# Benthic Community Assessment
# and Physical Habitat Assessment
# Data Analysis
# Ambient Station / Unnamed Tributary to Winters Run
# Harford County, Maryland

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August 2010 EA Project No. 14479.09

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## 1. INTRODUCTION

Harford County Department of Public Works (DPW) collected benthic macroinvertebrates and conducted a physical habitat assessment once per year as a requirement of the County's National Pollutant Discharge Elimination System (NPDES) permit. The benthic samples were collected from three stream monitoring stations along an unnamed tributary to Winters Run. The lower station (001) is just upstream of Tollgate Road near an existing pumping station, the upper station (002) is located just downstream of Brentwood Park Drive and an existing stormwater management facility, and the middle station is between these two stations and accessed thru the Woodland Hills Development (Figure 1).

## 2. METHODOLOGY

### 2.1 BENTHIC INDEX OF BIOTIC INTEGRITY

Harford County DPW personnel conducted benthic sampling on June 22, 2009. EA Engineering, Science and Technology, Inc. (EA) entered Harford County's benthic data into the existing database and calculated a suite of metrics. The scores of six metrics are used to calculate the Eastern Piedmont Benthic Index of Biotic Integrity (B-IBI) to obtain a measure of the biological condition of the community. Metric selection and data analysis followed the Maryland Biological Stream Survey (MBSS) program guidance documents (Southerland, et. al. 2005). The six metrics to calculate the overall B-IBI value include number of taxa, number of EPT taxa, number of Ephemeroptera, percent intolerant urban taxa, percent Chironimidae, and percent clingers.

1. Total number of taxa represent the total number of distinct taxa present in the sample. This metric reflects the health of the community through a measurement of the variety of taxa present.
2. EPT taxa represent the number of taxa in the sample that are included in the insect orders Ephemeroptera (mayflies), Plecoptera (stoneflies), and Trichoptera (caddisflies).
3. Ephemeroptera taxa represent the number of mayfly taxa present in the sample.
4. Percent intolerant urban taxa represent the percentage of taxa sensitive to disturbances with tolerance values between 0-3 present in the sample.
5. Percent Chironimidae represent the percentage of midge larvae and pupae present in the sample.
6. Percent clingers represent the percentage of the sample that is adapted for inhabiting flowing water as a primary or secondary habit.

EA Engineering, Science, and Technology, Inc.

Harford County
Benthic Monitoring

Harford County, Maryland

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**Figure 1.**
**Location of Benthic Monitoring Stations**

**2 November 2009**

Scores for the B-IBI were calculated as the mean of the individual metric scores. This average metric value, which ranges between one and five, was used to rate the condition of the benthic community from very poor (1.0 to 1.9) to good (4.0 to 5.0) using the following scale presented in Table 1.

**Table 1. Benthic Index of Biotic Integrity (B-IBI) Classifications**

| Narrative Category | B-IBI Score |
|---|---|
| Good | 4.0 to 5.0 |
| Fair | 3.0 to 3.9 |
| Poor | 2.0 to 2.9 |
| Very Poor | 1.0 to 1.9 |

## 2.2 URBAN REFERENCE INDEX

In 2001, EA developed a benchmark B-IBI for urban watersheds in order to evaluate urban monitoring stations against the "best achievable" urban reference condition (EA 2001). The Urban Reference Index (URI) was calculated as the 90$^{th}$ percentile of the B-IBI scores in watersheds with a predominantly urban land cover using MBSS data from the first round of sampling 1995 through 1997.

In 2005, MBSS concluded the second round of sampling (2000 through 2005), and published a revision in the IBI metric. In 2007, MBSS released the entire results of the second round of sampling. EA revised the URI using the 2005 IBI metric, the combined two rounds of MBSS data, and land cover data provided by the National Land Cover Database (NLCD). As done previously, the 2007 URI was calculated as the 90$^{th}$ percentile of the B-IBI scores in watersheds with a predominantly urban land cover. The 2007 URI was determined to be 3.3.

As an effort to identify candidate stations for stream restoration efforts, a rating was assigned to each station based on the percent of the URI as presented in Table 2. The URI was scaled to the 1 to 5 narrative categories used by the MBSS IBI.

**Table 2. MBSS and Urban Reference Index (URI) Classifications**

| Narrative Category | B-IBI Score | |
|---|---|---|
| | MBSS Scale | URI Scale |
| Good | 4.0 | 2.6 |
| Fair | 3.0 | 2.0 |
| Poor | 2.0 | 1.3 |
| Very Poor | 1.0 | 0.7 |

For example, a B-IBI score of 2.0 in an urban watershed would be given a "poor" rating on the MBSS scale, but a "fair" rating among other urban watersheds using the scale. B-IBI scores less than 2.6 indicate urban watersheds that would most benefit from restoration. A score of greater than 2.6 is considered approaching a best attainable urban benthic community.

## 2.3 HILSENHOFF BIOTIC INDEX

In addition to the selected metrics used in the B-IBI, MBSS (Roth, et al. 1999) also recommends calculating the Hilsenhoff Biotic Index (HBI) which is an indicator of biological tolerance to various pollutants (Roth, et al. 1999). The HBI provides an additional means of applying threshold values to determine degradation due to organic pollution which could be an issue in the County's streams. The HBI generally increases with increasing environmental stress. A tolerance value ranging from 0 to 10 is assigned to each taxon collected then the HBI is calculated by determining the average tolerance value for the assemblage which is weighted by the abundance of each taxon. The tolerance values used by EA for this calculation have consisted of values that are supported by a variety of available sources, including but not limited to, research conducted in the Midwest, New York and North Carolina by Hilsenhoff (1987), Bode (1988) and Lenat (1993), respectively. The current MBSS publication (Southerland, et. al. 2005) provides a list of benthic tolerance values for urban and agricultural areas. The HBI scores range from 0 to 10 with narrative rating from very poor (8.51 to 10.0) to good (0 to 4.5) using the following scale presented in Table 3.

**Table 3. Hilsenhoff Biotic Index (HBI) Classifications**

| Narrative Category | HBI Score |
|---|---|
| Good | 0 to 4.5 |
| Fair | 4.51 to 6.5 |
| Poor | 6.51 to 8.5 |
| Very Poor | 8.51 to 10.0 |

## 2.4 PHYSICAL HABITAT ASSESSMENT

The physical habitat assessment was conducted on June 22, 2009 during the collection of benthic macroinvertebrates. These observations and measurements were recorded on the MBSS Stream Habitat Assessment Data Sheet (Appendix E). The physical habitat assessment data was entered into the benthic database and a suite of metrics calculated. Metric selection and data analysis followed the guidance document A Physical Habitat Index for Freshwater Wadeable Streams in Maryland, Final Report, (Paul, et al. 2002). Eight metrics are used to calculate the Physical Habitat Index (PHI) for the Piedmont or Non-Coastal Plain eco region. The metrics include the following:

1. Percent embeddedness
2. Remoteness
3. Percent shading
4. Epifaunal substrate
5. Instream habitat
6. Instream woody debris and rootwads
7. Bank stability
8. Riffle run quality

The PHI is another important measurement in the prediction of biological integrity and in assessing a stream's health stream habitat quality. The equations used to calculate the PHI are included in Appendix E. The PHI scores range from 0 to 100 with narrative rating from minimally degraded (81 to 100) to severely degraded (0 to 50) using the following scale presented in Table 4.

**Table 4. Physical Habitat Index (PHI) Classifications**

| Narrative Category | PHI Score |
|---|---|
| Minimally Degraded | 81 to 100 |
| Degraded | 66 to 80 |
| Partially Degraded | 51 to 65 |
| Severely Degraded | 0 to 50 |

## 3. RESULTS

### 3.1 BENTHIC COMMUNITY ASSESSMENT 2009 DATA

A list of all taxa collected at each station and relative abundance is presented in Table 5.

**Table 5. Mean Abundance of Macroinvertebrates Collected from an Unnamed Tributary to Winters Run, Harford County Department of Public Works, June 2009**

| Taxa | Station | | |
|---|---|---|---|
| | Lower | Middle | Upper |
| *Amphinemura sp.* | --- | --- | 0.333 |
| *Antocha sp.* | --- | 0.667 | 0.667 |
| *Brilla sp.* | 0.333 | --- | --- |
| *Cambarus sp.* | --- | 0.333 | --- |
| *Chaetocladius sp.* | --- | 0.333 | --- |
| *Cheumatopsyche sp.* | 9.33 | 12 | 10.7 |
| *Chimarra sp.* | 2 | 6.33 | 1 |

**Table 5. Mean Abundance of Macroinvertebrates Collected from an Unnamed Tributary to Winters Run, Harford County Department of Public Works, June 2009**

| Taxa | Station | | |
|---|---|---|---|
| | Lower | Middle | Upper |
| Curculionidae | 0.333 | --- | --- |
| *Dicranota sp.* | --- | --- | 0.333 |
| *Diplectrona sp.* | 4 | 5.33 | 4.33 |
| *Dolophilodes sp.* | 5 | 2.33 | 2 |
| *Eccoptura sp.* | --- | 0.333 | --- |
| *Ectopria sp.* | 0.333 | 0.333 | 1.33 |
| Empididae | --- | --- | 0.333 |
| *Eukiefferiella sp.* | 0.333 | --- | --- |
| *Glossosoma sp.* | 2.33 | --- | 1 |
| Gomphidae | 0.667 | 2.67 | --- |
| Gordiodea | 0.333 | 0.667 | --- |
| *Hydropsyche sp.* | 1.33 | 0.333 | 0.333 |
| Hydropsychidae | --- | --- | 0.333 |
| *Isotomurus sp.* | 0.667 | --- | --- |
| *Lepidostoma sp.* | --- | 0.333 | --- |
| *Leuctra sp.* | --- | 4.33 | 0.333 |
| Lumbriculidae | 0.333 | --- | --- |
| *Micropectra sp.* | 1 | --- | --- |
| *Microvelia sp.* | --- | --- | 1 |
| *Natarsia sp.* | --- | --- | 0.333 |
| Orthocladinae | --- | --- | 0.333 |
| *Orthocladius sp.* | --- | 0.333 | --- |
| *Oulimnius sp.* | 2.33 | 4.33 | 2 |
| *Parametriocnemus sp.* | 1 | --- | 0.333 |
| *Physa sp.* | 0.333 | --- | 0.667 |
| *Polypedilum sp.* | 4.33 | 0.667 | 0.667 |
| *Psephenus sp.* | 0.333 | 4 | 0.333 |
| *Rheotanytarsus sp.* | 1.67 | 0.333 | 1 |
| *Simulium sp.* | 1.33 | 0.667 | 0.333 |
| *Spirosperma sp.* | --- | --- | 0.667 |
| *Stenelmis sp.* | 1 | 1 | 1 |
| *Stylurus sp.* | --- | 0.333 | --- |
| Tanypodinae | --- | --- | 0.333 |
| *Tipula sp.* | 3 | 1.33 | 0.333 |
| *Tvetenia sp.* | 3.67 | 1.67 | 0.667 |
| Total Benthos | 47 | 51 | 33 |
| Total Taxa | 25 | 24 | 28 |

Abundance of benthic macroinvertebrates is expressed as mean number of individuals sampled from the three replicate Surber samples. The mean number of individuals varied from 33 at the upper station, 51 at the middle station and 47 at the lower station. The total number of taxa at the upper station is 28, middle station is 24 and lower station is 25. The dominant taxon at all three stations is *Cheumatopsyche sp.* (Trichoptera).

The six Piedmont metrics used to access the benthic community and calculate the B-IBI include number of taxa, number of EPT taxa, number of Ephemeroptera, percent intolerant urban taxa, percent Chironimidae, and percent clingers. The metrics scores were combined to calculate the B-IBI and then categorized with a narrative rating. The calculated metrics are presented in Table 6.

**Table 6. Summary of Benthic Community Metrics Used to Calculate the Benthic Index of Biotic Integrity (B-IBI), Harford County Department of Publics Works, June 2009**

| Metrics | Metric Values | | |
|---|---|---|---|
| | Station | | |
| | Upper | Middle | Lower |
| Number of Taxa | 14 | 14 | 12 |
| Number of EPT Taxa | 6 | 6 | 6 |
| Number of Ephemeroptera Taxa | 0 | 0 | 0 |
| Percent Intolerant Urban Taxa | 32.6 | 36.0 | 32.7 |
| Percent Chironimidae | 14.0 | 9.6 | 18.6 |
| Percent Clingers | 80.2 | 86.6 | 58.8 |
| B-IBI | 2.88 | 3.00 | 2.22 |
| B-IBI Rating | Poor | Fair | Poor |

B-IBI = Index of Biotic Integrity
EPT = Ephemeroptera, Plecoptera, Trichoptera

Total taxa represent the total number of distinct taxa present in the sample. The total number of taxa, or taxa richness, indicates biodiversity for the ecosystem and is commonly used as a quantitative measure of stream water and habitat quality. Taxa richness generally decreases as a stream ecosystem degrades (Resh and Grodhaus 1983) and may be a factor of habitat elimination, competitive displacement of opportunist taxa following disturbance, and or local extirpation of relatively intolerant taxa. This metric can also reflect temporarily higher numbers of taxa (relative to reference conditions) due to organic enrichment. The mean number of taxa at the upper and middle station is 14 and 12 at the lower station.

The total number EPT taxa represent the number of taxa in the sample that are included in the insect orders Ephemeroptera (mayflies), Plecoptera (stoneflies), and Trichoptera (caddisflies), which can indicate stream condition, since these taxa tend to be sensitive and become more scarce with increasing levels of disturbance (Lenat 1988). The number of EPT taxa at all three stations is 6.

The number of Ephemeroptera taxa, which is a measure of mayfly taxa richness, indicates the ability of a stream to support this generally intolerant insect order. Organic enrichment and excess fine sediment, indicators of anthropogenic stress, will often reduce the diversity of mayflies. The number of Ephemeroptera taxa at all three stations is 0.

Percent intolerant urban taxa represent the number of taxa sensitive to disturbances with tolerance values between 0-3 present in the sample. Intolerant taxon is a measure of the intolerant taxa that are the first to be eliminated by perturbations. Often, intolerant taxa

are specialist and perturbations can disturb or eliminate them due to specialized habitat or water quality requirements. Intolerant individuals became less abundant as stress increases, leading to more individuals of tolerant, opportunistic taxa. The percent of intolerant urban taxa at the upper station is 32.6, middle 36 and lower station is 32.7.

Percent Chironimidae is a measure of the degree to which midges, generally pollution tolerant individuals in the benthic community, dominate the community. The presence of stress will increase the abundance of Chironomids. The percent of Chironimidae at the upper station is 14, middle 9.6 and lower station is 18.6.

Percent Clingers are the percent of taxa that possess physical adaptations that allow them to cling to smooth surfaces or substrates in fast flowing water. Clingers are known to be very sensitive to inputs of fine sediment since they live between spaces in stream bottom rocks. The percent clingers at the upper station is 80.2, middle station 86.6 and lower station is 58.8.

## 3.2 BENTHIC COMMUNITY ASSESSMENT 1998-2009 DATA

The list of all taxa collected at each station between 1998 and 2009, associated urban tolerance values and functional feeding groups is reported in Appendix A. The list of all taxa collected at each station between 1998 and 2009 and relative abundance is reported in Appendix B.

The Benthic Index of Biotic Integrity (B-IBI) values were calculated using the six metrics outlined in Southerland, et al. 2005 and scores assigned to each sampling station. The metrics, B-IBI, narrative ratings and HBI are summarized in Table 7 and more detailed information is included in Appendix C for each station between 1998 and 2009. The lower station was rated good in 2000 and 2002. During the spring, some stations were rated poor including the upper station in 2002 (2.89), all three stations in 2003 (2.44 - 2.89), the middle station in 2006 (2.78), the upper station in 2007 (2.78) and 2008 (2.56), and the upper (2.88) and lower (2.22) station in 2009. The remaining stations were all rated fair (3.00 - 3.89) during other years sampled (Table 7). No temporal trends were evident according to the results of the regression analysis at the upper and middle stations of the B-IBI scores from 1998 - 2009 (Figure 2). The lower station shows a significant declining trend in the B-IBI scores from 1998-2009.

