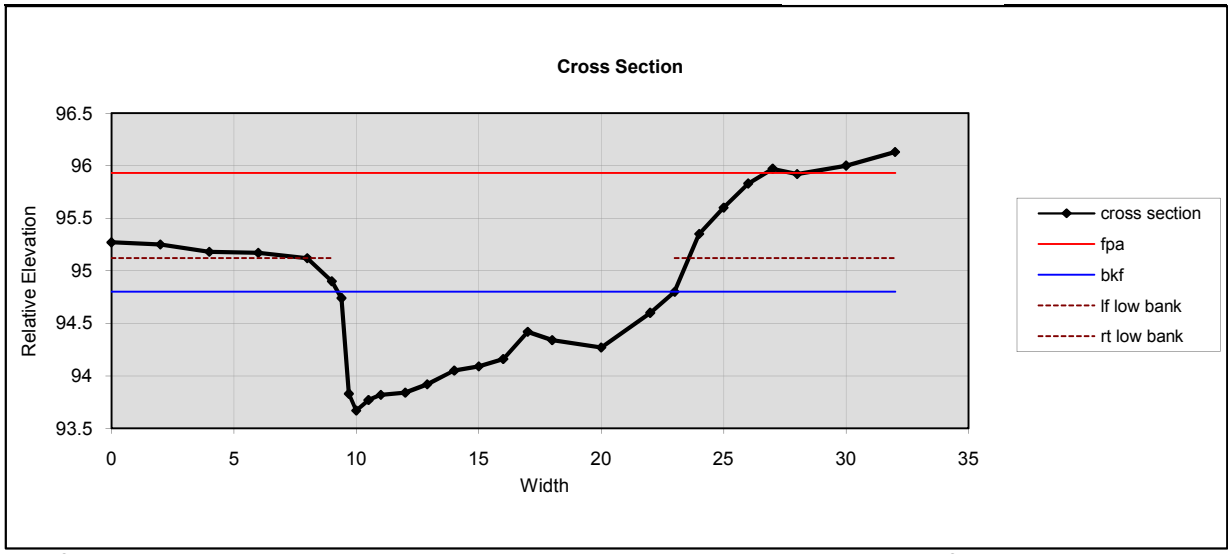
15DR-1-07-2009



Size (mm)	
D16	0.085
D35	0.65
D50	6
D65	11
D84	16
D95	29

Size Distribution	
mean	1.2
dispersion	36.6
skewness	-0.5

Type	
silt/clay	11%
sand	35%
gravel	54%
cobble	0%
boulder	0%
bedrock	



Bankfull Dimensions	
8.4	x-section area (ft.sq.)
13.8	width (ft)
0.6	mean depth (ft)
1.1	max depth (ft)
14.6	wetted perimeter (ft)
0.6	hydraulic radius (ft)
22.6	width-depth ratio

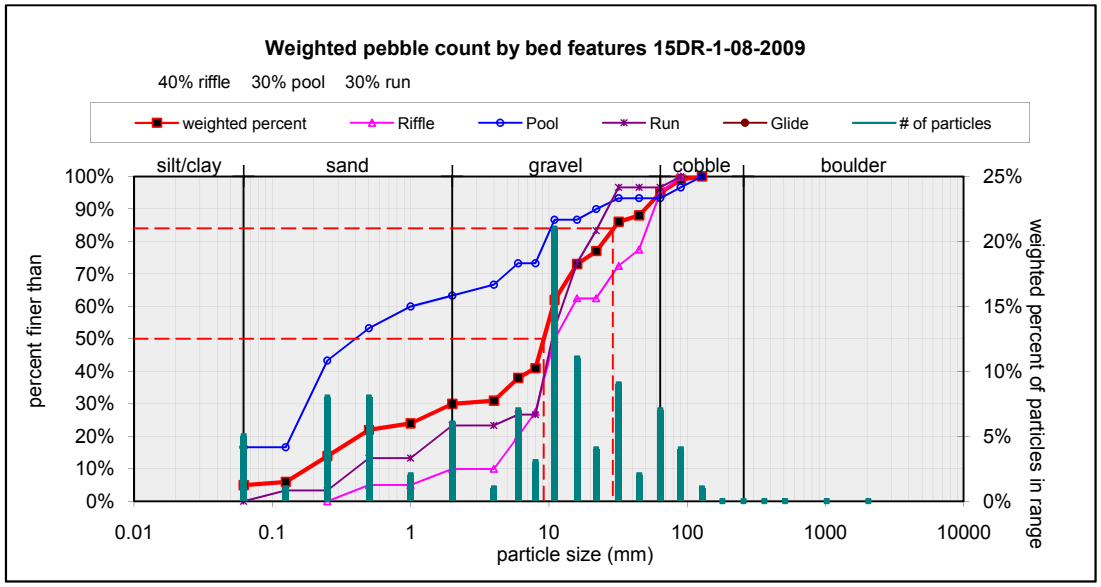
Flood Dimensions	
71.0	Width flood prone area (ft)
5.2	entrenchment ratio
1.5	low bank height (ft)
1.3	low bank height ratio