**Figure 2. Regression Analysis Results of Benthic Index of Biotic Integrity (IBI) Scores at Ambient Monitoring Spring 1998-2005, 2007-2009 and Summer 2006 Sampling Events.**

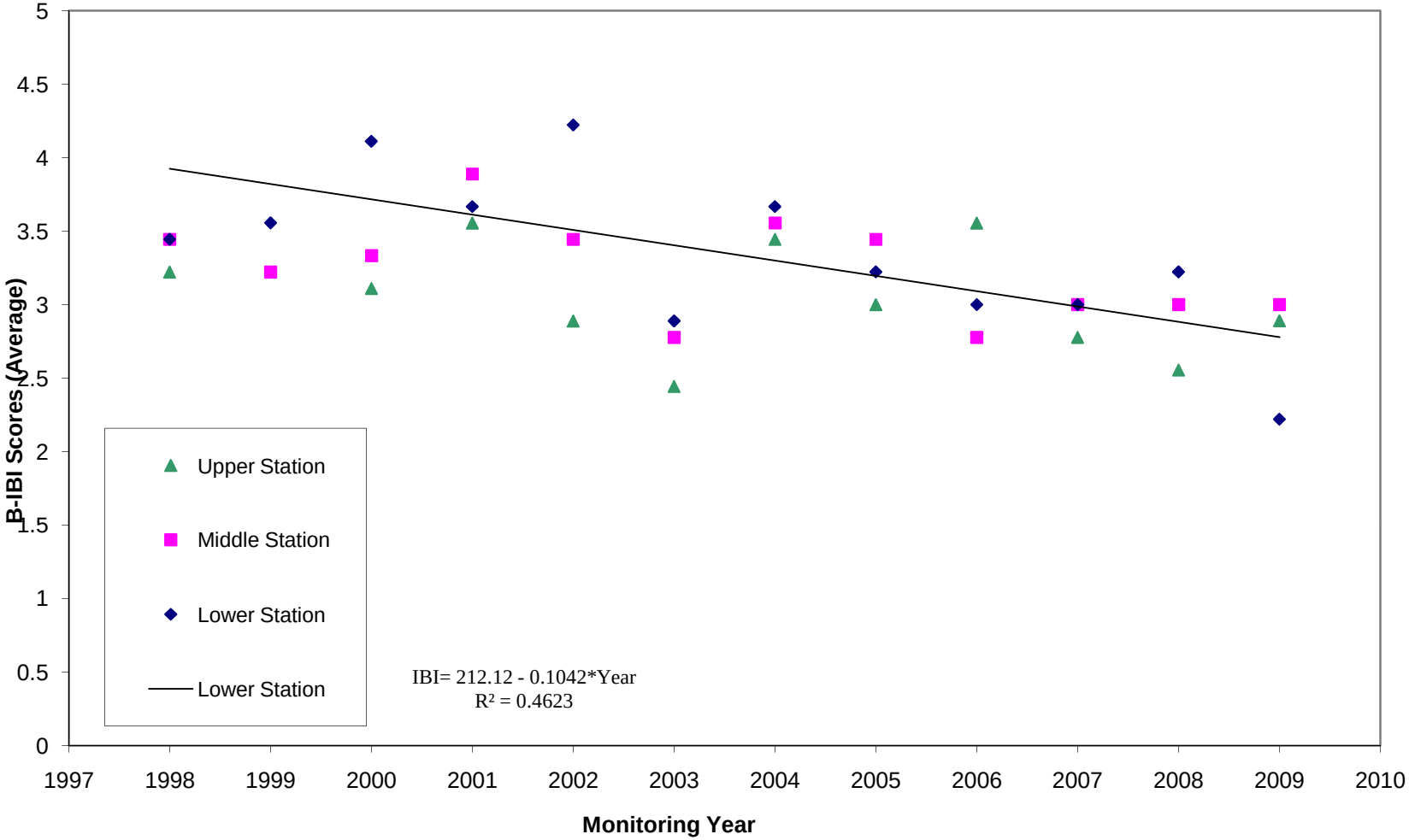


**Table 7. Benthic Index of Biotic Integrity (B-IBI) Scores, Percent of Urban Reference Index (URI), Hilsenhoff Biotic Index (HBI), and Urban Narrative Rating,**
**Harford County Department of Public Works, 1998-2009**

| Year | Station | B-IBI | Percent of URI | HBI | Urban Narrative Rating |
|---|---|---|---|---|---|
| 1998 | lower | 3.44 | 103.7 | 3.76 | approaching attainable community |
| | middle | 3.44 | 103.7 | 3.39 | approaching attainable community |
| | upper | 3.22 | 97.1 | 3.21 | approaching attainable community |
| 1999 | lower | 3.56 | 107.1 | 3.17 | approaching attainable community |
| | middle | 3.22 | 97.1 | 3.44 | approaching attainable community |
| 2000 | lower | 4.11 | 123.8 | 3.18 | approaching attainable community |
| | middle | 3.33 | 100.4 | 2.77 | approaching attainable community |
| | upper | 3.11 | 93.7 | 2.01 | approaching attainable community |
| 2001 | lower | 3.67 | 110.4 | 3.65 | approaching attainable community |
| | middle | 3.89 | 117.1 | 3.35 | approaching attainable community |
| | upper | 3.56 | 107.1 | 4.06 | approaching attainable community |
| 2002 | lower | 4.22 | 127.2 | 3.86 | approaching attainable community |
| | middle | 3.44 | 103.7 | 3.74 | approaching attainable community |
| | upper | 2.89 | 87.0 | 3.22 | approaching attainable community |
| 2003 | lower | 2.89 | 87.0 | 3.42 | approaching attainable community |
| | middle | 2.78 | 83.7 | 4.04 | approaching attainable community |
| | upper | 2.44 | 73.6 | 4.38 | improvement needed |
| 2004 | lower | 3.67 | 110.4 | 3.57 | approaching attainable community |
| | middle | 3.56 | 107.1 | 4.25 | approaching attainable community |
| | upper | 3.44 | 103.7 | 3.51 | approaching attainable community |
| 2005 | lower | 3.22 | 97.1 | 3.32 | approaching attainable community |
| | middle | 3.44 | 103.7 | 3.17 | approaching attainable community |
| | upper | 3.00 | 90.4 | 3.88 | approaching attainable community |
| 2006 | lower | 3.00 | 90.4 | 4.67 | approaching attainable community |
| | middle | 2.78 | 83.7 | 4.38 | approaching attainable community |
| | upper | 3.56 | 107.1 | 3.41 | approaching attainable community |
| 2007 | lower | 3.00 | 90.4 | 5.23 | approaching attainable community |
| | middle | 3.00 | 90.4 | 5.30 | approaching attainable community |
| | upper | 2.78 | 83.7 | 5.14 | approaching attainable community |
| 2008 | lower | 3.22 | 97.1 | 4.75 | approaching attainable community |
| | middle | 3.00 | 90.4 | 4.24 | approaching attainable community |
| | upper | 2.56 | 77.0 | 4.75 | improvement needed |
| 2009 | lower | 2.22 | 66.9 | 5.21 | improvement needed |
| | middle | 3.00 | 90.4 | 4.37 | approaching attainable community |
| | upper | 2.89 | 87.0 | 5.01 | approaching attainable community |

The Wilcoxon Signed-Rank test was used to investigate differences in B-IBI among the three stations. The Wilcoxon Signed-Rank test is a nonparametric test for paired sample data that incorporates both the sign and magnitude of the difference between observations. The results of the Wilcoxon Signed-Rank test indicate that the B-IBI scores in the upper station tend to be lower than the lower and middle stations (Table 8).

**Table 8. Wilcoxon Signed-Rank Test Results of Mean Benthic Index of Biotic Integrity (B-IBI) Scores for the Lower, Middle, and Upper Sampling Locations, Harford County Department of Public Works, 1998-2009**

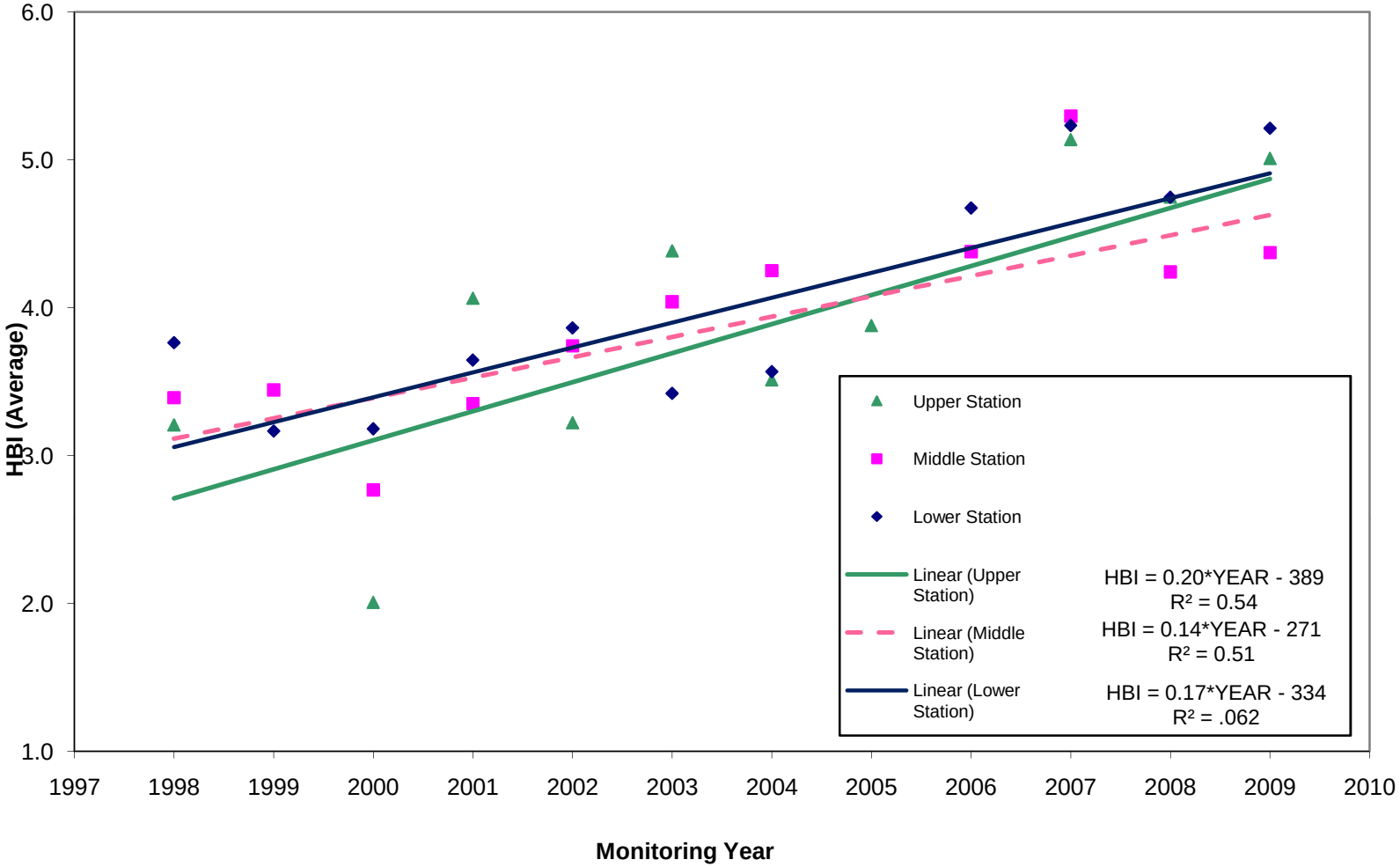
| Station | Mean B-IBI Score | |
|---|---|---|
| Lower | 3.35 | a |
| Middle | 3.24 | b |
| Upper | 3.04 | b |

Note: Mean scores with different letters are statistically different at the 95% significance level.

The B-IBI data were compared to the urban reference condition in Maryland using the urban reference index (URI). The URI results calculated indicate that all stations for every year are rated as approaching an attainable urban benthic community (73.6 – 127.2%), with the exception of the upper station in 2003 and 2008, and the lower station in 2009 (Table 7).

The HBI scores were calculated and rated according to the categories adopted by MBSS. The HBI scores for the upper (2.01 – 5.14), middle (2.77 – 5.30), and lower (3.17 – 5.23) stations were rated as good during the spring season, with the exception of the lower station in 2006, all three stations in 2007, and the upper and lower stations in 2008 and 2009 (Table 7). A linear regression analysis of HBI scores over time shows that the HBI scores have trended upward since 1998 (Figure 3).

**Figure 3. Regression Analysis Results of Hilsenhoff Biotic Index (HBI) at Ambient Monitoring Stations during Spring 1998-2005, 2007-2009 and Summer 2006 Sampling Events.**



The Wilcoxon Signed-Rank test was used to investigate differences in HBI among the three stations in the same manner used to investigate differences in B-IBI scores (Table 9). The results of the Wilcoxon Signed-Rank test indicate that HBI scores are similar at all three stations.

**Table 9. Wilcoxon Signed-Rank Test Results of Mean Hilsenhoff Biotic Index (HBI) Scores for the Lower, Middle, and Upper Sampling Locations, Harford County Department of Public Works, 1998-2009**

| Station | Mean HBI Score | |
|---|---|---|
| Lower | 3.99 | a |
| Middle | 3.87 | a |
| Upper | 3.87 | a |

Note: Mean scores with different letters are statistically different at the 95% significance level.

In the report CBWP-MANTA-EA-05-5, the B-IBI of the Harford County streams sampled by the MBSS between 2000 and 2004 indicated that 42% of the streams sampled were rated good. The results of the three indicators used in the study (Fish Index of Biotic Integrity, Benthic Index of Biotic Integrity Combined Biotic Index) did not indicate a trend in the B-IBI scores based on their location to each other within the county (Stribling, J.B. 2005). The B-IBI for the streams sampled in the Lower Winters Run watershed were rated as fair and poor during this study.

### 3.3 PHYSICAL HABITAT ASSESSMENT 2005 - 2009 DATA

The eight habitat metrics used to calculate the Physical Habitat Index (PHI) for each station includes percent embeddedness, remoteness, percent shading, epifaunal substrate, instream habitat, instream woody debris and rootwads, bank stability and riffle run quality. The habitat metrics measured in 2009 are presented in Table 10. The PHI of the upper 58 (partially degraded), middle 63 (partially degraded) and lower station is 63 (degraded), in 2009. The calculated PHI measured from 2005 to 2008 is presented in Appendix D.

**Table 10. Summary of Physical Habitat Metrics Used to Calculate the Physical Habitat Index (PHI), Harford County Department of Publics Works, June 2009**

| Metric | Station | | | | | |
|---|---|---|---|---|---|---|
| | Upper | | Middle | | Lower | |
| | Metric Score | Scaled Metric Score | Metric Score | Scaled Metric Score | Metric Score | Scaled Metric Score |
| Embeddedness | 85 | 16.6 | 75 | 27.80 | 75 | 27.78 |
| Shading | 100 | 95.56 | 100 | 98.19 | 100 | 99.19 |
| Epifaunal substrate | 11 | 58.80 | 11 | 58.80 | 11 | 58.80 |
| Instream Habitat | 11 | 68.85 | 13 | 79.19 | 13 | 79.04 |
| Woody Debris + Rootwads | 4 | 33.3 | 4 | 33.33 | 3 | 25 |
| Riffle/Run Quality | 9 | 75.24 | 11 | 82.48 | 12 | 87.30 |
| Physical Habitat Index | | 58 partially degraded | | 63 partially degraded | | 63 partially degraded |

Percent embeddedness is the fraction of surface area of larger particles that is surrounded by fine sediments on the stream bottom. Increases in embeddedness levels decrease the space between particles and limit the available area macroinvertebrates, and periphyton. Shifts to finer materials in particle size distributions can alter biotic communities by reducing species diversity and density (Lenat, Penrose, and Eagleson 1981). The percent embeddedness observed at the upper station is 85 and the middle and lower station is 75.

The shading rating is based on estimates of the degree and duration of shading at a site during summer months, including any effects shading may have on the landforms. Riparian canopy cover over a stream plays an important role in moderating stream temperatures through shading, and also as an indicator of conditions that control bank stability. Decaying organic material from riparian vegetation become food for benthic macroinvertebrates and other stream organisms and structure to create and maintain channel habitats. The percent shading recorded at all three stations is 100.

Epifaunal substrate is based on the amount and variety of hard stable substrates available to benthic macroinvertebrates. Low scores for epifaunal substrate may be an indication of erosion and sedimentation. The number of epifaunal substrate observed is 11 for all stations. The number of instream habitats observed at the upper station is 11 and the middle station and lower stations is13.

The amount of woody debris in streams contributes to increases in habitat diversity and complexity, improved flow heterogeneity, long-term nutrient storage and substrate for aquatic invertebrates, moderating flow disturbances, and provides refuge for aquatic organisms during flow events (Bisson, et al. 1987).

Rootwads provide erosion control and substrate for benthic macroinvertebrates and may act as anchors along the stream bank during high flows, thereby reducing sedimentation downstream (Remich, ODNR 2002). The number of woody debris and rootwads recorded at the upper and middle station is 4 and the lower station is 3.

In the report CBWP-MANTA-EA-05-5, the PHI of the Harford County streams sampled by the MBSS between 2000 and 2004 indicated that 12% of the streams sampled were rated good, 47% had partially degraded habitat, 40% poor or very poor. The average PHI score of the physical habitat assessment conducted at the County's unnamed tributary to Winters Run indicate that the habitat of the stream was minimally degraded in 2005, partially degraded in 2006, 2007 and 2009, and degraded in 2008.

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# APPENDIX A
# PHYLOGENETIC LIST, TOLERANCE VALUES (TOLVAL), AND FUNCTIONAL FEEDING GROUPS (FFG)

Table A-1. Phylogenetic list, tolerance values (TolVal), and functional feeding groups (FFG) of macroinvertebrates for Spring 1998-2005, 2007-2009 and Summer 2006 Sampling Events.

| Family | Taxon | Tolerance Value | FFG | Tribe | Habit |
|---|---|---|---|---|---|
| | Nematoda | 5 | | | |
| | Terrestrial/adults | | | | |
| Goriodea | Gordiodea | | | | bu |
| Prostomatidae | Prostoma sp. | 7.3 | Predator | | |
| | Gastropoda | 7 | Scraper | | |
| Lymnaeidae | Lymnaeidae | 6.9 | Scraper | | cb |
| Physidae | Physa sp. | 7 | Scraper | | cb |
| Physidae | Physella sp. | 7 | Scraper | | cb |
| Hirudinidae | Placobdella sp. | 6 | Predator | | |
| Curculionidae | Curculionidae | | Shredder | | cn |
| Drypoidae | Helichus sp. | 6.4 | Scraper | | cn |
| Dytiscidae | Deronectes sp. | 5.4 | Predator | | sw |
| Dytiscidae | Hydroporus sp. | 4.6 | Predator | | sw,cb |
| Elmidae | Elmidae | 4.8 | Collector | | cn |
| Elmidae | Microcylleopus sp. | 4.8 | Shredder | | |
| Elmidae | Optioservus sp. | 5.4 | Scraper | | cn |
| Elmidae | Oulimnius sp. | 2.7 | Scraper | | cn |
| Elmidae | Promoresia sp. | 0 | Scraper | | cn |
| Elmidae | Stenelmis sp. | 7.1 | Scraper | | cn |
| Hydrophilidae | Hydrobius sp. | 4.1 | Collector | | cb,cn,sp |
| Hydrophilidae | Hydrochus sp. | 4.1 | Shredder | | cb |
| Hydrophilidae | Tropisternus sp. | 4.1 | Collector | | cb |
| Psephenidae | Ectopria nervosa | 2.2 | Scraper | | cn |
| Psephenidae | Ectopria sp. | 2.2 | Scraper | | cn |
| Psephenidae | Psephenus herricki | 4.4 | Scraper | | cn |
| Psephenidae | Psephenus sp. | 4.4 | Scraper | | cn |
| Ptilodactylidae | Anchytarsus bicolor | 3.1 | Shredder | | cn |
| Ptilodactylidae | Anchytarsus sp. | 3.1 | Shredder | | cn |
| Isotomidae | Isotomurus sp. | 4.8 | Collector | | |
| | Diptera | 6 | | | |
| Ceratopogonidae | Ceratopogonidae | 3.6 | Predator | | sp,bu |
| Ceratopogonidae | Probezzia sp. | 3 | Predator | | bu |
| Chironomidae | Ablabesmyia sp. | 8.1 | Predator | | sp |
| Chironomidae | Brillia sp. | 7.4 | Shredder | | bu,sp |
| Chironomidae | Chaetocladius sp. | 7 | Collector | | sp |
| Chironomidae | Chironomidae | 6.6 | Predator | | |
| Chironomidae | Chironominae | 6.6 | Collector | | |
| Chironomidae | Chironomini | 5.9 | | Chironomini | |
| Chironomidae | Conchapelopia sp. | 6.1 | Predator | Pentaneurini | sp |
| Chironomidae | Corynoneura sp. | 4.1 | Collector | | sp |
| Chironomidae | Cricotopus sp. | 9.6 | Shredder | | cn,bu |
| Chironomidae | Diamesa sp. | 8.5 | Collector | | sp |
| Chironomidae | Eukiefferiella sp. | 6.1 | Collector | | sp |
| Chironomidae | Heterotrissocladius sp. | 2 | Collector | Metriocremini | sp,bu |
| Chironomidae | Hydrobaenus sp. | 7.2 | Scraper | | sp |
| Chironomidae | Limnophyes sp. | 8.6 | Collector | | sp |
| Chironomidae | Micropsectra sp. | 2.1 | Collector | Tanytarsini | cb,sp |
| Chironomidae | Microtendipes sp. | 4.9 | Filterer | Chironomini | cn |
| Chironomidae | Natarsia sp. | 6.6 | Predator | | sp. |
| Chironomidae | Nilotanypus sp. | 6.6 | Predator | Pentaneurini | sp |
| Chironomidae | Orthocladiinae | 7.6 | Collector | | |
| Chironomidae | Orthocladinae | 7.6 | Collector | | |
| Chironomidae | Orthocladius sp. | 9.2 | Collector | | sp,bu |
| Chironomidae | Paramerina sp. | 6.6 | Predator | Pentaneurini | sp |
| Chironomidae | Parametriocnemus sp. | 4.6 | Collector | | sp |
| Chironomidae | Paraphaenocladius sp. | 4 | Collector | | sp |
| Chironomidae | Paratanytarsus sp. | 7.7 | Collector | | sp |
| Chironomidae | Paratendipes sp. | 6.6 | Collector | | bu |
| Chironomidae | Phaenopsectra sp. | 8.7 | Collector | Chironomini | cn |
| Chironomidae | Polypedilum sp. | 6.3 | Shredder | Chironomini | cb,cn |
| Chironomidae | Pseudoorthocladius sp. | 6 | Collector | | sp |
| Chironomidae | Rheotanytarsus sp. | 7.2 | Filterer | Tanytarsini | cn |

Habit: bu-burrower, cn-clinger, cb-climber, sp-sprawler, dv-diver, and sk-skater.