Flow Resistance	
0.028	Manning's roughness

Bankfull Flow	
3.9	velocity (ft/s)
32.4	discharge rate (cfs)
1.1	channel slope (%)

Sinuosity	Channel Type
1.14	C4

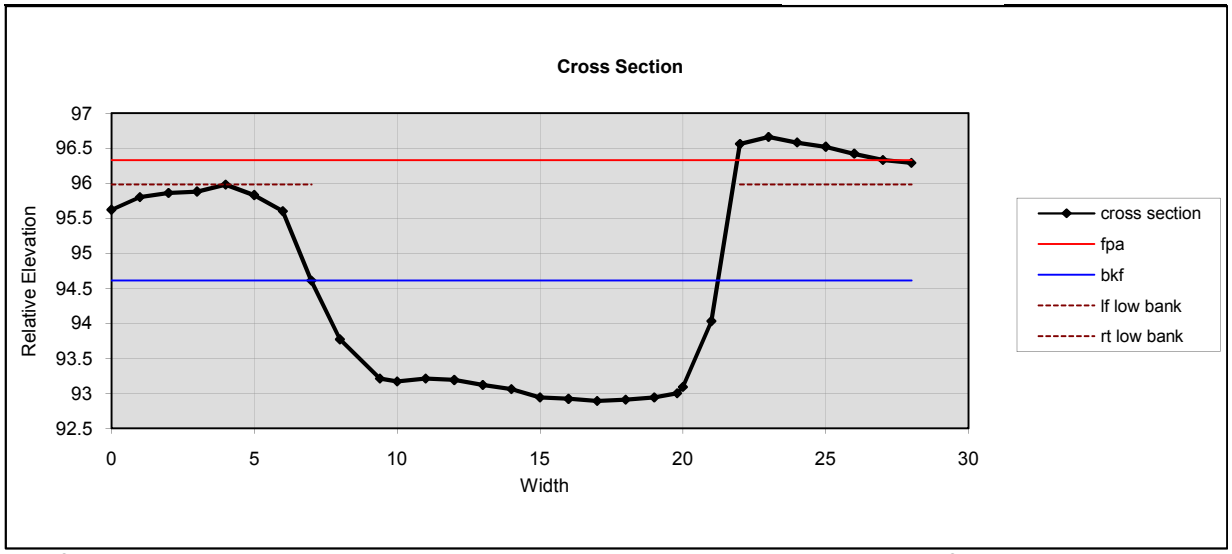
15DR-1-08-2009



Size (mm)	
D16	0.3
D35	5
D50	9.2
D65	12
D84	29
D95	64

Size Distribution	
mean	2.9
dispersion	16.9
skewness	-0.4

Type	
silt/clay	5%
sand	25%
gravel	65%
cobble	5%
boulder	0%
bedrock	



Bankfull Dimensions	
19.8	x-section area (ft.sq.)
14.2	width (ft)
1.4	mean depth (ft)
1.7	max depth (ft)
15.4	wetted perimeter (ft)
1.3	hydraulic radius (ft)
10.2	width-depth ratio