Table A-1. Phylogenetic list, tolerance values (TolVal), and functional feeding groups (FFG) of macroinvertebrates for Spring 1998-2005, 2007-2009 and Summer 2006 Sampling Events.

| Family | Taxon | Tolerance Value | FFG | Tribe | Habit |
|---|---|---|---|---|---|
| Chironomidae | Stempellinella sp. | 4.2 | Collector | Tanytarsini | cb,sp,cn |
| Chironomidae | Tanypodinae | 7.5 | Predator | | |
| Chironomidae | Tanytarsini | 3.5 | Collector | Tanytarsini | |
| Chironomidae | Tanytarsus sp. | 4.9 | Filterer | Tanytarsini | cb,cn |
| Chironomidae | Thienemanniella sp. | 5.1 | Collector | | sp |
| Chironomidae | Thienemannimyia grp. | 8.2 | Predator | Pentaneurini | sp |
| Chironomidae | Trissopelopia sp. | 4.1 | Predator | | sp |
| Chironomidae | Tvetenia sp. | 5.1 | Collector | | sp |
| Chironomidae | Zavrelimyia sp. | 5.3 | Predator | Pentaneurini | sp |
| Empididae | Chelifera sp. | 7.1 | Predator | | sp,bu |
| Empididae | Clinocera sp. | 7.4 | Predator | | cn |
| Empididae | Empididae | 7.5 | Predator | | sp,bu |
| Empididae | Hemerodromia sp. | 7.9 | Predator | | sp,bu |
| Simuliidae | Simuliidae | 3.2 | Filterer | | cn |
| Simuliidae | Simulium sp. | 5.7 | Filterer | | cn |
| Tipulidae | Antocha sp. | 8 | Collector | | cn |
| Tipulidae | Dicranota sp. | 1.1 | Predator | | |
| Tipulidae | Hexatoma sp. | 1.5 | Predator | | bu,sp |
| Tipulidae | Limonia sp. | 4.8 | Shredder | | bu,sp |
| Tipulidae | Pseudolimnophila sp. | 2.8 | Predator | | bu |
| Tipulidae | Tipula sp. | 6.7 | Shredder | | bu |
| Tipulidae | Tipulidae | 4.8 | Predator | | bu,sp |
| Baetidae | Baetidae | 2.3 | Collector | | sw,cn |
| Baetidae | Baetis sp. | 3.9 | Collector | | sw,cb,cn |
| Ephemerellidae | Ephemerella sp. | 2.3 | Collector | | cn,sw |
| Heptageniidae | Heptageniidae | 2.6 | Scraper | | cn |
| Heptageniidae | Stenacron sp. | 2 | Collector | | cn |
| Heptageniidae | Stenonema sp. | 4.6 | Scraper | | cn |
| Leptophlebiidae | Leptophlebiidae | 1.7 | Collector | | sw,cn |
| Leptophlebiidae | Paraleptophlebia sp. | 2 | Collector | | sw,cn,sp |
| Gerridae | Trepobates sp. | 6 | Predator | | skater |
| Vellidae | Microvelia sp. | 6 | Predator | | skater |
| Vellidae | Rhagovelia sp. | 6 | Predator | | skater |
| Vellidae | Veliidae | | | | |
| Corydalidae | Corydalidae | 1.4 | Predator | | |
| Corydalidae | Nigronia sp. | 1.4 | Predator | | cn,cb |
| Sialidae | Sialis sp. | 1.9 | Predator | | bu,cd,cn |
| | Odonata | 6.6 | Predator | | |
| Aeshnidae | Aeshnidae | 6.2 | Predator | | cb |
| Aeshnidae | Boyeria sp. | 6.3 | Predator | | cb,sp |
| Corduliidae | Corduliidae | 2 | Predator | | sp,cb |
| Gomphidae | Gomphidae | 2.2 | Predator | | bu |
| Gomphidae | Lanthus sp. | 1.1 | Predator | | bu |
| Gomphidae | Stylogomphus sp. | 2.2 | Predator | | bu |
| Gomphidae | Stylurus sp. | 2.2 | Predator | | bu |
| | Plecoptera | 2.4 | | | |
| Leuctridae | Leuctra sp. | 0.4 | Shredder | | cn |
| Leuctridae | Leuctridae | 0.8 | Shredder | | sp,cn |
| Nemouridae | Amphinemura sp. | 3 | Shredder | | sp,cn |
| Perlidae | Acroneuria abnormis | 2.5 | Predator | | cn |
| Perlidae | Acroneuria sp. | 2.5 | Predator | | cn |
| Perlidae | Eccoptura sp. | 0.6 | Predator | | cn |
| Perlidae | Perlesta sp. | 1.6 | Predator | | cn |
| Perlidae | Perlidae | 2.2 | Predator | | cn |
| Glossosomatidae | Glossosoma nigrior | 0 | Scraper | | cn |
| Glossosomatidae | Glossosoma sp. | 0 | Scraper | | cn |
| Hydropsychidae | Cheumatopsyche sp. | 6.5 | Filterer | | cn |
| Hydropsychidae | Diplectrona modesta | 2.7 | Filterer | | cn |
| Hydropsychidae | Diplectrona sp. | 2.7 | Filterer | | cn |
| Hydropsychidae | Hydropsyche sp. | 7.5 | Filterer | | cn |
| Hydropsychidae | Hydropsychidae | 5.7 | Filterer | | cn |
| Lepidostomatidae | Lepidostoma sp. | 0 | Shredder | | cb,sp,cn |

Habit: bu-burrower, cn-clinger, cb-climber, sp-sprawler, dv-diver, and sk-skater.

Table A-1. Phylogenetic list, tolerance values (TolVal), and functional feeding groups (FFG) of macroinvertebrates for Spring 1998-2005, 2007-2009 and Summer 2006 Sampling Events.

| Family | Taxon | Tolerance Value | FFG | Tribe | Habit |
|---|---|---|---|---|---|
| Lepidostomatidae | Lepidostomatidae | 1 | | | |
| Odontoceridae | Psilotreta sp. | 0.9 | Scraper | | sp |
| Philopotamidae | Chimarra aterrima | 4.4 | Filterer | | cn |
| Philopotamidae | Chimarra sp. | 4.4 | Filterer | | cn |
| Philopotamidae | Dolophilodes distinctus | 1.7 | Filterer | | cn |
| Philopotamidae | Dolophilodes sp. | 1.7 | Filterer | | cn |
| Philopotamidae | Philopotamidae | 2.6 | Filterer | | cn |
| Polycentropodidae | Neureclipsis sp. | 0.2 | Filterer | | cn |
| Polycentropodidae | Polycentropus sp. | 1.1 | Filterer | | cn |
| Psychomyiidae | Lype sp. | 4.7 | Scraper | | cn |
| Rhyacophilidae | Rhyacophila sp. | 2.1 | Predator | | cn |
| Rhyacophilidae | Rhyacophilidae | 0 | | | |
| Uenoidae | Neophylax sp. | 2.7 | Scraper | | cn |
| Cambaridae | Cambaridae | 2.8 | Shredder | | sp |
| Cambaridae | Cambarus sp. | 0.4 | Collector | | sp |
| Cambaridae | Orconectes sp. | 2.8 | Shredder | | sp |
| Lumbriculidae | Lumbriculidae | 6.6 | Collector | | bu |
| Enchytraeidae | Enchytraeidae | 9.1 | Collector | | bu |
| Naididae | Naididae | 8.5 | Collector | | bu |
| Naididae | Nais sp. | 8.5 | Collector | | |
| Tubificidae | Spirosperma sp. | 6.6 | Collector | | cn |
| Tubificidae | Tubificidae | 8.4 | Collector | | cn |
| Sphaeridae | Sphaeridae | 6.5 | Filterer | | bu |
| Dugesiidae | Dugesiidae | 8.4 | Predator | | sp |

Habit: bu-burrower, cn-clinger, cb-climber, sp-sprawler, dv-diver, and sk-skater.

# APPENDIX B
# ABUNDANCE OF MACROINVERTEBRATES COLLECTED IN SPRING OF 1998-2005, 2007- 2009 AND SUMMER OF 2006

Appendix B. Abundance of Macroinvertebrates Collected in Spring of 1998-2005, 2007-2009 and Summer of 2006

| | | | | Spring 1998 | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | lower | | | middle | | | upper | | |
| order | family | tribe | taxon name | 1 | 2 | 3 | 1 | 2 | 3 | 1 | 2 | 3 |
| Hoplonemertea | Prostomatidae | | Prostoma sp. | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| | Lumbriculidae | | Lumbriculidae | --- | --- | --- | --- | --- | --- | --- | --- | 1 |
| Decapoda | Cambaridae | | Cambaridae | --- | --- | --- | --- | 1 | --- | --- | --- | --- |
| Decapoda | Cambaridae | | Cambarus sp. | --- | --- | --- | --- | --- | --- | --- | --- | 1 |
| Ephemeroptera | Baetidae | | Baetidae | --- | --- | --- | --- | 2 | --- | --- | --- | 1 |
| Ephemeroptera | Baetidae | | Baetis sp. | 15 | --- | 1 | --- | --- | --- | --- | --- | --- |
| Ephemeroptera | Leptophlebiidae | | Paraleptophlebia sp. | 3 | 1 | --- | --- | 1 | --- | --- | --- | 1 |
| Odonata | Gomphidae | | Gomphidae | 3 | --- | 2 | --- | --- | --- | --- | --- | --- |
| Odonata | Gomphidae | | Lanthus sp. | --- | --- | --- | --- | --- | --- | --- | --- | 1 |
| Plecoptera | Capniidae | | Capniidae | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Plecoptera | Capniidae | | Allocapnia sp. | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Plecoptera | Leuctridae | | Leuctra sp. | 53 | --- | 1 | 7 | 26 | 2 | --- | 11 | 52 |
| Plecoptera | Nemouridae | | Amphinemura sp. | --- | --- | 9 | --- | 2 | --- | --- | --- | --- |
| Plecoptera | Perlidae | | Perlidae | --- | 1 | --- | 1 | 2 | 1 | --- | --- | --- |
| Plecoptera | Perlidae | | Acroneuria abnormis | 1 | 1 | --- | --- | --- | --- | --- | --- | --- |
| Plecoptera | Perlodidae | | Perlodidae | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Plecoptera | Taeniopterygidae | | Taeniopteryx sp. | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Hemiptera | Vellidae | | Microvelia sp. | --- | --- | --- | --- | --- | --- | --- | --- | 2 |
| Hemiptera | Vellidae | | Rhagovelia sp. | 1 | --- | --- | --- | --- | 2 | 1 | --- | --- |
| Hemiptera | Gerridae | | Trepobates sp. | 1 | --- | --- | --- | --- | --- | --- | --- | --- |
| Megaloptera | Corydalidae | | Nigronia sp. | 1 | --- | 1 | --- | --- | --- | --- | --- | --- |
| Megaloptera | Sialidae | | Sialis sp. | --- | --- | --- | --- | --- | --- | --- | --- | 2 |
| Trichoptera | Glossosomatidae | | Glossosoma nigrior | 1 | 3 | --- | 1 | 1 | 2 | --- | --- | --- |
| Trichoptera | Hydropsychidae | | Cheumatopsyche sp. | 21 | 3 | 4 | 2 | 11 | 1 | 3 | 4 | 21 |
| Trichoptera | Hydropsychidae | | Diplectrona modesta | 16 | 5 | 7 | 7 | 28 | 4 | 4 | 4 | 12 |
| Trichoptera | Hydropsychidae | | Hydropsyche sp. | 6 | 4 | --- | --- | 24 | 1 | --- | 1 | --- |
| Trichoptera | Hydropsychidae | | Hydropsyche betteni | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Trichoptera | Lepidostomatidae | | Lepidostoma sp. | --- | --- | --- | --- | 2 | --- | --- | --- | --- |
| Trichoptera | Odontoceridae | | Psilotreta sp. | --- | --- | --- | --- | 1 | --- | --- | --- | --- |
| Trichoptera | Philopotamidae | | Chimarra aterrima | 2 | 1 | 3 | --- | 1 | --- | --- | --- | --- |
| Trichoptera | Philopotamidae | | Dolophilodes distinctus | 11 | --- | --- | --- | 6 | --- | --- | --- | 1 |
| Trichoptera | Polycentropodidae | | Polycentropus sp. | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Trichoptera | Rhyacophilidae | | Rhyacophila sp. | 1 | 1 | --- | 1 | --- | --- | --- | --- | --- |

Appendix B. Abundance of Macroinvertebrates Collected in Spring of 1998-2005, 2007-2009 and Summer of 2006

| | | | | Spring 1998 | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | lower | | | middle | | | upper | | |
| order | family | tribe | taxon name | 1 | 2 | 3 | 1 | 2 | 3 | 1 | 2 | 3 |
| Trichoptera | Uenoidae | | Neophylax sp. | --- | --- | --- | --- | --- | 1 | --- | --- | --- |
| Coleoptera | Drypoidae | | Helichus sp. | --- | --- | --- | --- | 1 | --- | --- | --- | --- |
| Coleoptera | Dytiscidae | | Deronectes sp. | --- | --- | --- | --- | 1 | --- | --- | --- | --- |
| Coleoptera | Elmidae | | Optioservus sp. | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Coleoptera | Elmidae | | Oulimnius sp. | 3 | --- | --- | --- | 3 | --- | --- | --- | --- |
| Coleoptera | Hydrophilidae | | Hydrobius sp. | --- | --- | 1 | --- | --- | --- | --- | --- | --- |
| Coleoptera | Hydrophilidae | | Stenelmis sp. | 1 | --- | 3 | --- | 10 | 1 | --- | --- | 3 |
| Coleoptera | Psephenidae | | Psephenus herricki | 14 | 8 | 13 | 2 | 12 | 2 | 6 | 2 | 13 |
| Coleoptera | Psephenidae | | Ectopria nervosa | 1 | --- | --- | 3 | 5 | --- | 6 | 7 | 13 |
| Coleoptera | Ptilodactylidae | | Anchytarsus bicolor | 1 | 1 | --- | --- | --- | --- | --- | --- | --- |
| Diptera | Chironomidae | | Brillia sp. | --- | --- | --- | --- | 1 | --- | --- | --- | --- |
| Diptera | Chironomidae | Pentaneurini | Conchapelopia sp. | 7 | 1 | --- | --- | 2 | 1 | --- | 1 | 3 |
| Diptera | Chironomidae | | Corynoneura sp. | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Diptera | Chironomidae | | Cricotopus/Orthocladius sp. | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Diptera | Chironomidae | | Eukiefferiella sp. | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Diptera | Chironomidae | Tanytarsini | Micropsectra sp. | --- | --- | 1 | --- | 6 | --- | --- | --- | --- |
| Diptera | Chironomidae | | Parachaetocladius sp. | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Diptera | Chironomidae | | Parakiefferiella sp. | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Diptera | Chironomidae | | Parametriocnemus sp. | --- | --- | --- | --- | 14 | --- | --- | --- | --- |
| Diptera | Chironomidae | Chironomini | Polypedilum sp. | 1 | --- | --- | --- | 2 | --- | --- | --- | --- |
| Diptera | Chironomidae | Tanytarsini | Rheotanytarsus sp. | --- | --- | --- | --- | 2 | --- | 2 | --- | --- |
| Diptera | Chironomidae | | Trissopelopia sp. | 3 | --- | --- | --- | 5 | --- | --- | --- | 11 |
| Diptera | Chironomidae | | Tvetenia sp. | --- | 1 | --- | --- | 12 | 1 | --- | --- | --- |
| Diptera | Empididae | | Hemerodromia sp. | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Diptera | Simuliidae | | Simulium sp. | 1 | --- | --- | --- | 8 | --- | --- | --- | --- |
| Diptera | Tipulidae | | Antocha sp. | 2 | --- | --- | --- | --- | --- | --- | --- | --- |
| Diptera | Tipulidae | | Tipula sp. | --- | --- | --- | 1 | 1 | --- | --- | --- | 2 |
| Total Benthos | | | | 170 | 31 | 46 | 25 | 193 | 19 | 22 | 30 | 140 |
| Total Taxa | | | | 25 | 13 | 12 | 9 | 30 | 12 | 6 | 7 | 17 |

Appendix B. Abundance of Macroinvertebrates Collected in Spring of 1998-2005, 2007, 2008, 2009 and Summer of 2006

| | | | | Spring 1999 | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | lower | | | middle | | |
| order | family | tribe | taxon name | 1 | 2 | 3 | 1 | 2 | 3 |
| | Lumbriculidae | | Lumbriculidae | 1 | --- | 2 | 1 | --- | --- |
| Isopoda | | | Terrestrial/Adults | --- | 3 | --- | 1 | 1 | --- |
| Isopoda | | | Terrestrial Isopoda | --- | --- | --- | --- | --- | --- |
| Decapoda | Cambaridae | | Cambaridae | --- | --- | 1 | --- | --- | --- |
| Decapoda | Cambaridae | | Orconectes sp. | --- | 1 | --- | --- | --- | --- |
| Ephemeroptera | Baetidae | | Baetidae | --- | 1 | 9 | 3 | 1 | --- |
| Ephemeroptera | Leptophlebiidae | | Leptophlebiidae | --- | 1 | --- | --- | --- | --- |
| Odonata | | | Odonata | --- | --- | 1 | --- | --- | --- |
| Odonata | Gomphidae | | Gomphidae | --- | --- | --- | 2 | --- | --- |
| Plecoptera | Leuctridae | | Leuctridae | --- | 3 | --- | --- | --- | --- |
| Plecoptera | Leuctridae | | Leuctra sp. | 6 | --- | 13 | 10 | 10 | --- |
| Plecoptera | Nemouridae | | Amphinemura sp. | --- | --- | 1 | --- | --- | --- |
| Plecoptera | Perlidae | | Perlidae | 12 | 7 | 9 | 3 | --- | --- |
| Plecoptera | Perlidae | | Acroneuria sp. | --- | --- | --- | --- | --- | --- |
| Hemiptera | Vellidae | | Microvelia sp. | --- | --- | 1 | 1 | 1 | --- |
| Trichoptera | Glossosomatidae | | Glossosoma sp. | 1 | 4 | 7 | 1 | --- | --- |
| Trichoptera | Hydropsychidae | | Hydropsychidae | 13 | --- | 12 | --- | --- | --- |
| Trichoptera | Hydropsychidae | | Cheumatopsyche sp. | 3 | --- | 2 | --- | 1 | 1 |
| Trichoptera | Hydropsychidae | | Diplectrona sp. | 11 | 11 | 38 | 5 | 18 | 1 |
| Trichoptera | Hydropsychidae | | Hydropsyche sp. | 14 | --- | 7 | 1 | --- | --- |
| Trichoptera | Leptoceridae | | Leptoceridae | --- | --- | --- | --- | --- | --- |
| Trichoptera | Philopotamidae | | Philopotamidae | --- | --- | 3 | --- | --- | --- |
| Trichoptera | Philopotamidae | | Chimarra sp. | --- | --- | 5 | 4 | 8 | --- |
| Trichoptera | Philopotamidae | | Dolophilodes sp. | 14 | 12 | 5 | --- | --- | --- |
| Trichoptera | Psychomyiidae | | Lype sp. | 1 | --- | --- | --- | --- | --- |
| Trichoptera | Rhyacophilidae | | Rhyacophilidae | --- | --- | --- | --- | 1 | --- |
| Trichoptera | Uenoidae | | Neophylax sp. | --- | --- | --- | 1 | --- | --- |
| Coleoptera | Dytiscidae | | Hydroporus sp. | --- | --- | 2 | --- | --- | --- |
| Coleoptera | Elmidae | | Elmidae | --- | --- | --- | --- | --- | --- |
| Coleoptera | Elmidae | | Promoresia sp. | 1 | --- | --- | --- | --- | --- |
| Coleoptera | Hydrophilidae | | Stenelmis sp. | 2 | --- | --- | --- | 1 | --- |
| Coleoptera | Psephenidae | | Psephenus sp. | 2 | --- | --- | 19 | 3 | 13 |
| Coleoptera | Psephenidae | | Ectopria sp. | --- | --- | --- | 9 | 3 | --- |

Appendix B. Abundance of Macroinvertebrates Collected in Spring of 1998-2005, 2007, 2008, 2009 and Summer of 2006

| | | | | Spring 1999 | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | lower | | | middle | | |
| order | family | tribe | taxon name | 1 | 2 | 3 | 1 | 2 | 3 |
| Diptera | Chironomidae | Tanytarsini | Tanytarsini | 1 | --- | --- | --- | 1 | --- |
| Diptera | Chironomidae | | Tanypodinae | --- | --- | --- | --- | --- | --- |
| Diptera | Chironomidae | | Orthocladiinae | --- | 1 | 2 | --- | --- | --- |
| Diptera | Chironomidae | Pentaneurini | Conchapelopia sp. | 4 | --- | 3 | --- | --- | --- |
| Diptera | Chironomidae | | Cricotopus/Orthocladius gr. | --- | --- | --- | --- | --- | --- |
| Diptera | Chironomidae | | Parametriocnemus sp. | 6 | --- | 2 | --- | --- | --- |
| Diptera | Chironomidae | Tanytarsini | Rheotanytarsus sp. | --- | --- | --- | 1 | --- | --- |
| Diptera | Chironomidae | Tanytarsini | Tanytarsus sp. | --- | --- | 5 | 1 | --- | --- |
| Diptera | Chironomidae | | Trissopelopia sp. | --- | --- | 3 | --- | --- | --- |
| Diptera | Chironomidae | | Tvetenia sp. | --- | --- | --- | --- | 1 | --- |
| Diptera | Simuliidae | | Simulium sp. | 2 | --- | 2 | --- | --- | --- |
| Diptera | Tipulidae | | Tipula sp. | 1 | --- | 2 | --- | --- | --- |
| Total Benthos | | | | 95 | 44 | 137 | 63 | 50 | 15 |
| Total Taxa | | | | 18 | 10 | 24 | 16 | 13 | 3 |

Appendix B. Abundance of Macroinvertebrates Collected in Spring of 1998-2005, 2007, 2008, 2009 and Summer of 2006

| | | | | Spring 2000 | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | lower | | | middle | | | upper | | |
| order | family | tribe | taxon name | 1 | 2 | 3 | 1 | 2 | 3 | 1 | 2 | 3 |
| | | | Nematoda | 1 | --- | --- | --- | --- | --- | --- | --- | --- |
| | Lumbriculidae | | Lumbriculidae | 1 | --- | --- | --- | --- | --- | --- | --- | --- |
| Decapoda | Cambaridae | | Cambaridae | --- | --- | --- | --- | 1 | --- | --- | --- | --- |
| Collembola | | | Collembola | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Ephemeroptera | Ameletidae | | Ameletus sp. | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Ephemeroptera | Baetidae | | Baetidae | 5 | --- | --- | 5 | 2 | --- | --- | 1 | --- |
| Ephemeroptera | Ephemerellidae | | Ephemerellidae | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Ephemeroptera | Ephemerellidae | | Eurylophella sp. | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Ephemeroptera | Heptageniidae | | Heptageniidae | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Ephemeroptera | Heptageniidae | | Epeorus sp. | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Ephemeroptera | Heptageniidae | | Stenacron sp. | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Ephemeroptera | Leptophlebiidae | | Leptophlebiidae | 2 | --- | --- | --- | --- | --- | --- | --- | --- |
| Ephemeroptera | Leptophlebiidae | | Paraleptophlebia sp. | --- | --- | 9 | --- | --- | --- | --- | --- | --- |
| Odonata | Calopterygidae | | Calopteryx sp. | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Odonata | Gomphidae | | Gomphidae | --- | 4 | 1 | --- | --- | --- | --- | --- | --- |
| Plecoptera | | | Plecoptera | --- | --- | --- | --- | --- | --- | 3 | 1 | --- |
| Plecoptera | Capniidae | | Capniidae | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Plecoptera | Capniidae | | Allocapnia sp. | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Plecoptera | Leuctridae | | Leuctra sp. | 23 | 13 | 11 | 25 | 26 | 16 | 101 | 15 | 10 |
| Plecoptera | Nemouridae | | Amphinemura sp. | --- | --- | 1 | --- | --- | --- | --- | --- | --- |
| Plecoptera | Perlidae | | Perlidae | 17 | 6 | 2 | 1 | --- | --- | --- | --- | --- |
| Plecoptera | Perlidae | | Acroneuria sp. | 2 | --- | --- | --- | --- | --- | --- | --- | --- |
| Plecoptera | Perlidae | | Eccoptura sp. | 1 | --- | --- | 2 | --- | --- | --- | --- | --- |
| Plecoptera | Taeniopterygidae | | Taeniopteryx sp. | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Megaloptera | Corydalidae | | Corydalidae | 1 | --- | --- | --- | --- | --- | --- | --- | --- |
| Megaloptera | Corydalidae | | Nigronia sp. | --- | --- | --- | 2 | --- | --- | --- | --- | --- |
| Megaloptera | Sialidae | | Sialis sp. | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Trichoptera | Glossosomatidae | | Glossosoma sp. | 4 | 2 | 5 | --- | --- | 2 | --- | --- | --- |
| Trichoptera | Hydropsychidae | | Hydropsychidae | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Trichoptera | Hydropsychidae | | Cheumatopsyche sp. | 10 | 4 | 8 | 6 | 6 | 4 | 1 | 1 | --- |
| Trichoptera | Hydropsychidae | | Diplectrona sp. | 46 | 22 | 20 | 43 | 39 | 15 | 83 | 3 | 12 |
| Trichoptera | Hydropsychidae | | Hydropsyche sp. | --- | 2 | 7 | --- | 3 | 1 | --- | --- | --- |
| Trichoptera | Limnephilidae | | Limnephilidae | --- | --- | --- | --- | --- | --- | --- | --- | --- |

Appendix B. Abundance of Macroinvertebrates Collected in Spring of 1998-2005, 2007, 2008, 2009 and Summer of 2006

| | | | | Spring 2000 | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | lower | | | middle | | | upper | | |
| order | family | tribe | taxon name | 1 | 2 | 3 | 1 | 2 | 3 | 1 | 2 | 3 |
| Trichoptera | Limnephilidae | | Hydatophylax sp. | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Trichoptera | Philopotamidae | | Philopotamidae | --- | --- | 2 | --- | --- | --- | --- | --- | --- |
| Trichoptera | Philopotamidae | | Chimarra sp. | 1 | 2 | --- | --- | 1 | --- | --- | --- | --- |
| Trichoptera | Philopotamidae | | Dolophilodes sp. | 10 | 1 | 3 | 3 | 22 | --- | --- | --- | --- |
| Trichoptera | Polycentropodidae | | Polycentropus sp. | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Trichoptera | Rhyacophilidae | | Rhyacophila sp. | 4 | --- | 2 | 1 | 1 | --- | 1 | --- | --- |
| Trichoptera | Uenoidae | | Neophylax sp. | 3 | 1 | --- | --- | --- | --- | 4 | --- | --- |
| Coleoptera | Drypoidae | | Helichus sp. | --- | --- | --- | 1 | --- | --- | --- | --- | --- |
| Coleoptera | Dytiscidae | | Hydroporus sp. | 3 | --- | --- | 1 | --- | --- | 2 | --- | --- |
| Coleoptera | Elmidae | | Optioservus sp. | 3 | --- | --- | --- | --- | --- | --- | --- | --- |
| Coleoptera | Elmidae | | Oulimnius sp. | 5 | --- | 1 | 1 | 2 | --- | 1 | --- | --- |
| Coleoptera | Hydrophilidae | | Hydrobius sp. | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Coleoptera | Hydrophilidae | | Stenelmis sp. | 5 | 2 | --- | --- | --- | 5 | --- | 1 | 1 |
| Coleoptera | Hydrophilidae | | Tropisternus sp. | --- | --- | --- | --- | --- | --- | 1 | --- | --- |
| Coleoptera | Psephenidae | | Psephenus sp. | 33 | 2 | 7 | 6 | 3 | 7 | 2 | --- | 1 |
| Coleoptera | Psephenidae | | Ectopria sp. | 1 | 1 | --- | 1 | --- | 1 | --- | --- | --- |
| Coleoptera | Ptilodactylidae | | Anchytarsus sp. | --- | 2 | --- | --- | --- | --- | --- | --- | --- |
| Diptera | | | Diptera | --- | --- | --- | --- | --- | --- | 1 | --- | --- |
| Diptera | Ceratopogonidae | | Probezzia sp. | --- | --- | --- | --- | --- | --- | --- | 1 | --- |
| Diptera | Chironomidae | Tanytarsini | Tanytarsini | --- | --- | --- | 2 | --- | --- | --- | --- | --- |
| Diptera | Chironomidae | | Tanypodinae | --- | --- | 1 | --- | --- | --- | --- | --- | --- |
| Diptera | Chironomidae | | Orthocladiinae | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Diptera | Chironomidae | | Brillia sp. | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Diptera | Chironomidae | Pentaneurini | Conchapelopia sp. | 7 | --- | --- | --- | --- | --- | 1 | --- | --- |
| Diptera | Chironomidae | | Diamesa sp. | 1 | 1 | --- | --- | --- | --- | --- | --- | --- |
| Diptera | Chironomidae | | Diplocladius sp. | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Diptera | Chironomidae | | Hydrobaenus sp. | --- | --- | --- | --- | --- | --- | 1 | --- | --- |
| Diptera | Chironomidae | | Limnophyes sp. | --- | --- | --- | --- | --- | --- | 1 | --- | --- |
| Diptera | Chironomidae | Tanytarsini | Micropsectra sp. | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Diptera | Chironomidae | | Parachaetocladius sp. | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Diptera | Chironomidae | Pentaneurini | Paramerina sp. | --- | --- | --- | --- | --- | --- | --- | 1 | --- |
| Diptera | Chironomidae | | Parametriocnemus sp. | 1 | 1 | --- | --- | 1 | --- | 4 | --- | --- |

Appendix B. Abundance of Macroinvertebrates Collected in Spring of 1998-2005, 2007, 2008, 2009 and Summer of 2006

| | | | | Spring 2000 | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | lower | | | middle | | | upper | | |
| order | family | tribe | taxon name | 1 | 2 | 3 | 1 | 2 | 3 | 1 | 2 | 3 |
| Diptera | Chironomidae | Chironomini | Polypedilum sp. | 3 | --- | --- | 2 | 1 | --- | 2 | --- | --- |
| Diptera | Chironomidae | Tanytarsini | Rheotanytarsus sp. | 1 | 1 | --- | --- | --- | --- | --- | --- | --- |
| Diptera | Chironomidae | Tanytarsini | Tanytarsus sp. | 5 | --- | --- | --- | --- | --- | 4 | --- | --- |
| Diptera | Chironomidae | | Trissopelopia sp. | 1 | --- | --- | 5 | 1 | --- | 3 | 1 | 1 |
| Diptera | Chironomidae | | Tvetenia sp. | 4 | --- | --- | 4 | 4 | 1 | 2 | --- | --- |
| Diptera | Chironomidae | Pentaneurini | Zavrelimyia sp. | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Diptera | Simuliidae | | Simuliidae | --- | --- | 1 | --- | --- | --- | --- | --- | --- |
| Diptera | Simuliidae | | Prosimulium sp. | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Diptera | Simuliidae | | Simulium sp. | 1 | --- | --- | 1 | --- | --- | --- | --- | --- |
| Diptera | Tipulidae | | Antocha sp. | 3 | --- | 1 | 3 | --- | --- | --- | --- | --- |
| Diptera | Tipulidae | | Dicranota sp. | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Diptera | Tipulidae | | Tipula sp. | --- | 1 | --- | --- | 1 | --- | --- | 1 | --- |
| Total Benthos | | | | 208 | 68 | 82 | 115 | 114 | 52 | 218 | 26 | 25 |
| Total Taxa | | | | 32 | 18 | 17 | 20 | 16 | 9 | 19 | 10 | 5 |

Appendix B. Abundance of Macroinvertebrates Collected in Spring of 1998-2005, 2007, 2008, 2009 and Summer of 2006

| | | | | Spring 2001 | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | lower | | | middle | | | upper | | |
| order | family | tribe | taxon name | 1 | 2 | 3 | 1 | 2 | 3 | 1 | 2 | 3 |
| | Naididae | | Naididae | --- | --- | --- | --- | --- | --- | --- | 1 | --- |
| Decapoda | Cambaridae | | Cambaridae | --- | 1 | 1 | --- | --- | 2 | --- | --- | --- |
| Ephemeroptera | Baetidae | | Baetidae | --- | --- | --- | 8 | 2 | 2 | --- | 4 | 2 |
| Ephemeroptera | Baetidae | | Baetis sp. | 15 | 20 | --- | --- | --- | --- | --- | --- | --- |
| Ephemeroptera | Heptageniidae | | Heptageniidae | 6 | --- | --- | 1 | --- | --- | --- | --- | 12 |
| Ephemeroptera | Heptageniidae | | Stenacron sp. | --- | 4 | --- | --- | --- | 5 | --- | 4 | --- |
| Ephemeroptera | Leptophlebiidae | | Leptophlebiidae | 6 | 9 | --- | 1 | --- | 1 | --- | --- | --- |
| Ephemeroptera | Leptophlebiidae | | Paraleptophlebia sp. | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Odonata | Aeshnidae | | Boyeria sp. | --- | --- | --- | --- | 1 | --- | --- | --- | 1 |
| Odonata | Gomphidae | | Gomphidae | --- | --- | --- | 1 | 1 | --- | --- | 1 | 1 |
| Odonata | Gomphidae | | Stylogomphus sp. | --- | --- | --- | --- | --- | --- | --- | --- | 1 |
| Plecoptera | Leuctridae | | Leuctra sp. | 10 | 20 | --- | 7 | 7 | 11 | 1 | 2 | 4 |
| Plecoptera | Perlidae | | Perlidae | 17 | 28 | 9 | 26 | --- | 12 | 2 | 7 | 5 |
| Plecoptera | Perlidae | | Acroneuria sp. | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Hemiptera | Vellidae | | Microvelia sp. | --- | --- | --- | --- | --- | --- | --- | 1 | --- |
| Hemiptera | Vellidae | | Rhagovelia sp. | --- | --- | --- | --- | --- | --- | --- | 1 | --- |
| Megaloptera | Corydalidae | | Nigronia sp. | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Trichoptera | Glossosomatidae | | Glossosoma sp. | 1 | 8 | 2 | --- | 1 | 1 | --- | --- | --- |
| Trichoptera | Hydropsychidae | | Hydropsychidae | --- | 15 | --- | --- | --- | --- | --- | --- | --- |
| Trichoptera | Hydropsychidae | | Cheumatopsyche sp. | 7 | 3 | --- | 9 | 14 | 5 | --- | 1 | 6 |
| Trichoptera | Hydropsychidae | | Diplectrona sp. | 20 | 31 | 1 | 8 | 27 | 6 | 2 | 11 | 38 |
| Trichoptera | Hydropsychidae | | Hydropsyche sp. | 4 | 16 | 1 | 1 | --- | --- | --- | --- | --- |
| Trichoptera | Lepidostomatidae | | Lepidostoma sp. | --- | --- | --- | --- | --- | --- | 1 | --- | --- |
| Trichoptera | Philopotamidae | | Chimarra sp. | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Trichoptera | Philopotamidae | | Dolophilodes sp. | 8 | 29 | 1 | 9 | 10 | --- | --- | 2 | --- |
| Trichoptera | Polycentropodidae | | Polycentropus sp. | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Trichoptera | Rhyacophilidae | | Rhyacophila sp. | --- | 3 | --- | 3 | 2 | 2 | --- | --- | --- |
| Trichoptera | Uenoidae | | Neophylax sp. | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Coleoptera | Drypoidae | | Helichus sp. | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Coleoptera | Dytiscidae | | Hydroporus sp. | --- | --- | --- | --- | 1 | 1 | --- | --- | 1 |
| Coleoptera | Elmidae | | Elmidae | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Coleoptera | Elmidae | | Microcylleopus sp. | --- | --- | --- | --- | --- | --- | 1 | --- | --- |
| Coleoptera | Elmidae | | Optioservus sp. | --- | 3 | --- | 1 | --- | --- | --- | --- | 3 |