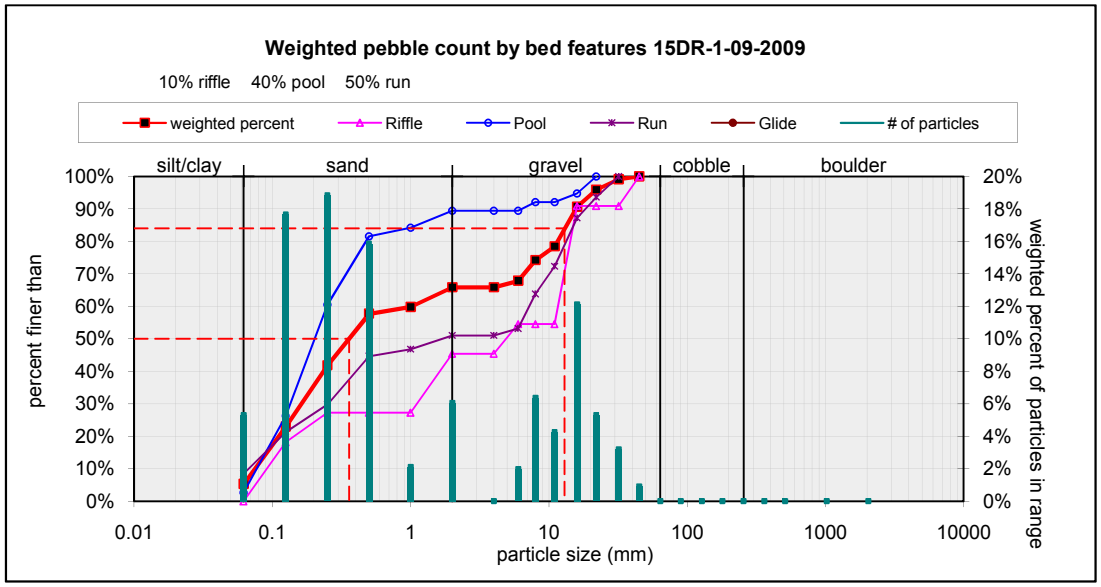
Flood Dimensions	
175.0	Width flood prone area (ft)
12.3	entrenchment ratio
3.1	low bank height (ft)
1.8	low bank height ratio

Flow Resistance	
0.033	Manning's roughness

Bankfull Flow	
3.1	velocity (ft/s)
61.6	discharge rate (cfs)
0.4	channel slope (%)

Sinuosity	Channel Type
1.12	C4

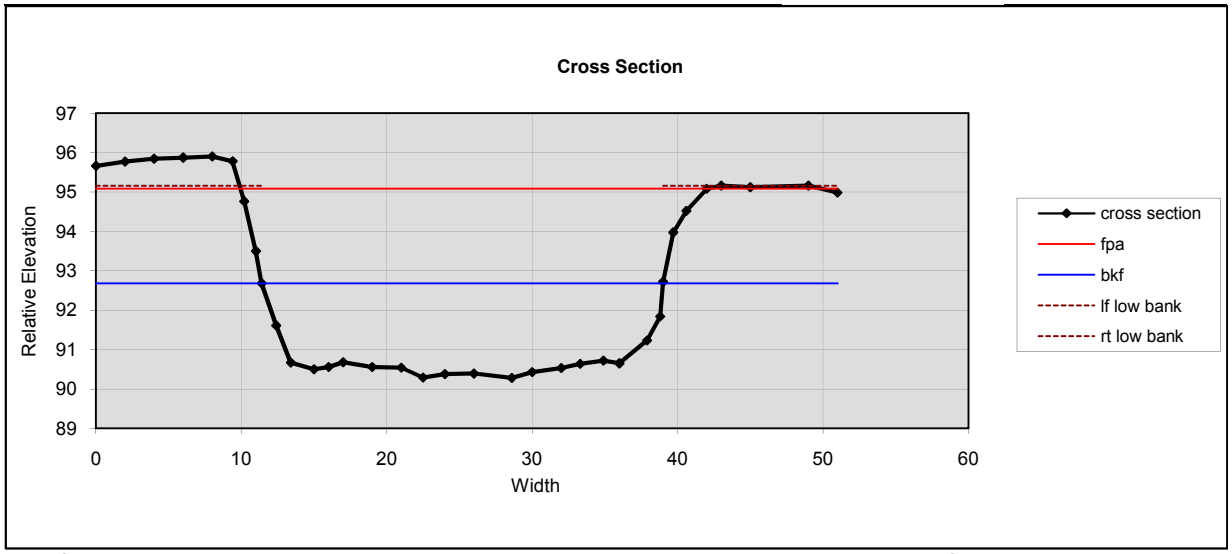
15DR-1-09-2009



Size (mm)	
D16	0.095
D35	0.19
D50	0.36
D65	1.8
D84	13
D95	21

Size Distribution	
mean	1.1
dispersion	20.0
skewness	0.3

Type	
silt/clay	5%
sand	58%
gravel	32%
cobble	0%
boulder	0%
bedrock	



Bankfull Dimensions	
55.8	x-section area (ft.sq.)
27.6	width (ft)
2.0	mean depth (ft)
2.4	max depth (ft)
29.4	wetted perimeter (ft)
1.9	hydraulic radius (ft)
13.6	width-depth ratio