Appendix B. Abundance of Macroinvertebrates Collected in Spring of 1998-2005, 2007, 2008, 2009 and Summer of 2006

| | | | | Spring 2001 | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | lower | | | middle | | | upper | | |
| order | family | tribe | taxon name | 1 | 2 | 3 | 1 | 2 | 3 | 1 | 2 | 3 |
| Coleoptera | Elmidae | | Oulimnius sp. | 1 | 7 | 1 | 3 | 2 | 3 | --- | --- | 3 |
| Coleoptera | Hydrophilidae | | Stenelmis sp. | 6 | 4 | 1 | 1 | 4 | 2 | 14 | 2 | 8 |
| Coleoptera | Psephenidae | | Psephenus sp. | 43 | 57 | 12 | 9 | 49 | 11 | --- | 11 | 1 |
| Coleoptera | Psephenidae | | Ectopria sp. | 1 | 4 | --- | 4 | 1 | 4 | 5 | --- | 5 |
| Coleoptera | Ptilodactylidae | | Anchytarsus sp. | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Diptera | Chironomidae | Chironomini | Chironomini | --- | --- | --- | --- | --- | --- | --- | 1 | 1 |
| Diptera | Chironomidae | Tanytarsini | Tanytarsini | 2 | 1 | --- | --- | 3 | --- | --- | --- | --- |
| Diptera | Chironomidae | | Tanypodinae | --- | 2 | --- | --- | --- | 1 | --- | --- | 1 |
| Diptera | Chironomidae | | Orthocladiinae | 1 | --- | --- | --- | --- | --- | --- | --- | 1 |
| Diptera | Chironomidae | | Brillia sp. | --- | 1 | --- | --- | --- | --- | --- | 1 | --- |
| Diptera | Chironomidae | Pentaneurini | Conchapelopia sp. | 1 | 5 | --- | --- | --- | --- | --- | --- | 3 |
| Diptera | Chironomidae | | Eukiefferiella sp. | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Diptera | Chironomidae | Tanytarsini | Micropsectra sp. | --- | --- | --- | --- | --- | --- | --- | --- | 1 |
| Diptera | Chironomidae | | Parachaetocladius sp. | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Diptera | Chironomidae | | Parametriocnemus sp. | 2 | 3 | --- | 1 | --- | --- | --- | --- | --- |
| Diptera | Chironomidae | Chironomini | Polypedilum sp. | --- | 2 | --- | --- | --- | --- | --- | --- | 2 |
| Diptera | Chironomidae | Tanytarsini | Rheotanytarsus sp. | 1 | 4 | --- | 3 | 1 | --- | --- | 1 | 1 |
| Diptera | Chironomidae | Tanytarsini | Stempellina sp. | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Diptera | Chironomidae | Tanytarsini | Tanytarsus sp. | --- | --- | --- | --- | 1 | --- | --- | 1 | --- |
| Diptera | Chironomidae | | Tvetenia sp. | --- | 3 | 1 | 1 | 1 | 1 | 1 | --- | 1 |
| Diptera | Chironomidae | Pentaneurini | Zavrelimyia sp. | --- | --- | --- | --- | --- | --- | --- | --- | 1 |
| Diptera | Empididae | | Empididae | --- | --- | --- | --- | --- | --- | --- | 1 | 1 |
| Diptera | Empididae | | Chelifera sp. | 1 | 1 | --- | --- | 1 | 1 | --- | --- | --- |
| Diptera | Simuliidae | | Simulium sp. | 2 | 3 | --- | --- | 1 | 2 | 1 | --- | --- |
| Diptera | Tabanidae | | Tabanidae | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Diptera | Tipulidae | | Antocha sp. | 1 | --- | --- | 1 | --- | --- | --- | --- | --- |
| Diptera | Tipulidae | | Dicranota sp. | --- | --- | --- | 1 | --- | --- | --- | --- | --- |
| Diptera | Tipulidae | | Hexatoma sp. | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Diptera | Tipulidae | | Pseudolimnophila sp. | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Diptera | Tipulidae | | Tipula sp. | --- | --- | 1 | --- | 4 | 1 | --- | 1 | --- |
| Total Benthos | | | | 156 | 287 | 31 | 99 | 134 | 74 | 28 | 54 | 104 |
| Total Taxa | | | | 22 | 28 | 11 | 21 | 21 | 20 | 9 | 19 | 25 |

Appendix B. Abundance of Macroinvertebrates Collected in Spring of 1998-2005, 2007, 2008, 2009 and Summer of 2006

| | | | | Spring 2002 | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | lower | | | middle | | | upper | | |
| order | family | tribe | taxon name | 1 | 2 | 3 | 1 | 2 | 3 | 1 | 2 | 3 |
| Nematomorpha | Goriodea | | Goriodea | 1 | 1 | --- | 1 | --- | 1 | --- | --- | 1 |
| | Lumbriculidae | | Lumbriculidae | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| | Naididae | | Naididae | 1 | --- | --- | --- | --- | 1 | --- | --- | 3 |
| | Tubificidae | | Tubificidae | --- | 1 | --- | --- | --- | --- | --- | --- | 4 |
| Gnathobdellida | Hirudinidae | | Placobdella sp. | 1 | --- | --- | --- | --- | --- | --- | --- | --- |
| | Sphaeridae | | Sphaeridae | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Ephemeroptera | Baetidae | | Baetidae | 20 | 24 | 2 | 2 | 7 | 6 | 3 | 1 | --- |
| Ephemeroptera | Heptageniidae | | Heptageniidae | --- | --- | --- | --- | --- | --- | --- | 1 | --- |
| Ephemeroptera | Heptageniidae | | Stenacron sp. | --- | --- | 1 | --- | --- | --- | --- | --- | --- |
| Ephemeroptera | Heptageniidae | | Stenonema sp. | --- | 2 | --- | --- | --- | --- | --- | --- | --- |
| Ephemeroptera | Leptophlebiidae | | Leptophlebiidae | --- | 3 | --- | --- | --- | 1 | --- | --- | --- |
| Ephemeroptera | Leptophlebiidae | | Paraleptophlebia sp. | 3 | --- | --- | --- | --- | --- | --- | --- | --- |
| Odonata | Gomphidae | | Gomphidae | 1 | 5 | 9 | 2 | --- | 1 | 7 | --- | --- |
| Odonata | Gomphidae | | Stylogomphus sp. | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Plecoptera | Leuctridae | | Leuctridae | 4 | 4 | --- | 1 | --- | --- | --- | 1 | 11 |
| Plecoptera | Leuctridae | | Leuctra sp. | --- | --- | --- | --- | 9 | 13 | 7 | --- | --- |
| Plecoptera | Nemouridae | | Nemouridae | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Plecoptera | Perlidae | | Perlidae | 4 | 29 | 5 | 1 | 3 | 5 | --- | --- | 1 |
| Plecoptera | Perlidae | | Acroneuria sp. | 2 | --- | --- | --- | --- | --- | --- | --- | --- |
| Plecoptera | Perlidae | | Eccoptura sp. | 1 | --- | --- | --- | --- | 2 | --- | --- | --- |
| Hemiptera | Vellidae | | Microvelia sp. | 1 | --- | --- | 4 | 2 | --- | --- | 1 | 1 |
| Hemiptera | Vellidae | | Rhagovelia sp. | --- | --- | --- | 1 | 3 | --- | --- | --- | --- |
| Megaloptera | Corydalidae | | Corydalidae | 1 | --- | --- | --- | --- | --- | --- | --- | --- |
| Megaloptera | Corydalidae | | Nigronia sp. | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Megaloptera | Sialidae | | Sialis sp. | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Trichoptera | Glossosomatidae | | Glossosoma sp. | --- | 2 | 3 | --- | --- | --- | --- | --- | --- |
| Trichoptera | Hydropsychidae | | Hydropsychidae | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Trichoptera | Hydropsychidae | | Cheumatopsyche sp. | 18 | 36 | 10 | 2 | 1 | 4 | --- | --- | --- |
| Trichoptera | Hydropsychidae | | Diplectrona sp. | 15 | 52 | 2 | 7 | 10 | 12 | 9 | --- | 14 |
| Trichoptera | Hydropsychidae | | Hydropsyche sp. | --- | 7 | --- | --- | --- | --- | --- | --- | --- |
| Trichoptera | Lepidostomatidae | | Lepidostoma sp. | --- | --- | --- | --- | --- | --- | --- | --- | 2 |
| Trichoptera | Odontoceridae | | Psilotreta sp. | 1 | --- | --- | --- | --- | --- | --- | --- | --- |
| Trichoptera | Philopotamidae | | Chimarra sp. | 4 | 2 | --- | --- | --- | --- | --- | --- | --- |

Appendix B. Abundance of Macroinvertebrates Collected in Spring of 1998-2005, 2007, 2008, 2009 and Summer of 2006

| | | | | Spring 2002 | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | lower | | | middle | | | upper | | |
| order | family | tribe | taxon name | 1 | 2 | 3 | 1 | 2 | 3 | 1 | 2 | 3 |
| Trichoptera | Philopotamidae | | Dolophilodes sp. | 6 | 4 | --- | 2 | --- | 1 | 3 | 4 | 2 |
| Trichoptera | Polycentropodidae | | Neureclipsis sp. | --- | 1 | --- | --- | --- | --- | --- | --- | --- |
| Trichoptera | Polycentropodidae | | Polycentropus sp. | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Trichoptera | Psychomyiidae | | Lype sp. | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Trichoptera | Rhyacophilidae | | Rhyacophila sp. | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Trichoptera | Uenoidae | | Neophylax sp. | --- | 2 | --- | --- | --- | --- | --- | --- | --- |
| Coleoptera | Drypoidae | | Helichus sp. | --- | --- | 1 | --- | --- | --- | --- | --- | --- |
| Coleoptera | Elmidae | | Elmidae | --- | 3 | 1 | --- | --- | --- | --- | --- | --- |
| Coleoptera | Elmidae | | Oulimnius sp. | 7 | 8 | 1 | --- | 2 | 13 | --- | --- | 2 |
| Coleoptera | Hydrophilidae | | Hydrobius sp. | --- | --- | --- | 1 | --- | --- | --- | --- | --- |
| Coleoptera | Hydrophilidae | | Stenelmis sp. | 7 | 9 | 2 | --- | 3 | 7 | --- | 1 | 5 |
| Coleoptera | Psephenidae | | Psephenus sp. | 8 | 20 | 1 | 1 | 9 | 9 | 1 | --- | --- |
| Coleoptera | Psephenidae | | Ectopria sp. | 1 | 2 | 1 | 3 | 3 | 6 | 1 | 1 | --- |
| Coleoptera | Ptilodactylidae | | Anchytarsus sp. | 2 | 1 | 1 | --- | --- | --- | --- | --- | 4 |
| Diptera | Ceratopogonidae | | Ceratopogonidae | --- | --- | --- | --- | --- | --- | --- | --- | 1 |
| Diptera | Ceratopogonidae | | Probezzia sp. | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Diptera | Chironomidae | | Chironomidae | --- | --- | 2 | 4 | --- | --- | --- | --- | --- |
| Diptera | Chironomidae | | Orthocladiinae | --- | --- | --- | --- | --- | --- | --- | --- | 2 |
| Diptera | Chironomidae | | Brillia sp. | --- | --- | --- | --- | --- | 1 | --- | --- | --- |
| Diptera | Chironomidae | | Chaetocladius sp. | --- | --- | --- | --- | 1 | --- | 1 | --- | --- |
| Diptera | Chironomidae | Pentaneurini | Conchapelopia sp. | 1 | --- | --- | --- | 1 | 1 | --- | --- | 5 |
| Diptera | Chironomidae | Orthocladiini/Metriocremini | Heterotrissocladius sp. | --- | --- | --- | --- | --- | --- | --- | --- | 3 |
| Diptera | Chironomidae | | Limnophyes sp. | 1 | --- | --- | --- | --- | --- | --- | --- | --- |
| Diptera | Chironomidae | Tanytarsini | Micropsectra sp. | --- | --- | --- | 1 | 1 | --- | --- | 2 | 17 |
| Diptera | Chironomidae | Chironomini | Microtendipes sp. | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Diptera | Chironomidae | Pentaneurini | Nilotanypus sp. | --- | --- | --- | --- | 1 | --- | --- | --- | --- |
| Diptera | Chironomidae | | Parachaetocladius sp. | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Diptera | Chironomidae | | Parametriocnemus sp. | 2 | --- | --- | --- | --- | 5 | --- | 1 | 24 |
| Diptera | Chironomidae | Chironomini | Phaenopsectra sp. | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Diptera | Chironomidae | Chironomini | Polypedilum sp. | 1 | 1 | --- | 1 | --- | --- | --- | --- | 2 |
| Diptera | Chironomidae | | Pseudoorthocladius sp. | --- | --- | --- | --- | --- | 1 | --- | --- | --- |
| Diptera | Chironomidae | Tanytarsini | Rheotanytarsus sp. | --- | --- | --- | --- | --- | --- | 1 | --- | --- |
| Diptera | Chironomidae | Tanytarsini | Tanytarsus sp. | 2 | 1 | 1 | 1 | --- | --- | --- | --- | --- |

Appendix B. Abundance of Macroinvertebrates Collected in Spring of 1998-2005, 2007, 2008, 2009 and Summer of 2006

| | | | | Spring 2002 | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | lower | | | middle | | | upper | | |
| order | family | tribe | taxon name | 1 | 2 | 3 | 1 | 2 | 3 | 1 | 2 | 3 |
| Diptera | Chironomidae | Pentaneurini | Thienemannimyia grp. | --- | --- | 1 | 1 | --- | 2 | --- | --- | 1 |
| Diptera | Chironomidae | | Trissopelopia sp. | --- | --- | --- | --- | --- | 2 | --- | 1 | 2 |
| Diptera | Chironomidae | | Tvetenia sp. | 1 | 1 | --- | --- | --- | 1 | 1 | --- | --- |
| Diptera | Chironomidae | Pentaneurini | Zavrelimyia sp. | --- | --- | --- | --- | --- | --- | --- | --- | 3 |
| Diptera | Empididae | | Chelifera sp. | --- | --- | --- | --- | 6 | 1 | 1 | --- | --- |
| Diptera | Empididae | | Hemerodromia sp. | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Diptera | Tabanidae | | Chrysops sp. | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Diptera | Tipulidae | | Tipulidae | --- | --- | --- | --- | --- | --- | --- | --- | 1 |
| Diptera | Tipulidae | | Antocha sp. | --- | --- | --- | 1 | --- | --- | --- | --- | --- |
| Diptera | Tipulidae | | Dicranota sp. | --- | --- | --- | --- | --- | 2 | --- | --- | --- |
| Diptera | Tipulidae | | Pseudolimnophila sp. | --- | --- | --- | --- | --- | --- | --- | --- | 2 |
| Diptera | Tipulidae | | Tipula sp. | 1 | 1 | --- | --- | 1 | 2 | 1 | 1 | 3 |
| Total Benthos | | | | 118 | 222 | 44 | 37 | 63 | 100 | 36 | 15 | 116 |
| Total Taxa | | | | 29 | 26 | 17 | 19 | 17 | 25 | 12 | 11 | 25 |

Appendix B. Abundance of Macroinvertebrates Collected in Spring of 1998-2005, 2007, 2008, 2009 and Summer of 2006

| | | | | Spring 2003 | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | lower | | | middle | | | upper | | |
| order | family | tribe | taxon name | 1 | 2 | 3 | 1 | 2 | 3 | 1 | 2 | 3 |
| | | | Gastropoda | --- | --- | --- | --- | --- | --- | 1 | --- | --- |
| | | | Hirudinea | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| | Sphaeridae | | Sphaeridae | --- | --- | --- | 1 | --- | --- | --- | --- | --- |
| Coleoptera | Drypoidae | | Helichus sp. | --- | --- | --- | --- | --- | --- | --- | 1 | --- |
| Coleoptera | Elmidae | | Optioservus sp. | 1 | --- | --- | --- | --- | --- | 1 | 2 | --- |
| Coleoptera | Elmidae | | Oulimnius sp. | --- | --- | --- | --- | 1 | --- | --- | --- | --- |
| Coleoptera | Hydrophilidae | | Stenelmis sp. | 1 | 2 | --- | --- | 3 | 1 | 2 | 2 | 2 |
| Coleoptera | Psephenidae | | Ectopria sp. | --- | --- | 1 | --- | --- | 1 | --- | --- | --- |
| Coleoptera | Psephenidae | | Psephenus sp. | 3 | 5 | 2 | --- | 2 | 8 | --- | 1 | --- |
| Coleoptera | Ptilodactylidae | | Anchytarsus sp. | --- | 1 | --- | --- | --- | --- | --- | --- | --- |
| Collembola | Isotomidae | | Isotomurus sp. | --- | --- | --- | --- | 1 | --- | --- | --- | --- |
| Diptera | Ceratopogonidae | | Ceratopogonidae | --- | --- | --- | --- | --- | 1 | --- | --- | --- |
| Diptera | Chironomidae | | Brillia sp. | --- | 1 | --- | --- | --- | --- | --- | --- | --- |
| Diptera | Chironomidae | | Chironomidae | --- | --- | 1 | --- | --- | --- | --- | --- | --- |
| Diptera | Chironomidae | | Corynoneura sp. | 1 | --- | --- | --- | --- | --- | --- | --- | --- |
| Diptera | Chironomidae | | Diamesa sp. | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Diptera | Chironomidae | | Diamesinae | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Diptera | Chironomidae | | Eukiefferiella sp. | 2 | 2 | --- | 5 | 2 | 1 | --- | --- | 1 |
| Diptera | Chironomidae | | Limnophyes sp. | --- | --- | --- | --- | 2 | --- | --- | --- | --- |
| Diptera | Chironomidae | | Orthocladinae | 1 | --- | --- | --- | --- | --- | 1 | --- | --- |
| Diptera | Chironomidae | | Orthocladius sp. | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Diptera | Chironomidae | | Parachaetocladius sp. | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Diptera | Chironomidae | | Parametriocnemus sp. | 4 | 3 | --- | --- | 1 | 1 | --- | --- | --- |
| Diptera | Chironomidae | | Paraphaenocladius sp. | 2 | --- | --- | --- | 1 | 1 | --- | --- | 1 |
| Diptera | Chironomidae | | Stilocladius sp. | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Diptera | Chironomidae | | Tanypodinae | --- | --- | --- | --- | --- | 1 | --- | --- | --- |
| Diptera | Chironomidae | | Thienemannimyia sp. | 1 | --- | --- | --- | --- | --- | --- | --- | --- |
| Diptera | Chironomidae | | Tvetenia sp. | 3 | 5 | 2 | 1 | 1 | 1 | --- | --- | 1 |
| Diptera | Chironomidae | Chironomini | Microtendipes sp. | --- | --- | --- | 1 | 1 | --- | --- | --- | --- |
| Diptera | Chironomidae | Chironomini | Polypedilum sp. | 3 | 2 | --- | --- | --- | 6 | --- | --- | 1 |
| Diptera | Chironomidae | Pentaneurini | Conchapelopia sp. | 1 | 1 | --- | --- | 3 | 3 | --- | --- | 1 |
| Diptera | Chironomidae | Tanytarsini | Stempellinella sp. | --- | --- | 1 | --- | --- | --- | --- | --- | --- |
| Diptera | Chironomidae | Tanytarsini | Tanytarsini | --- | --- | --- | --- | 1 | --- | --- | --- | --- |

Appendix B. Abundance of Macroinvertebrates Collected in Spring of 1998-2005, 2007, 2008, 2009 and Summer of 2006

| | | | | Spring 2003 | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | lower | | | middle | | | upper | | |
| order | family | tribe | taxon name | 1 | 2 | 3 | 1 | 2 | 3 | 1 | 2 | 3 |
| Diptera | Empididae | | Clinocera sp. | --- | --- | --- | --- | --- | 1 | --- | --- | --- |
| Diptera | Simuliidae | | Simulium sp. | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Diptera | Tipulidae | | Antocha sp. | --- | --- | --- | --- | --- | 2 | --- | --- | --- |
| Diptera | Tipulidae | | Dicranota sp. | --- | --- | --- | --- | --- | 4 | --- | --- | --- |
| Diptera | Tipulidae | | Tipula sp. | --- | --- | --- | --- | --- | 2 | --- | --- | 1 |
| Ephemeroptera | Baetidae | | Acentrella sp. | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Ephemeroptera | Baetidae | | Baetidae | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Ephemeroptera | Heptageniidae | | Heptageniidae | --- | --- | --- | 1 | --- | 2 | 1 | --- | --- |
| Ephemeroptera | Leptophlebiidae | | Leptophlebiidae | --- | --- | 1 | --- | --- | --- | --- | --- | --- |
| Lumbriculida | Lumbriculidae | | Lumbriculidae | --- | --- | --- | --- | --- | 1 | --- | --- | 1 |
| Odonata | Gomphidae | | Gomphidae | 1 | --- | 2 | --- | 1 | 6 | --- | --- | 2 |
| Odonata | Gomphidae | | Stylogomphus sp. | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Plecoptera | Leuctridae | | Leuctra sp. | 2 | 6 | --- | --- | 4 | --- | --- | --- | --- |
| Plecoptera | Leuctridae | | Leuctridae | --- | --- | --- | 1 | --- | 4 | --- | --- | --- |
| Plecoptera | Nemouridae | | Amphinemura sp. | --- | --- | --- | --- | --- | 1 | --- | --- | --- |
| Plecoptera | Perlidae | | Acroneuria sp. | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Plecoptera | Perlidae | | Eccoptura sp. | --- | --- | 1 | --- | 1 | 1 | 1 | --- | --- |
| Plecoptera | Perlidae | | Perlidae | 1 | 1 | --- | --- | 3 | 2 | --- | --- | --- |
| Trichoptera | Glossosomatidae | | Glossosoma sp. | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Trichoptera | Hydropsychidae | | Cheumatopsyche sp. | --- | 1 | --- | --- | --- | --- | --- | --- | --- |
| Trichoptera | Hydropsychidae | | Diplectrona sp. | 11 | 7 | 14 | 4 | 1 | 12 | 3 | 5 | 10 |
| Trichoptera | Hydropsychidae | | Hydropsyche sp. | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Trichoptera | Hydropsychidae | | Hydropsychidae | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Trichoptera | Philopotamidae | | Dolophilodes sp. | 15 | 3 | 8 | --- | --- | 2 | --- | --- | --- |
| Trichoptera | Polycentropodidae | | Polycentropus sp. | --- | --- | --- | --- | 1 | --- | --- | --- | --- |
| Trichoptera | Rhyacophilidae | | Rhyacophila sp. | --- | --- | --- | --- | 1 | 1 | --- | --- | --- |
| Tubificida | Enchytraeidae | | Enchytraeidae | 1 | --- | --- | --- | --- | --- | --- | --- | --- |
| Tubificida | Tubificidae | | Spirosperma sp. | 1 | --- | --- | --- | --- | --- | --- | --- | --- |
| Tubificida | Tubificidae | | Tubificidae | --- | 1 | --- | --- | --- | --- | --- | --- | --- |
| Total Benthos | | | | 55 | 41 | 33 | 14 | 31 | 66 | 10 | 11 | 21 |
| Total Taxa | | | | 19 | 15 | 10 | 7 | 19 | 25 | 7 | 5 | 10 |

Appendix B. Abundance of Macroinvertebrates Collected in Spring of 1998-2005, 2007, 2008, 2009 and Summer of 2006

| | | | | Spring 2004 | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | lower | | | middle | | | upper | | |
| order | family | tribe | taxon name | 1 | 2 | 3 | 1 | 2 | 3 | 1 | 2 | 3 |
| Coleoptera | Curculionidae | | Curculionidae | 1 | --- | 1 | --- | --- | --- | --- | --- | --- |
| Coleoptera | Elmidae | | Optioservus sp. | --- | --- | --- | --- | --- | 1 | --- | --- | --- |
| Coleoptera | Elmidae | | Oulimnius sp. | 2 | --- | 3 | 1 | 1 | --- | --- | --- | 8 |
| Coleoptera | Elmidae | | Stenelmis sp. | 5 | 1 | --- | --- | 1 | 1 | 2 | 7 | 15 |
| Coleoptera | Psephenidae | | Ectopria sp. | 1 | --- | --- | --- | --- | 1 | 3 | 2 | 1 |
| Coleoptera | Psephenidae | | Psephenus sp. | 1 | 6 | 5 | --- | --- | 1 | --- | --- | 1 |
| Coleoptera | Ptilodactylidae | | Anchytarsus sp. | --- | 20 | 1 | --- | --- | --- | --- | --- | --- |
| Collembola | Isotomidae | | Isotomurus sp. | --- | --- | 1 | --- | --- | --- | --- | --- | 1 |
| Decapoda | Cambaridae | | Cambaridae | --- | 1 | --- | --- | --- | --- | --- | --- | --- |
| Diptera | Chironomidae | | Chaetocladius sp. | --- | --- | --- | --- | 2 | 1 | --- | --- | --- |
| Diptera | Chironomidae | | Cricotopus sp. | --- | --- | --- | --- | --- | --- | --- | 1 | --- |
| Diptera | Chironomidae | | Diamesa sp. | 1 | 1 | --- | 1 | --- | 1 | --- | --- | --- |
| Diptera | Chironomidae | | Eukiefferiella sp. | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Diptera | Chironomidae | | Parametriocnemus sp. | --- | --- | --- | --- | --- | 1 | --- | --- | 1 |
| Diptera | Chironomidae | | Paraphaenocladius sp. | --- | --- | --- | --- | --- | --- | --- | --- | 2 |
| Diptera | Chironomidae | | Tanypodinae | 1 | --- | --- | --- | 1 | --- | --- | --- | --- |
| Diptera | Chironomidae | | Thienemanniella sp. | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Diptera | Chironomidae | | Trissopelopia sp. | 1 | --- | --- | --- | --- | --- | --- | --- | --- |
| Diptera | Chironomidae | | Tvetenia sp. | 1 | 3 | --- | 1 | --- | 3 | --- | 1 | 4 |
| Diptera | Chironomidae | Chironomini | Microtendipes sp. | --- | --- | 1 | --- | --- | --- | --- | --- | --- |
| Diptera | Chironomidae | Chironomini | Polypedilum sp. | 1 | 1 | --- | --- | --- | 2 | --- | --- | --- |
| Diptera | Chironomidae | Tanytarsini | Rheotanytarsus sp. | 3 | --- | 2 | --- | 2 | 1 | --- | 3 | 3 |
| Diptera | Chironomidae | Tanytarsini | Tanytarsus sp. | --- | --- | --- | --- | --- | 2 | --- | --- | 1 |
| Diptera | Chironominae | | Chironominae | 3 | --- | --- | --- | --- | --- | --- | --- | --- |
| Diptera | Empididae | | Empididae | 1 | --- | --- | --- | --- | --- | --- | --- | --- |
| Diptera | Empididae | | Hemerodromia sp. | --- | --- | --- | --- | 1 | --- | --- | --- | --- |
| Diptera | Simuliidae | | Simulium sp. | --- | --- | --- | 1 | --- | --- | --- | --- | --- |
| Diptera | Tipulidae | | Antocha sp. | --- | --- | --- | 1 | 10 | 3 | --- | 1 | --- |
| Diptera | Tipulidae | | Dicranota sp. | --- | --- | --- | 2 | --- | 6 | --- | --- | 1 |
| Diptera | Tipulidae | | Hexatoma sp. | --- | --- | --- | 1 | --- | 1 | --- | --- | --- |
| Diptera | Tipulidae | | Tipula sp. | 2 | --- | --- | --- | 1 | --- | 3 | --- | 2 |

Appendix B. Abundance of Macroinvertebrates Collected in Spring of 1998-2005, 2007, 2008, 2009 and Summer of 2006

| | | | | Spring 2004 | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | lower | | | middle | | | upper | | |
| order | family | tribe | taxon name | 1 | 2 | 3 | 1 | 2 | 3 | 1 | 2 | 3 |
| Ephemeroptera | Baetidae | | Baetidae | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Ephemeroptera | Baetidae | | Baetis sp. | 10 | 11 | 3 | 2 | 8 | 8 | 1 | --- | 2 |
| Ephemeroptera | Heptageniidae | | Heptageniidae | 1 | --- | --- | --- | --- | 1 | 1 | 3 | --- |
| Ephemeroptera | Leptophlebiidae | | Leptophlebiidae | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Hemiptera | Vellidae | | Microvelia sp. | 1 | --- | --- | --- | --- | --- | 1 | --- | 1 |
| Hemiptera | Vellidae | | Rhagovelia sp. | --- | --- | --- | --- | 2 | --- | --- | --- | --- |
| Hoplonemertea | Prostomatidae | | Prostoma sp. | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Limnophila | Physidae | | Physella sp. | --- | 1 | --- | --- | --- | --- | --- | --- | --- |
| Megaloptera | Corydalidae | | Corydalidae | --- | --- | 1 | --- | --- | --- | --- | --- | --- |
| Megaloptera | Corydalidae | | Nigronia sp. | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Megaloptera | Sialidae | | Sialis sp. | 1 | --- | --- | --- | --- | --- | --- | --- | --- |
| Nematomorpha | Goriodea | | Gordiodea | --- | --- | --- | --- | --- | --- | --- | --- | 1 |
| Odonata | Gomphidae | | Gomphidae | --- | --- | --- | --- | 1 | 1 | --- | 1 | 2 |
| Plecoptera | Leuctridae | | Leuctra sp. | 16 | 17 | 6 | 5 | 11 | 15 | 3 | 1 | 8 |
| Plecoptera | Perlidae | | Acroneuria sp. | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Plecoptera | Perlidae | | Eccoptura sp. | --- | --- | 1 | --- | --- | --- | --- | --- | --- |
| Plecoptera | Perlidae | | Perlesta sp. | --- | 1 | --- | --- | --- | --- | --- | --- | --- |
| Plecoptera | Perlidae | | Perlidae | 4 | 4 | --- | 1 | 3 | 7 | 2 | 2 | 9 |
| Trichoptera | Glossosomatidae | | Glossosoma sp. | 1 | 3 | --- | 1 | --- | 5 | --- | --- | --- |
| Trichoptera | Hydropsychidae | | Cheumatopsyche sp. | 7 | 1 | 6 | 3 | 9 | 3 | 1 | 1 | 1 |
| Trichoptera | Hydropsychidae | | Diplectrona sp. | 30 | 5 | 7 | 12 | 16 | 30 | 10 | 82 | 74 |
| Trichoptera | Hydropsychidae | | Hydropsyche sp. | 8 | 7 | 3 | 7 | 5 | 71 | --- | --- | --- |
| Trichoptera | Hydropsychidae | | Hydropsychidae | 19 | 2 | 6 | 11 | 5 | 38 | --- | 26 | 12 |
| Trichoptera | Philopotamidae | | Chimarra sp. | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Trichoptera | Philopotamidae | | Dolophilodes sp. | 24 | 8 | 5 | 8 | 4 | 40 | 1 | 5 | 7 |
| Trichoptera | Polycentropodidae | | Polycentropus sp. | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Trichoptera | Psychomyiidae | | Lype sp. | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Trichoptera | Rhyacophilidae | | Rhyacophila sp. | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Trichoptera | Uenoidae | | Neophylax sp. | 2 | 4 | --- | --- | 10 | --- | 1 | --- | --- |

Appendix B. Abundance of Macroinvertebrates Collected in Spring of 1998-2005, 2007, 2008, 2009 and Summer of 2006

| | | | | Spring 2004 | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | lower | | | middle | | | upper | | |
| order | family | tribe | taxon name | 1 | 2 | 3 | 1 | 2 | 3 | 1 | 2 | 3 |
| Tricladida | Planariidae | | Planariidae | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Tubificida | Enchytraeidae | | Enchytraeidae | --- | --- | --- | --- | 1 | --- | --- | --- | --- |
| Tubificida | Naididae | | Naididae | --- | --- | --- | --- | --- | --- | --- | --- | 1 |
| Tubificida | Naididae | | Nais sp. | --- | --- | --- | --- | --- | --- | --- | --- | 1 |
| Tubificida | Tubificidae | | Tubificidae | --- | --- | --- | --- | 1 | --- | --- | --- | --- |
| Total Benthos | | | | 148 | 97 | 52 | 58 | 95 | 244 | 29 | 136 | 159 |
| Total Taxa | | | | 27 | 19 | 16 | 16 | 21 | 25 | 12 | 14 | 24 |

Appendix B. Abundance of Macroinvertebrates Collected in Spring of 1998-2005, 2007, 2008, 2009 and Summer of 2006

| | | | | Spring 2005 | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | lower | | | middle | | | upper | | |
| order | family | tribe | taxon name | 1 | 2 | 3 | 1 | 2 | 3 | 1 | 2 | 3 |
| | Sphaeridae | | Sphaeridae | --- | --- | --- | --- | --- | --- | --- | 1 | --- |
| Coleoptera | Drypoidae | | Helichus sp. | --- | --- | --- | --- | --- | --- | --- | 1 | --- |
| Coleoptera | Elmidae | | Optioservus sp. | --- | 2 | 2 | 1 | --- | --- | --- | 1 | --- |
| Coleoptera | Elmidae | | Oulimnius sp. | --- | 1 | 2 | 1 | --- | --- | --- | 1 | 1 |
| Coleoptera | Elmidae | | Stenelmis sp. | --- | 1 | 1 | --- | --- | 1 | --- | 11 | 1 |
| Coleoptera | Psephenidae | | Ectopria sp. | --- | --- | --- | 3 | --- | 2 | --- | 2 | --- |
| Coleoptera | Psephenidae | | Psephenus sp. | --- | 8 | 7 | 1 | --- | 1 | --- | 7 | --- |
| Coleoptera | Ptilodactylidae | | Anchytarsus sp. | --- | 1 | 3 | 1 | --- | 2 | --- | 2 | --- |
| Diptera | Chironomidae | | Chaetocladius sp. | --- | --- | --- | --- | --- | --- | --- | 2 | --- |
| Diptera | Chironomidae | | Chironomidae | --- | --- | --- | 1 | --- | --- | --- | --- | --- |
| Diptera | Chironomidae | | Diamesa sp. | --- | 1 | 1 | --- | --- | --- | --- | --- | --- |
| Diptera | Chironomidae | | Parametriocnemus sp. | --- | 1 | --- | 2 | --- | --- | --- | 2 | --- |
| Diptera | Chironomidae | | Tanypodinae | --- | 1 | 3 | --- | --- | --- | --- | --- | --- |
| Diptera | Chironomidae | | Trissopelopia sp. | --- | --- | --- | --- | --- | --- | --- | 1 | --- |
| Diptera | Chironomidae | | Tvetenia sp. | --- | 1 | 6 | --- | --- | 2 | --- | 1 | --- |
| Diptera | Chironomidae | Chironomini | Polypedilum sp. | --- | 1 | 4 | 1 | --- | --- | --- | 1 | --- |
| Diptera | Chironomidae | Pentaneurini | Thienemannimyia grp. | --- | 1 | 1 | --- | --- | --- | --- | --- | --- |
| Diptera | Chironomidae | Tanytarsini | Rheotanytarsus sp. | --- | --- | 5 | 5 | --- | 2 | --- | 4 | 2 |
| Diptera | Chironomidae | Tanytarsini | Tanytarsus sp. | --- | --- | --- | --- | --- | --- | --- | --- | 3 |
| Diptera | Chironominae | | Chironominae | --- | 1 | --- | --- | --- | --- | --- | --- | --- |
| Diptera | Empididae | | Chelifera sp. | --- | --- | --- | 1 | --- | --- | --- | --- | --- |
| Diptera | Empididae | | Empididae | --- | --- | --- | 1 | --- | --- | --- | --- | --- |
| Diptera | Empididae | | Hemerodromia sp. | --- | --- | 1 | --- | --- | --- | --- | --- | --- |
| Diptera | Simuliidae | | Simulium sp. | --- | --- | 1 | --- | --- | --- | --- | --- | --- |
| Diptera | Tipulidae | | Antocha sp. | --- | --- | --- | --- | --- | 1 | --- | --- | --- |
| Diptera | Tipulidae | | Dicranota sp. | --- | --- | --- | --- | --- | 1 | --- | --- | --- |
| Diptera | Tipulidae | | Tipula sp. | --- | 1 | 1 | --- | --- | --- | --- | 4 | 1 |
| Ephemeroptera | Baetidae | | Baetidae | --- | 1 | 2 | 2 | --- | --- | --- | --- | --- |
| Ephemeroptera | Baetidae | | Baetis sp. | --- | --- | --- | --- | --- | 3 | --- | --- | --- |
| Ephemeroptera | Ephemerellidae | | Ephemerella sp. | --- | --- | 1 | --- | --- | --- | --- | --- | --- |
| Ephemeroptera | Heptageniidae | | Stenacron sp. | --- | --- | --- | --- | --- | --- | --- | 4 | --- |
| Hemiptera | Vellidae | | Microvelia sp. | --- | 1 | 1 | --- | --- | --- | --- | --- | 1 |
| Hemiptera | Vellidae | | Rhagovelia sp. | --- | --- | --- | 1 | --- | --- | --- | --- | --- |