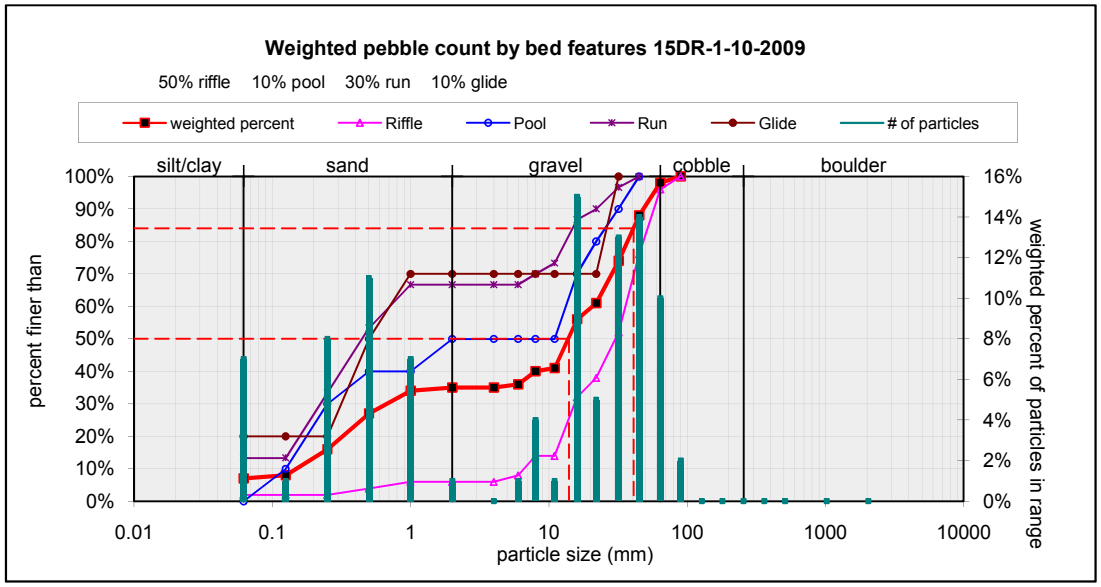
Flood Dimensions	
200.0	Width flood prone area (ft)
7.2	entrenchment ratio
4.9	low bank height (ft)
2.0	low bank height ratio

Flow Resistance	
0.024	Manning's roughness

Bankfull Flow	
4.3	velocity (ft/s)
237.5	discharge rate (cfs)
0.2	channel slope (%)