Appendix B. Abundance of Macroinvertebrates Collected in Spring of 1998-2005, 2007, 2008, 2009 and Summer of 2006

| | | | | Spring 2005 | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | lower | | | middle | | | upper | | |
| order | family | tribe | taxon name | 1 | 2 | 3 | 1 | 2 | 3 | 1 | 2 | 3 |
| Odonata | Aeshnidae | | Aeshnidae | --- | --- | --- | --- | --- | --- | 1 | --- | --- |
| Odonata | Gomphidae | | Gomphidae | --- | --- | 1 | 2 | --- | --- | --- | --- | --- |
| Plecoptera | Leuctridae | | Leuctra sp. | --- | 9 | 8 | 20 | --- | 7 | --- | 6 | --- |
| Plecoptera | Perlidae | | Acroneuria sp. | --- | --- | 1 | --- | --- | --- | --- | --- | --- |
| Plecoptera | Perlidae | | Eccoptura sp. | --- | --- | --- | 1 | --- | --- | --- | --- | --- |
| Plecoptera | Perlidae | | Perlidae | --- | 86 | 18 | 34 | --- | 15 | 2 | 10 | --- |
| Trichoptera | Glossosomatidae | | Glossosoma sp. | --- | 5 | 3 | 2 | --- | 4 | --- | 1 | --- |
| Trichoptera | Hydropsychidae | | Cheumatopsyche sp. | --- | 18 | 21 | 5 | 1 | 14 | --- | 2 | --- |
| Trichoptera | Hydropsychidae | | Diplectrona sp. | --- | 30 | 5 | 14 | --- | 8 | 3 | 22 | 2 |
| Trichoptera | Hydropsychidae | | Hydropsyche sp. | --- | 13 | 29 | 11 | --- | --- | --- | --- | --- |
| Trichoptera | Hydropsychidae | | Hydropsychidae | --- | --- | --- | --- | --- | 1 | --- | --- | --- |
| Trichoptera | Philopotamidae | | Dolophilodes sp. | --- | 74 | 76 | 18 | 1 | 11 | 2 | 11 | --- |
| Trichoptera | Uenoidae | | Neophylax sp. | --- | --- | --- | --- | 2 | 4 | --- | --- | --- |
| Total Benthos | | | | 0 | 258 | 204 | 128 | 4 | 79 | 8 | 97 | 11 |
| Total Taxa | | | | 0 | 22 | 26 | 22 | 3 | 17 | 4 | 22 | 7 |

Appendix B. Abundance of Macroinvertebrates Collected in Spring of 1998-2005, 2007, 2008, 2009 and Summer of 2006

| | | | | Summer 2006 | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | lower | | | middle | | | upper | | |
| order | family | tribe | taxon name | 1 | 2 | 3 | 1 | 2 | 3 | 1 | 2 | 3 |
| Basommatophora | Physidae | | Physella sp. | 1 | --- | --- | --- | --- | --- | --- | --- | --- |
| Coleoptera | Elmidae | | Optioservus sp. | --- | 3 | 2 | --- | --- | --- | --- | --- | --- |
| Coleoptera | Elmidae | | Oulimnius sp. | --- | --- | --- | --- | --- | 1 | --- | 1 | 6 |
| Coleoptera | Elmidae | | Stenelmis sp. | 2 | 5 | 4 | 7 | --- | 16 | 2 | --- | 7 |
| Coleoptera | Hydrophilidae | | Hydrochus sp. | --- | --- | --- | --- | --- | --- | --- | 1 | --- |
| Coleoptera | Psephenidae | | Ectopria sp. | --- | --- | --- | 2 | 3 | 1 | 1 | --- | 2 |
| Coleoptera | Psephenidae | | Psephenus sp. | 18 | 35 | 23 | --- | --- | 2 | 2 | 2 | 15 |
| Coleoptera | Ptilodactylidae | | Anchytarsus sp. | 2 | 1 | 2 | --- | --- | --- | --- | 1 | 1 |
| Decapoda | Cambaridae | | Cambaridae | --- | --- | --- | --- | --- | --- | 1 | --- | --- |
| Diptera | Chironomidae | | Chironomidae | 7 | --- | --- | --- | --- | --- | --- | --- | --- |
| Diptera | Chironomidae | | Cricotopus sp. | --- | 1 | --- | --- | --- | --- | --- | --- | --- |
| Diptera | Chironomidae | | Eukiefferiella sp. | 1 | --- | 2 | --- | --- | --- | --- | --- | --- |
| Diptera | Chironomidae | | Orthocladinae | --- | 1 | 2 | --- | --- | --- | --- | --- | --- |
| Diptera | Chironomidae | | Parametriocnemus sp. | 1 | 1 | 12 | --- | --- | --- | --- | --- | --- |
| Diptera | Chironomidae | | Tanypodinae | --- | --- | 1 | --- | --- | --- | --- | --- | --- |
| Diptera | Chironomidae | | Tvetenia sp. | 14 | 6 | 4 | --- | 2 | --- | 2 | 1 | --- |
| Diptera | Chironomidae | Chironomini | Polypedilum sp. | 21 | 3 | 12 | --- | --- | --- | 1 | 1 | 1 |
| Diptera | Chironomidae | Pentaneurini | Thienemannimyia grp. | --- | --- | 2 | --- | --- | --- | --- | --- | --- |
| Diptera | Chironomidae | Tanytarsini | Rheotanytarsus sp. | 4 | 9 | 5 | 1 | 1 | 5 | 1 | 8 | 3 |
| Diptera | Chironomidae | Tanytarsini | Tanytarsus sp. | 2 | 2 | 1 | --- | --- | 1 | --- | --- | --- |
| Diptera | Empididae | | Clinocera sp. | 7 | 1 | 4 | --- | --- | --- | --- | --- | --- |
| Diptera | Simuliidae | | Simulium sp. | --- | 1 | 4 | --- | --- | --- | 1 | --- | --- |
| Diptera | Tipulidae | | Tipula sp. | --- | --- | 3 | --- | --- | 1 | --- | --- | --- |
| Ephemeroptera | Baetidae | | Baetidae | --- | --- | --- | --- | --- | --- | 1 | --- | --- |
| Ephemeroptera | Baetidae | | Baetis sp. | 5 | 11 | 12 | --- | 1 | --- | --- | 2 | 4 |
| Hemiptera | Vellidae | | Microvelia sp. | --- | --- | --- | --- | --- | 1 | --- | --- | --- |
| Hemiptera | Vellidae | | Rhagovelia sp. | --- | --- | --- | 1 | --- | --- | --- | --- | --- |
| Hoplonemertea | Prostomatidae | | Prostoma sp. | --- | 2 | --- | --- | 1 | --- | --- | 1 | --- |
| Odonata | Gomphidae | | Gomphidae | --- | 2 | 1 | --- | --- | 1 | --- | --- | 1 |
| Odonata | Gomphidae | | Stylogomphus sp. | --- | --- | --- | --- | --- | 1 | --- | --- | --- |
| Plecoptera | Nemouridae | | Amphinemura sp. | --- | --- | --- | --- | --- | --- | 1 | --- | --- |
| Plecoptera | Perlidae | | Acroneuria sp. | --- | --- | --- | --- | --- | --- | 1 | --- | --- |
| Plecoptera | Perlidae | | Eccoptura sp. | --- | --- | --- | --- | --- | --- | --- | --- | 1 |

Appendix B. Abundance of Macroinvertebrates Collected in Spring of 1998-2005, 2007, 2008, 2009 and Summer of 2006

| | | | | Summer 2006 | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | lower | | | middle | | | upper | | |
| order | family | tribe | taxon name | 1 | 2 | 3 | 1 | 2 | 3 | 1 | 2 | 3 |
| Trichoptera | Hydropsychidae | | Cheumatopsyche sp. | 16 | 100 | 5 | 11 | 1 | 32 | 3 | 17 | 23 |
| Trichoptera | Hydropsychidae | | Diplectrona sp. | 9 | 3 | 16 | 6 | 9 | 10 | 33 | 12 | 59 |
| Trichoptera | Hydropsychidae | | Hydropsyche sp. | 1 | 88 | 12 | --- | 3 | --- | 1 | 3 | 6 |
| Trichoptera | Philopotamidae | | Chimarra sp. | --- | 1 | 2 | --- | 1 | 2 | 4 | 1 | 34 |
| Trichoptera | Philopotamidae | | Dolophilodes sp. | 57 | 42 | 65 | 8 | 22 | 6 | 82 | 12 | 129 |
| Trichoptera | Psychomyiidae | | Lype sp. | --- | --- | --- | --- | --- | --- | --- | 1 | --- |
| Total Benthos | | | | 168 | 318 | 196 | 36 | 44 | 80 | 137 | 64 | 292 |
| Total Taxa | | | | 17 | 21 | 23 | 7 | 10 | 14 | 16 | 15 | 15 |

Appendix B. Abundance of Macroinvertebrates Collected in Spring of 1998-2005, 2007, 2008, 2009 and Summer of 2006

| | | | | Spring 2007 | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | lower | | | middle | | | upper | | |
| order | family | tribe | taxon name | 1 | 2 | 3 | 1 | 2 | 3 | 1 | 2 | 3 |
| Basommatophora | Lymnaeidae | | Lymnaeidae | --- | --- | --- | --- | --- | 2 | --- | 1 | --- |
| Basommatophora | Physidae | | Physa sp. | --- | --- | 1 | 3 | --- | 5 | --- | 3 | --- |
| Coleoptera | Elmidae | | Elmidae | --- | --- | --- | --- | --- | 1 | --- | --- | --- |
| Coleoptera | Elmidae | | Oulimnius sp. | 7 | 4 | 7 | 2 | 3 | --- | 10 | 9 | 35 |
| Coleoptera | Elmidae | | Stenelmis sp. | 6 | --- | 1 | 2 | 2 | 1 | 2 | 4 | 7 |
| Coleoptera | Psephenidae | | Ectopria sp. | 1 | 1 | --- | --- | 3 | 1 | --- | 2 | --- |
| Coleoptera | Psephenidae | | Psephenus sp. | 32 | 11 | 9 | 5 | 6 | 4 | 3 | --- | 1 |
| Decapoda | Cambaridae | | Cambaridae | --- | --- | --- | --- | --- | --- | 2 | --- | --- |
| Diptera | Ceratopogonidae | | Ceratopogonidae | --- | --- | --- | --- | 1 | --- | --- | --- | --- |
| Diptera | Chironomidae | | Ablabesmyia sp. | --- | --- | --- | 2 | --- | --- | --- | --- | --- |
| Diptera | Chironomidae | | Brillia sp. | --- | --- | --- | --- | --- | --- | 1 | 2 | --- |
| Diptera | Chironomidae | | Chaetocladius sp. | --- | --- | --- | --- | --- | --- | --- | 3 | 3 |
| Diptera | Chironomidae | | Chironomidae | --- | --- | --- | --- | --- | --- | 3 | --- | --- |
| Diptera | Chironomidae | | Limnophyes sp. | --- | --- | --- | --- | --- | --- | --- | 2 | --- |
| Diptera | Chironomidae | | Parametriocnemus sp. | --- | --- | 3 | 2 | --- | --- | --- | --- | 1 |
| Diptera | Chironomidae | | Paratanytarsus sp. | --- | --- | --- | --- | --- | --- | 2 | --- | --- |
| Diptera | Chironomidae | | Paratendipes sp. | --- | --- | --- | --- | --- | --- | 1 | --- | --- |
| Diptera | Chironomidae | | Tanypodinae | --- | --- | 2 | --- | --- | 1 | --- | --- | --- |
| Diptera | Chironomidae | | Trissopelopia sp. | --- | --- | --- | 1 | --- | --- | 2 | --- | 2 |
| Diptera | Chironomidae | | Tvetenia sp. | 3 | 1 | --- | --- | --- | 2 | --- | --- | 4 |
| Diptera | Chironomidae | Chironomini | Chironomini | --- | --- | 2 | --- | --- | --- | --- | --- | 2 |
| Diptera | Chironomidae | Chironomini | Polypedilum sp. | 70 | 9 | 55 | 21 | 9 | 4 | 13 | 21 | 48 |
| Diptera | Chironomidae | Pentaneurini | Thienemannimyia grp. | 9 | 3 | 12 | --- | 2 | --- | --- | --- | 1 |
| Diptera | Chironomidae | Tanytarsini | Micropsectra sp. | 3 | --- | 1 | 4 | 8 | 5 | 5 | 3 | 6 |
| Diptera | Chironomidae | Tanytarsini | Rheotanytarsus sp. | 1 | --- | 8 | 9 | 7 | 6 | 4 | 1 | 26 |
| Diptera | Chironomidae | Tanytarsini | Tanytarsus sp. | --- | --- | 1 | --- | --- | --- | --- | --- | --- |
| Diptera | Empididae | | Clinocera sp. | 1 | --- | 1 | 1 | --- | --- | --- | 1 | 5 |
| Diptera | Empididae | | Empididae | 4 | --- | 4 | 2 | 2 | --- | --- | --- | 2 |
| Diptera | Simuliidae | | Simulium sp. | 1 | --- | 8 | 1 | 1 | 1 | --- | 5 | 3 |
| Diptera | Tipulidae | | Antocha sp. | --- | --- | --- | 1 | 2 | 1 | --- | --- | --- |
| Diptera | Tipulidae | | Tipula sp. | 7 | --- | 2 | 1 | 2 | --- | 3 | 1 | 2 |
| Diptera | Tipulidae | | Tipulidae | --- | --- | 1 | --- | --- | --- | --- | --- | --- |
| Ephemeroptera | Baetidae | | Baetidae | 1 | --- | 1 | --- | --- | --- | --- | --- | --- |

Appendix B. Abundance of Macroinvertebrates Collected in Spring of 1998-2005, 2007, 2008, 2009 and Summer of 2006

| | | | | Spring 2007 | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | lower | | | middle | | | upper | | |
| order | family | tribe | taxon name | 1 | 2 | 3 | 1 | 2 | 3 | 1 | 2 | 3 |
| Ephemeroptera | Baetidae | | Baetis sp. | --- | --- | --- | 4 | 2 | 3 | --- | --- | --- |
| Hemiptera | Vellidae | | Microvelia sp. | --- | --- | 1 | --- | --- | --- | 1 | --- | --- |
| Hemiptera | Vellidae | | Rhagovelia sp. | --- | --- | --- | --- | 1 | --- | 1 | 2 | 1 |
| Hoplonemertea | Prostomatidae | | Prostoma sp. | --- | --- | --- | --- | --- | --- | --- | 1 | --- |
| Insecta | Diptera | | Limonia sp. | --- | --- | --- | --- | --- | --- | --- | 1 | --- |
| Odonata | Corduliidae | | Corduliidae | --- | --- | --- | --- | --- | --- | --- | --- | 1 |
| Odonata | Gomphidae | | Gomphidae | --- | --- | --- | 1 | 1 | 2 | --- | --- | 1 |
| Plecoptera | Leuctridae | | Leuctra sp. | --- | --- | --- | 8 | --- | --- | --- | --- | --- |
| Plecoptera | Leuctridae | | Leuctridae | 4 | --- | 3 | --- | 1 | 3 | --- | --- | --- |
| Plecoptera | Perlidae | | Perlidae | 8 | 6 | 7 | --- | 1 | --- | --- | --- | --- |
| Trichoptera | Glossosomatidae | | Glossosoma sp. | 7 | --- | 3 | --- | --- | --- | --- | --- | 4 |
| Trichoptera | Hydropsychidae | | Cheumatopsyche sp. | 52 | 26 | 120 | 37 | 27 | 36 | 10 | 1 | 20 |
| Trichoptera | Hydropsychidae | | Diplectrona sp. | 5 | --- | 2 | 7 | 6 | 1 | --- | 3 | 4 |
| Trichoptera | Hydropsychidae | | Hydropsyche sp. | 15 | 3 | 18 | --- | 1 | 1 | --- | --- | 1 |
| Trichoptera | Hydropsychidae | | Hydropsychidae | --- | --- | --- | --- | --- | 1 | --- | 3 | --- |
| Trichoptera | Philopotamidae | | Chimarra sp. | --- | 1 | --- | 5 | 1 | 1 | --- | --- | --- |
| Trichoptera | Philopotamidae | | Dolophilodes sp. | 53 | 11 | 12 | 5 | 6 | 2 | 1 | 9 | 22 |
| Trichoptera | Philopotamidae | | Philopotamidae | 1 | --- | --- | --- | --- | --- | --- | --- | 3 |
| Trichoptera | Rhyacophilidae | | Rhyacophila sp. | --- | 1 | --- | --- | --- | --- | --- | --- | --- |
| Trichoptera | Uenoidae | | Neophylax sp. | --- | --- | 1 | --- | --- | --- | --- | --- | --- |
| Tricladia | Planariidae | | Dugesiidae | --- | --- | --- | --- | --- | --- | --- | --- | 1 |
| Tubificida | Tubificidae | | Tubificidae | --- | --- | --- | --- | --- | --- | 2 | --- | --- |
| Total Benthos | | | | 291 | 77 | 286 | 124 | 95 | 84 | 66 | 78 | 206 |
| Total Taxa | | | | 22 | 12 | 27 | 22 | 23 | 22 | 18 | 21 | 26 |

Appendix B. Abundance of Macroinvertebrates Collected in Spring of 1998-2005, 2007, 2008, 2009 and Summer of 2006

| | | | | Spring 2008 | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | lower | | | middle | | | upper | | |
| order | family | tribe | taxon name | 1 | 2 | 3 | 1 | 2 | 3 | 1 | 2 | 3 |
| | | | Gastropoda | --- | --- | 1 | --- | --- | --- | --- | --- | --- |
| Basommatophora | Physidae | | Physa sp. | --- | --- | --- | 9 | 1 | 3 | --- | --- | --- |
| Coleoptera | Drypoidae | | Helichus sp. | --- | --- | --- | 1 | --- | --- | --- | --- | --- |
| Coleoptera | Elmidae | | Optioservus sp. | --- | 1 | --- | 3 | 4 | --- | 2 | --- | --- |
| Coleoptera | Elmidae | | Oulimnius sp. | 4 | 13 | 1 | 1 | 4 | 2 | 20 | 1 | 7 |
| Coleoptera | Elmidae | | Stenelmis sp. | 5 | 1 | 4 | 2 | 2 | --- | 2 | 1 | 2 |
| Coleoptera | Psephenidae | | Ectopria sp. | --- | --- | 1 | 16 | 7 | 2 | 4 | 1 | 5 |
| Coleoptera | Psephenidae | | Psephenus sp. | 3 | 4 | 4 | 8 | 5 | 1 | --- | --- | 8 |
| Decapoda | Cambaridae | | Cambarus sp. | --- | --- | 1 | --- | --- | --- | --- | --- | --- |
| Diptera | | | Diptera | 1 | --- | --- | --- | --- | --- | --- | --- | --- |
| Diptera | Chironomidae | | Brillia sp. | --- | --- | --- | 1 | --- | --- | 1 | --- | 1 |
| Diptera | Chironomidae | | Chaetocladius sp. | --- | --- | --- | --- | --- | 1 | 5 | 2 | --- |
| Diptera | Chironomidae | | Diamesa sp. | --- | 1 | --- | --- | --- | --- | --- | --- | --- |
| Diptera | Chironomidae | | Eukiefferiella sp. | --- | --- | --- | --- | --- | --- | 1 | --- | --- |
| Diptera | Chironomidae | | Orthocladinae | --- | --- | --- | 5 | 1 | --- | --- | --- | 2 |
| Diptera | Chironomidae | | Parametriocnemus sp. | --- | 2 | 1 | 18 | 6 | 4 | 6 | --- | 22 |
| Diptera | Chironomidae | | Paraphaenocladius sp. | --- | 2 | --- | 5 | 4 | --- | 4 | --- | 9 |
| Diptera | Chironomidae | | Tanypodinae | --- | --- | --- | 2 | --- | --- | --- | --- | --- |
| Diptera | Chironomidae | | Thienemanniella sp. | --- | --- | --- | --- | --- | --- | 1 | --- | --- |
| Diptera | Chironomidae | | Trissopelopia sp. | --- | --- | --- | 3 | 1 | --- | --- | --- | --- |
| Diptera | Chironomidae | | Tvetenia sp. | 6 | 23 | 3 | 78 | 44 | 7 | 11 | 2 | 31 |
| Diptera | Chironomidae | Chironomini | Chironomini | --- | 2 | --- | --- | --- | --- | --- | --- | --- |
| Diptera | Chironomidae | Chironomini | Phaenopsectra sp. | --- | --- | --- | --- | --- | --- | 1 | --- | --- |
| Diptera | Chironomidae | Chironomini | Polypedilum sp. | 3 | 5 | 5 | 3 | 2 | 3 | 1 | --- | 2 |
| Diptera | Chironomidae | Pentaneurini | Nilotanypus sp. | --- | --- | --- | 1 | --- | --- | --- | --- | --- |
| Diptera | Chironomidae | Pentaneurini | Thienemannimyia grp. | --- | 1 | --- | 7 | 2 | 1 | --- | --- | 3 |
| Diptera | Chironomidae | Pentaneurini | Zavrelimyia sp. | --- | --- | --- | 1 | --- | --- | --- | --- | --- |
| Diptera | Chironomidae | Tanytarsini | Micropsectra sp. | --- | 1 | 1 | 40 | 17 | --- | 5 | --- | 21 |
| Diptera | Chironomidae | Tanytarsini | Rheotanytarsus sp. | 2 | 1 | --- | 10 | 2 | 3 | --- | --- | --- |
| Diptera | Simuliidae | | Simulium sp. | --- | --- | --- | --- | --- | --- | 4 | --- | 1 |
| Diptera | Tipulidae | | Antocha sp. | --- | --- | --- | --- | --- | 1 | --- | --- | --- |
| Diptera | Tipulidae | | Tipula sp. | --- | 1 | 2 | 1 | 1 | 1 | --- | --- | 2 |
| Ephemeroptera | Ephemerellidae | | Ephemerella sp. | --- | --- | 1 | --- | --- | --- | --- | --- | --- |