Sinuosity	Channel Type
1.12	C5

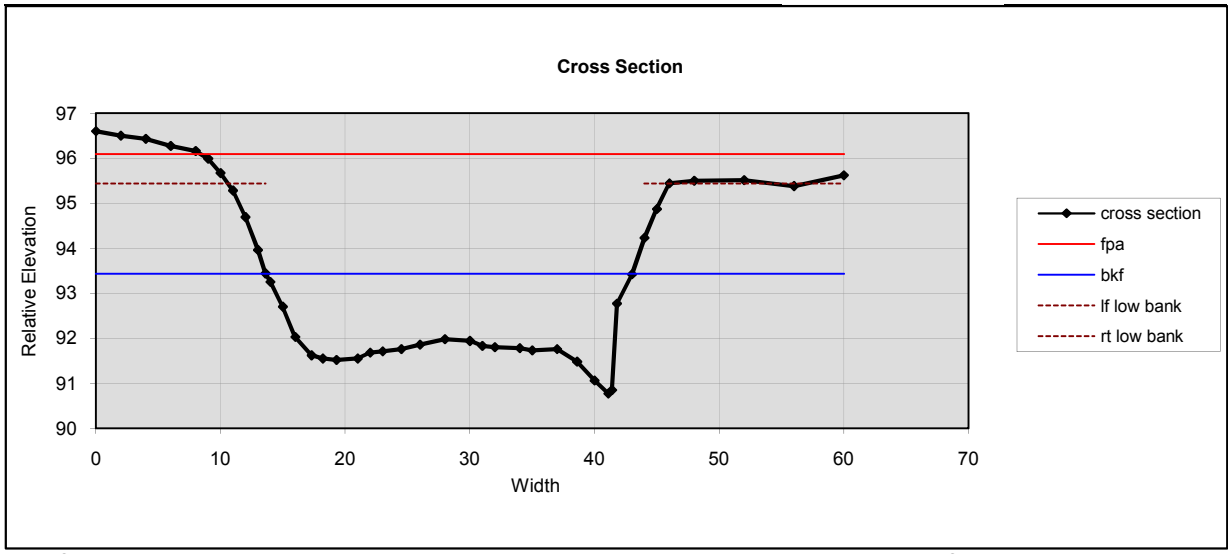
15DR-1-10-2009



Size (mm)	
D16	0.25
D35	2
D50	14
D65	25
D84	41
D95	58

Size Distribution	
mean	3.2
dispersion	29.5
skewness	-0.4

Type	
silt/clay	7%
sand	28%
gravel	63%
cobble	2%
boulder	0%
bedrock	



Bankfull Dimensions	
47.1	x-section area (ft.sq.)
29.4	width (ft)
1.6	mean depth (ft)
2.7	max depth (ft)
31.7	wetted perimeter (ft)
1.5	hydraulic radius (ft)
18.3	width-depth ratio

Flood Dimensions	
200.0	Width flood prone area (ft)
6.8	entrenchment ratio
4.7	low bank height (ft)
1.8	low bank height ratio

Flow Resistance	
0.032	Manning's roughness

Bankfull Flow	
4.1	velocity (ft/s)
193.0	discharge rate (cfs)
0.5	channel slope (%)

Sinuosity	Channel Type
1.04	C4

Appendix F: Quality Assurance/Quality Control

The biological monitoring program for the Rocky Gorge, Hammond Branch, and Dorsey Run subwatersheds includes chemical, physical, and biological assessments conducted throughout the selected PSUs. The sampling methods used are compatible with the Design of the Biological Monitoring and Assessment Program for Howard County Maryland (Tetra Tech, 2001) and the Quality Assurance Project Plan (QAPP) for Howard County Department of Public Works (Tetra Tech, 2001). A summary of the Quality Assurance/Quality Control (QA/QC) procedures and results are presented in this Appendix.

A quality assurance and quality control analysis was completed for the assessment work conducted in the Rocky Gorge, Hammond Branch, and Dorsey Run subwatersheds following the methods described by Hill et al. (2005). This analysis included performance characteristics of precision, accuracy, bias and completeness. Performance measures include:

- Precision (consistency) of field sampling and overall site assessments using intra-team site duplication
    - median relative percent difference (mRPD)
    - coefficient of variability (CV)
    - 90% confidence interval (CI)
- Bias of sample sorting and subsampling
    - percent sorting efficiency (PSE)
- Accuracy of data entry
    - number of errors/corrective actions
- Completeness
    - number of valid data points obtained as a proportion of those planned (QAPP, 2001).

Data that does not meet performance or acceptable criteria are re-evaluated to correct any problems or investigated further to determine the cause of any discrepancies.

Field Sampling

All field crew members were recently trained in MBSS Spring Sampling protocols prior to the start of field sampling. All subjective scoring was completed with the input of all team members at the sampling site to reduce individual sampler bias.

Field water quality measurements were collected *in situ* at all monitoring sites including the duplicate sites, according to methods in the County QAPP. All *in situ* parameters were measured with a YSI Pro Plus series multiprobe, except turbidity which was measured using a Hach 2100 Turbidimeter. Water quality equipment was regularly inspected, maintained and calibrated to ensure proper usage and accuracy of the readings. Calibration logs were kept by field crew leaders and checked by the project manager regularly.

Sample buckets contained both internal and external labels. All chain-of-custody procedures were followed for transfer of the samples between the field and the identification lab.

Replicate (duplicate) samples were collected at ten percent of the sites (one site for each PSU, three total for the 2009 sampling year). These QC samples were collected to determine the consistency and precision of the sampling procedures and the intra-team adherence to those protocols. QC sites were field-selected rather than randomly selected to ensure that the QC sites maintained similar habitat conditions to the original site. Data collected from duplicate sites included water quality, benthic macroinvertebrate samples, and completion of the RBP habitat assessment. Photographs were also taken at duplicate sites.

Duplicate samples were collected at sites 09RG-1-04A-2009, 14HB-1-10-2009 and 15DR-1-09-2009. These sites represent varying drainage areas and impervious surface covers. The following table identifies the drainage areas and imperviousness for each site.

QC Site Characteristics

Site	Drainage Area (acres)	Impervious Percent
09RG-1-04A-2009	442.7	25.3
14HB-1-10-2009	1,632.9	7.9
15DR-1-09-2009	4,013.4	36.7

Precision

Measures of precision calculated for the consistency of field sampling using intra-team site duplication were:

- Median relative percent difference (mRPD) and relative percent difference (RPD)
- Coefficient of variability (CV)
- 90% confidence interval (CI)

Acceptable measurement quality objectives (MQO) are listed in the table below. DNR's MBSS protocols were used for the collection and analysis of macroinvertebrate data. In 2005, DNR updated their Benthic Index of Biotic Integrity (BIBI; Southerland et al., 2005). These new metrics were used to calculate the BIBI presented in this report.

Measurement Quality Objectives (QAPP, 2001)

Metric or Index	Precision	Accuracy	Completeness (%)
GPS		± 25m	100
Dissolved Oxygen	RPD ≤ 20%	± 0.2 mg/L	≥ 85
pH	RPD ≤ 20%	± 0.2 units	≥ 85
Temperature	RPD ≤ 20%	± 0.15 ˚C	≥ 85
Conductivity	RPD ≤ 20%	± 1% of value	≥ 85
RBP Physical Habitat Assessment	RPD ≤ 20%	NA	100
Macroinvertebrate taxa			100
Metric Scores	RPD ≤ 5%		
Bioassessment Scores	RPD ≤ 5%		
Sorting Efficiency	SE ≥ 90%		

GPS

All GPS points were collected with a Trimble ProXT GPS unit capable of accuracy of within 2 meters. Multiple readings (approximately 60) were recorded at the reach midpoint and averaged to obtain the location of the final point. Thus, the accuracy requirement of ± 25 meters was met. A GPS point was collected at all 30 sites, therefore the data meets the 100 percent MQO for completeness.

Water Quality

The following table shows the results of the water quality MQO analysis. The field equipment used, with correct maintenance and calibration, are capable of the required accuracy. Since the true accuracy of field measured water quality is not known with confidence, the measure of precision is used instead. Water quality data for all parameters were collected at all 30 sites,

therefore the data meets the >85 percent MQO for completeness. One sample pair (09RG-1-04A-2009 and 09RG-1-04A-2009QC) had a water quality measurement that exceeded the MQO of ≤20% for turbidity. The calculated RPD for this sample pair was 32.81, just above the stated MQO. The turbidity value reported below is an average of three observed measurements—taken at the midpoint, upstream end, and downstream end of the assessed reach. The turbidity measured higher at the downstream end of 09RG-1-04A-2009 (2.99 NTU), which may be a result of its proximity to the storm drain located on the bank. This elevated turbidity value therefore increased the average reported measurement, which affected the calculated RPD for this sample pair. All other water quality parameters were within the acceptable ranges for precision.

Measurement Quality Objectives Results – Water Quality. Bold records indicate values exceeding stated MQOs.

	Dissolved Oxygen (mg/l)	pH	Water Temperature (°C)	Turbidity (ntu)	Conductivity (µS/cm)
09RG-1-04A-2009	13.75	8.19	8.67	2.0	694.3
09RG-1-04A-2009QC	14.25	8.32	9.10	1.4	702.3
Absolute Difference	0.50	0.13	0.43	0.56	8.00
RPD	3.57	1.61	4.88	**32.81**	1.15
SD	0.35	0.09	0.31	0.40	5.66
14HB-1-10-2009	12.75	7.36	7.50	2.2	124.3
14HB-1-10-2009QC	12.99	7.28	7.57	2.0	125.9
Absolute Difference	0.23	0.08	0.07	0.19	1.60
RPD	1.81	1.05	0.88	9.25	1.28
SD	0.16	0.05	0.05	0.13	1.13
15DR-1-09-2009	13.99	7.40	9.27	3.7	1363.7
15DR-1-09-2009QC	14.12	7.50	9.47	3.8	1346.3
Absolute Difference	0.13	0.10	0.20	0.05	17.33
RPD	0.92	1.39	2.14	1.25	1.28
SD	0.09	0.07	0.14	0.03	12.26
Median RPD	1.81	1.39	2.14	9.25	1.28

Habitat Assessment

The following table provides the result of the MQO analysis for the habitat assessment. The RPD was <10 percent for all QC sites, therefore, all data meets the MQO of ≤20 percent.

Measurement Quality Objectives Results – Habitat Assessment (RBP)

	RBP Total Score	RBP Percent Comparability	Narrative Rating
09RG-1-04A-2009	143	72	Partially Supporting
09RG-1-04A-2009QC	135	68	Partially Supporting
Absolute Difference	8.00	4.00	
RPD	5.76	5.76	
SD	5.66	2.83	
14HB-1-10-2009	119	60	Non-supporting
14HB-1-10-2009QC	121	61	Partially Supporting
Absolute Difference	2.00	1.00	
RPD	1.67	1.67	
SD	1.41	0.71	
15DR-1-09-2009	113	57	Non-supporting
15DR-1-09-2009QC	115	58	Non-supporting
Absolute Difference	2.00	1.00	
RPD	1.75	1.75	
SD	1.41	0.71	
Median RPD	1.75	1.75	

Biological Assessment

The following three tables include the results of the QC analysis for the biological metrics and BIBI scores. A few metric scores fell outside the acceptable range for precision (shown in bold). In each case, the difference was only one scoring class (i.e, 1, 3, or 5), which resulted in a large RPD. In fact, even the smallest incremental difference in metric scores would result in an exceedance of the RPD MQO. Therefore, additional measures of precision were calculated among the combined QC data set to evaluate the significance of the differences in individual metric values and scores, as well as in the overall BIBI score.

Measurement Quality Objectives Results – Biological Sampling, Sample Pair RPD for Metric and IBI Scores

	BIBI	Total Taxa Score	EPT Taxa Score	Ephem Taxa Score	Percent Intolerant Urban Score	Percent Chironomidae Score	Percent Clinger Score
09RG-1-04A-2009	1.67	1	1	1	1	3	3
09RG-1-04A-2009QC	2.00	3	1	1	1	3	3
RPD	**18.18**	**100.00**	0.00	0.00	0.00	0.00	0.00
14HB-1-10-2009	2.00	5	1	1	1	1	3
14HB-1-10-2009QC	1.33	3	1	1	1	1	1
RPD	**40.00**	**50.00**	0.00	0.00	0.00	0.00	**100.00**
Median RPD	29.1	75.0	0.0	0.0	0.0	0.0	50.0

	BIBI	Total Taxa Score	EPT Taxa Score	Ephem Taxa Score	Percent Intolerant Urban Score	Percent Ephem Score	Scraper Taxa Score	Percent Climber Score
15DR-1-09-2009	2.14	3	1	1	1	1	3	5
15DR-1-09-2009QC	2.14	3	1	1	1	1	5	3
RPD	0.00	0.00	0.00	0.00	0.00	0.00	**50.00**	**50.00**
Median RPD	0.0	0.0	0.0	0.0	0.0	0.0	50.0	50.0

The BIBI is not scored on a continuous scale, but rather each metric is scored on an incremental scale (assigned a value of 1, 3 or 5), and these values are averaged to yield the final BIBI score. Since the piedmont BIBI score is an average of six metric scores (seven for the coastal plain), the BIBI scores shift by at least 0.3 or 0.4 with a difference in only metric (e.g., 2.0, 2.3, 2.7, 3.0). Additionally, an individual metric value may differ by only one taxa or one percent for a sample pair, but if it falls on either side of a scoring threshold (i.e, 1, 3, 5), the resulting difference in metric scores will differ by as much as 50 to 100% for RPD. For these reasons, the Scraper Taxa score RPD for all sample pair 15DR-1-09 did not meet the MQO despite a minor difference in metric values. For instance, there was only one additional Scraper Taxa found at site 15DR-1-09QC, but the scoring threshold was between one and two taxa, which resulted in a two point difference in metric scores. This one additional taxon resulted in an RPD of 50 for the sample pair.

Due to the overall BIBI score consisting of scaled incremental metrics, the RPD does not reflect the precision well. Additional measures of precision (CV, CI, and mRPD) for the combined sample pair results indicate far better precision than does RPD. None of the measures calculated deviated significantly from normal, acceptable levels of precision between duplicate sample pairs observed in similar studies (Hill et. al, 2005; Gallardo et. al, 2006).

All phases of the biological assessment were conducted for every site; therefore the 100 percent completeness MQO is met.

Measurement Quality Objectives Results – Biological Sampling, Combined Precision Measures for Metric Values

	Total Taxa	EPT Taxa	Ephem Taxa	Percent Intolerant Urban	Percent Chironomidae	Percent Clingers
09RG-1-04A-2009	8	1	0	0.0	22.9	70.3
09RG-1-04A-2009QC	15	2	0	0.0	49.1	36.6
14HB-1-10-2009	25	4	0	4.5	69.1	35.5
14HB-1-10-2009QC	18	3	0	1.8	78.8	25.7
CV	42.7	51.6	0.0	136.0	44.9	46.4
CI	11.6	2.1	0.0	3.5	40.5	32.0
mRPD	46.7	47.6	0.0	43.9	43.0	47.6

	Total Taxa Score	EPT Taxa Score	Ephem Taxa Score	Percent Intolerant Urban Score	Percent Ephem Score	Scraper Taxa Score	Percent Climber Score
15DR-1-09-2009	17	0	0	1.8	0.0	1.0	9.0
15DR-1-09-2009QC	18	0	0	0.0	0.0	2.0	2.8
CV	4.0	0	0	141.4	0	47.1	75.2
CI	1.2	0.0	0.0	2.1	0.0	1.2	7.3
mRPD	5.7	0.0	0.0	200.0	0.0	66.7	106.4

Measurement Quality Objectives Results – Biological Sampling, Combined Precision Measures for Metric and IBI Scores

	Total Taxa	EPT Taxa	Ephem Taxa	Percent Intolerant Urban	Percent Chironomidae	Percent Clingers	BIBI
09RG-1-04A-2009	1	1	1	1	3	3	1.67
09RG-1-04A-2009QC	3	1	1	1	3	3	2.00
14HB-1-10-2009	5	1	1	1	1	3	2.00
14HB-1-10-2009QC	3	1	1	1	1	1	1.33
CV	54.4	0.0	0.0	0.0	57.7	40.0	18.2
CI	2.7	0.0	0.0	0.0	1.9	1.6	0.5
mRPD	75.0	0.0	0.0	0.0	0.0	50.0	29.1

	Total Taxa Score	EPT Taxa Score	Ephem Taxa Score	Percent Intolerant Urban Score	Percent Ephem Score	Scraper Taxa Score	Percent Climber Score	BIBI
15DR-1-09-2009	3	1	1	1	1	3	5.0	2.14
15DR-1-09-2009QC	3	1	1	1	1	5	3.0	2.50
CV	0.0	0.0	0.0	0.0	0.0	35.4	35.4	10.9
CI	0.0	0.0	0.0	0.0	0.0	2.3	2.3	0.4
mRPD	0.0	0.0	0.0	0.0	0.0	50.0	50.0	15.4

Laboratory Sorting and Subsampling

Each individual sorter had their work checked until a 90% sorting efficiency was consistently achieved. After this level of efficiency was obtained, one out of every 10 randomly selected samples was checked by the laboratory QA officer. During this sampling period, the laboratory QA officer administered random QC checks for 26 samples resulting in the QC analysis of 49 sorted grids. For nine of the 26 samples, every grid sorted by lab technicians was checked by the laboratory QA officer. Of those 26 samples, the three lab technicians achieved an overall internal sorting efficiency of 90 percent. Any organisms recovered during the QC checks were added back to the subsample to be identified.

Subsampling was conducted for those sites with greater than 120 organisms. A post-processing subsampling was conducted using a spreadsheet based method (Tetra Tech, 2006). This post-processing randomly subsamples the identified organisms to a desired target number for the sample. Each taxon is subsampled based on its original proportion to the entire sample. In this case, the desired sample size selected was 110 individuals. This allows for a final sample size of approximately 110 individuals (±20%) but keeps the total number of individuals below the 120 maximum and above 100 organisms.

Laboratory Sorting Results – Percent Sorting Efficiency

Sample ID	Percent Sorting Efficiency
09RG-1-01-2009	82.8
09RG-1-02-2009	94.4
09RG-1-03-2009	75.5
09RG-1-04A-2009	93.4
09RG-1-04A-2009QC	79.7
09RG-4-02A-2009	90.1
09RG-4-03-2009	92.5
09RG-4-04-2009	96.7
09RG-4-04A-2009	95.2
14HB-1-01-2009	79.7
14HB-1-02-2009	86.8
14HB-1-03-2009	92.7
14HB-1-04-2009	92.1
14HB-1-06-2009	96.0
14HB-1-07-2009	98.1
14HB-1-08-2009	87.1
14HB-1-09-2009	89.2
14HB-1-10-2009	89.6
14HB-1-10-2009QC	81.0
15DR-1-02-2009	87.8
15DR-1-03-2009	90.9
15DR-1-05-2009	94.3
15DR-1-06-2009	97.4
15DR-1-07-2009	94.4
15DR-1-08-2009	94.9
15DR-1-09-2009	87.4

Data Entry/Analysis

All data entered into EDAS, Excel, or any other program used for site analysis were reviewed and checked for entry error. A table listing the data entry results is shown below. All errors were corrected and the database was deemed to be 100% accurate. Additionally, the spreadsheet formulae were checked for accuracy to verify computed values.

Data Entry Results – Percent Error

Data Type	No. of Entries	No. of Errors	Percent Error
Water Chemistry	185	10	5.4
Physical Characterization	901	11	1.2
Physical Habitat	969	3	0.3
Cross Section	2338	6	0.3
Pebble Count	795	205	25.8

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