Appendix B. Abundance of Macroinvertebrates Collected in Spring of 1998-2005, 2007, 2008, 2009 and Summer of 2006

| | | | | Spring 2008 | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | lower | | | middle | | | upper | | |
| order | family | tribe | taxon name | 1 | 2 | 3 | 1 | 2 | 3 | 1 | 2 | 3 |
| Hemiptera | Vellidae | | Microvelia sp. | --- | 1 | --- | --- | --- | --- | 1 | --- | --- |
| Hemiptera | Vellidae | | Rhagovelia sp. | --- | --- | --- | 1 | 1 | 2 | --- | --- | --- |
| Hemiptera | Vellidae | | Veliidae | --- | --- | --- | --- | --- | --- | --- | --- | 1 |
| Hoplonemertea | Prostomatidae | | Prostoma sp. | --- | --- | --- | --- | 1 | --- | --- | --- | --- |
| Lumbriculida | Lumbriculidae | | Lumbriculidae | --- | --- | --- | --- | 1 | --- | --- | --- | --- |
| Nematomorpha | Goriodea | | Gordiodea | --- | --- | --- | --- | 1 | 2 | --- | --- | --- |
| Odonata | Gomphidae | | Gomphidae | --- | 1 | --- | --- | 2 | --- | 2 | --- | --- |
| Plecoptera | Leuctridae | | Leuctra sp. | --- | --- | 4 | 14 | 22 | 12 | 1 | --- | --- |
| Plecoptera | Leuctridae | | Leuctridae | 4 | 18 | --- | --- | --- | --- | --- | --- | --- |
| Plecoptera | Perlidae | | Acroneuria sp. | 3 | --- | --- | --- | --- | --- | --- | --- | --- |
| Plecoptera | Perlidae | | Eccoptura sp. | --- | --- | --- | --- | 1 | --- | --- | --- | 1 |
| Plecoptera | Perlidae | | Perlidae | 1 | 8 | 1 | 7 | 8 | 3 | 2 | --- | 1 |
| Trichoptera | Glossosomatidae | | Glossosoma sp. | 2 | --- | --- | --- | --- | 2 | --- | --- | --- |
| Trichoptera | Hydropsychidae | | Cheumatopsyche sp. | 44 | 37 | 11 | 33 | 47 | 27 | 18 | 2 | 54 |
| Trichoptera | Hydropsychidae | | Diplectrona sp. | 6 | 9 | 1 | 4 | 9 | 8 | 9 | --- | 9 |
| Trichoptera | Hydropsychidae | | Hydropsyche sp. | 17 | 8 | 3 | 1 | 1 | --- | 4 | --- | 1 |
| Trichoptera | Lepidostomatidae | | Lepidostoma sp. | --- | --- | --- | 4 | --- | --- | --- | --- | --- |
| Trichoptera | Lepidostomatidae | | Lepidostomatidae | --- | 1 | --- | --- | --- | --- | --- | --- | --- |
| Trichoptera | Philopotamidae | | Chimarra sp. | 8 | 15 | 4 | 47 | 23 | 23 | 17 | 2 | 37 |
| Trichoptera | Philopotamidae | | Dolophilodes sp. | 11 | 25 | 2 | 29 | 15 | 8 | 8 | --- | 11 |
| Trichoptera | Uenoidae | | Neophylax sp. | --- | --- | --- | --- | --- | 4 | --- | --- | --- |
| Tubificida | Naididae | | Naididae | --- | --- | --- | 2 | --- | --- | --- | --- | --- |
| Total Benthos | | | | 120 | 181 | 51 | 357 | 235 | 120 | 130 | 11 | 231 |
| Total Taxa | | | | 16 | 24 | 19 | 31 | 29 | 22 | 24 | 7 | 22 |

Appendix B. Abundance of Macroinvertebrates Collected in Spring of 1998-2005, 2007, 2008, 2009 and Summer of 2006

| | | | | Spring 2009 | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | lower | | | middle | | | upper | | |
| order | family | tribe | taxon name | 1 | 2 | 3 | 1 | 2 | 3 | 1 | 2 | 3 |
| Basommatophora | Physidae | | Physa sp. | --- | --- | --- | --- | --- | --- | --- | 1 | 1 |
| Coleoptera | Curculionidae | | Curculionidae | --- | --- | 5 | --- | --- | 1 | --- | --- | 3 |
| Coleoptera | Elmidae | | Oulimnius sp. | --- | --- | --- | --- | --- | --- | --- | --- | 1 |
| Coleoptera | Elmidae | | Stenelmis sp. | --- | 2 | 2 | 1 | --- | 1 | 1 | --- | --- |
| Coleoptera | Psephenidae | | Ectopria sp. | --- | --- | --- | 1 | --- | 1 | 1 | --- | 1 |
| Coleoptera | Psephenidae | | Psephenus sp. | --- | --- | --- | --- | --- | --- | 1 | --- | --- |
| Collembola | Isotomidae | | Isotomurus sp. | --- | --- | 1 | --- | --- | --- | --- | --- | --- |
| Decapoda | Cambaridae | | Cambarus sp. | --- | --- | 1 | 1 | --- | --- | 1 | 2 | 1 |
| Diptera | Chironomidae | | Tanypodinae | 2 | --- | 7 | 2 | --- | 2 | --- | 1 | --- |
| Diptera | Chironomidae | | Natarsia sp. | --- | --- | --- | --- | --- | --- | 1 | 2 | --- |
| Diptera | Chironomidae | | Orthocladinae | 1 | --- | --- | --- | --- | --- | --- | --- | --- |
| Diptera | Chironomidae | | Brillia sp. | --- | 1 | --- | --- | --- | 2 | --- | --- | --- |
| Diptera | Chironomidae | | Chaetocladius sp. | --- | --- | 2 | 2 | 1 | 5 | --- | --- | --- |
| Diptera | Chironomidae | | Eukiefferiella sp. | --- | --- | --- | 1 | --- | --- | --- | --- | --- |
| Diptera | Chironomidae | | Orthocladius sp. | --- | --- | --- | 3 | 1 | 9 | --- | --- | 1 |
| Diptera | Chironomidae | | Parametriocnemus sp. | --- | --- | --- | --- | --- | --- | 1 | --- | --- |
| Diptera | Chironomidae | | Tvetenia sp. | --- | --- | --- | --- | --- | 1 | --- | --- | --- |
| Diptera | Chironomidae | Chironomini | Polypedilum sp. | --- | 1 | 6 | --- | --- | --- | 3 | --- | --- |
| Diptera | Chironomidae | Tanytarsini | Micropsectra sp. | --- | 1 | 27 | 10 | 6 | 20 | 20 | 1 | 11 |
| Diptera | Chironomidae | Tanytarsini | Rheotanytarsus sp. | --- | 1 | 11 | 3 | --- | 13 | 1 | --- | 12 |
| Diptera | Simuliidae | | Simulium sp. | --- | 1 | 3 | --- | --- | 1 | 1 | --- | --- |
| Diptera | Tipulidae | | Tipula sp. | --- | --- | --- | --- | --- | --- | --- | 1 | --- |
| Diptera | Tipulidae | | Antocha sp. | --- | --- | --- | 1 | --- | --- | --- | --- | --- |
| Diptera | Tipulidae | | Dicranota sp. | --- | --- | 6 | 1 | --- | 18 | 3 | --- | --- |
| Diptera | Empididae | | Empididae | --- | 1 | 14 | 1 | --- | 6 | 4 | 1 | 1 |
| Hemiptera | Vellidae | | Microvelia sp. | --- | --- | 1 | --- | --- | --- | --- | --- | --- |
| Lumbriculida | Lumbriculidae | | Lumbriculidae | --- | 1 | 6 | 2 | 1 | 10 | 3 | --- | 3 |
| Nematomorpha | Goriodea | | Gordiodea | --- | --- | 1 | --- | --- | --- | --- | --- | 2 |
| Odonata | Gomphidae | | Gomphidae | --- | --- | 1 | 6 | 3 | 3 | --- | --- | 1 |
| Odonata | Gomphidae | | Stylurus sp. | --- | 2 | --- | --- | --- | --- | --- | --- | --- |
| Plecoptera | Leuctridae | | Leuctra sp. | --- | --- | --- | 1 | --- | --- | --- | --- | --- |
| Plecoptera | Nemouridae | | Amphinemura sp. | --- | --- | 1 | --- | --- | --- | --- | --- | --- |
| Plecoptera | Perlidae | | Eccoptura sp. | --- | --- | --- | --- | --- | 1 | --- | --- | --- |

Appendix B. Abundance of Macroinvertebrates Collected in Spring of 1998-2005, 2007, 2008, 2009 and Summer of 2006

| | | | | Spring 2009 | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | lower | | | middle | | | upper | | |
| order | family | tribe | taxon name | 1 | 2 | 3 | 1 | 2 | 3 | 1 | 2 | 3 |
| Trichoptera | Philopotamidae | | Dolophilodes sp. | --- | --- | --- | --- | --- | --- | 1 | --- | --- |
| Trichoptera | Philopotamidae | | Chimarra sp. | --- | --- | --- | --- | --- | --- | --- | --- | 1 |
| Trichoptera | Hydropsychidae | | Hydropsychidae | --- | --- | --- | --- | --- | 1 | --- | --- | --- |
| Trichoptera | Hydropsychidae | | Diplectrona sp. | --- | --- | 3 | --- | --- | --- | --- | 1 | --- |
| Trichoptera | Hydropsychidae | | Cheumatopsyche sp. | --- | --- | --- | --- | --- | --- | --- | 1 | --- |
| Trichoptera | Hydropsychidae | | Hydropsyche sp. | 1 | 1 | 9 | --- | --- | 5 | 1 | --- | 1 |
| Trichoptera | Glossosomatidae | | Glossosoma sp. | --- | --- | 13 | --- | --- | 2 | --- | 1 | 1 |
| Trichoptera | Lepidostomatidae | | Lepidostoma sp. | --- | --- | 3 | --- | --- | --- | --- | --- | --- |
| Tubificida | Tubificidae | | Spirosperma sp. | 1 | 1 | 1 | 1 | --- | 2 | 1 | 1 | 1 |
| Total Benthos | | | | 5 | 13 | 124 | 37 | 12 | 104 | 44 | 13 | 42 |
| Total Taxa | | | | 4 | 11 | 22 | 16 | 5 | 20 | 16 | 11 | 16 |

# APPENDIX C
# 1998 – 2009 METRICS, BENTHIC INDEX OF BIOTIC INTEGRITY (B-IBI) SCORES, HILSENHOFF BIOTIC INDEX (HBI)

Table C-1. 1998-2009 Metrics, Benthic Index of Biotic Integrity (B-IBI) Scores, Hilsenhoff Biotic Index (HBI)

| Year/Season | Station | Replicate | nTaxa | nEPT Taxa | nEph Taxa | % IntUrb Taxa | % Chironomidae | % Clingers | B-IBI Urban | B-IBI Rating | HBI |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1998 Spring | lower | 1 | 25 | 11 | 2 | 55.29 | 6.47 | 80.00 | 4.33 | Good | 3.10 |
| | | 2 | 13 | 9 | 1 | 38.71 | 6.45 | 90.32 | 2.67 | Poor | 4.05 |
| | | 3 | 11 | 5 | 1 | 32.43 | 2.70 | 86.49 | 3.00 | Fair | 4.13 |
| | middle | 1 | 9 | 6 | 0 | 80.00 | 0.00 | 96.00 | 3.33 | Fair | 2.44 |
| | | 2 | 30 | 13 | 2 | 44.56 | 22.80 | 72.54 | 3.67 | Fair | 4.07 |
| | | 3 | 12 | 7 | 0 | 52.63 | 10.53 | 78.95 | 3.00 | Fair | 3.66 |
| | upper | 1 | 6 | 2 | 0 | 45.45 | 9.09 | 95.45 | 2.33 | Poor | 4.10 |
| | | 2 | 7 | 4 | 0 | 73.33 | 3.33 | 96.67 | 3.00 | Fair | 2.63 |
| | | 3 | 17 | 6 | 2 | 60.00 | 10.00 | 82.14 | 3.67 | Fair | 2.88 |
| 1999 Spring | lower | 1 | 18 | 9 | 0 | 47.37 | 11.58 | 86.32 | 3.00 | Fair | 4.09 |
| | | 2 | 10 | 7 | 2 | 90.91 | 2.27 | 77.27 | 3.67 | Fair | 2.01 |
| | | 3 | 24 | 12 | 1 | 62.77 | 10.95 | 75.18 | 3.67 | Fair | 3.40 |
| | middle | 1 | 16 | 8 | 1 | 53.97 | 3.17 | 85.71 | 3.67 | Fair | 3.09 |
| | | 2 | 13 | 6 | 1 | 66.00 | 4.00 | 88.00 | 3.33 | Fair | 2.82 |
| | | 3 | 3 | 2 | 0 | 6.67 | 0.00 | 100.00 | 2.33 | Poor | 4.43 |
| 2000 Spring | lower | 1 | 32 | 13 | 2 | 59.62 | 11.06 | 83.17 | 4.33 | Good | 3.34 |
| | | 2 | 18 | 9 | 0 | 73.53 | 4.41 | 89.71 | 3.67 | Fair | 2.93 |
| | | 3 | 16 | 10 | 0 | 65.75 | 1.37 | 95.89 | 3.67 | Fair | 3.28 |
| | middle | 1 | 21 | 8 | 1 | 73.04 | 11.30 | 83.48 | 3.33 | Fair | 2.80 |
| | | 2 | 16 | 8 | 1 | 81.58 | 6.14 | 90.35 | 3.33 | Fair | 2.54 |
| | | 3 | 10 | 5 | 0 | 65.38 | 1.92 | 98.08 | 3.33 | Fair | 2.96 |
| | upper | 1 | 29 | 12 | 1 | 88.53 | 8.26 | 88.53 | 4.00 | Good | 1.91 |
| | | 2 | 16 | 7 | 1 | 80.77 | 7.69 | 76.92 | 3.33 | Fair | 2.03 |
| | | 3 | 12 | 6 | 0 | 88.00 | 4.00 | 96.00 | 3.33 | Fair | 2.08 |
| 2001 Spring | lower | 1 | 22 | 10 | 3 | 44.87 | 4.49 | 82.05 | 3.67 | Fair | 3.65 |
| | | 2 | 28 | 12 | 3 | 50.17 | 7.32 | 83.28 | 4.00 | Good | 3.53 |
| | | 3 | 11 | 5 | 0 | 38.46 | 3.85 | 88.46 | 3.00 | Fair | 3.77 |
| | middle | 1 | 21 | 10 | 3 | 72.73 | 5.05 | 86.87 | 3.67 | Fair | 3.07 |
| | | 2 | 21 | 7 | 1 | 39.55 | 4.48 | 88.81 | 3.33 | Fair | 3.91 |
| | | 3 | 20 | 9 | 3 | 66.22 | 2.70 | 86.49 | 4.00 | Good | 3.07 |
| | upper | 1 | 9 | 4 | 0 | 39.29 | 3.57 | 89.29 | 2.67 | Poor | 4.86 |
| | | 2 | 19 | 7 | 2 | 57.41 | 7.41 | 75.93 | 3.67 | Fair | 3.66 |
| | | 3 | 25 | 6 | 2 | 69.23 | 11.54 | 82.69 | 4.00 | Good | 3.66 |

Table C-1. 1998-2009 Metrics, Benthic Index of Biotic Integrity (B-IBI) Scores, Hilsenhoff Biotic Index (HBI)

| Year/Season | Station | Replicate | nTaxa | nEPT Taxa | nEph Taxa | % IntUrb Taxa | % Chironomidae | % Clingers | B-IBI Urban | B-IBI Rating | HBI |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 2002 Spring | lower | 1 | 30 | 11 | 2 | 55.93 | 6.78 | 63.56 | 4.00 | Good | 3.79 |
| | | 2 | 26 | 13 | 3 | 61.26 | 1.35 | 81.53 | 4.67 | Good | 3.72 |
| | | 3 | 17 | 6 | 2 | 50.00 | 10.00 | 72.50 | 3.00 | Fair | 4.08 |
| | middle | 1 | 19 | 6 | 1 | 51.35 | 21.62 | 45.95 | 3.00 | Fair | 4.12 |
| | | 2 | 18 | 6 | 1 | 55.56 | 6.35 | 63.49 | 3.00 | Fair | 3.71 |
| | | 3 | 25 | 8 | 2 | 62.00 | 13.00 | 72.00 | 3.67 | Fair | 3.40 |
| | upper | 1 | 13 | 5 | 1 | 83.33 | 8.33 | 61.11 | 2.67 | Poor | 2.62 |
| | | 2 | 12 | 4 | 2 | 66.67 | 26.67 | 46.67 | 2.67 | Poor | 3.16 |
| | | 3 | 25 | 5 | 0 | 46.55 | 50.86 | 27.59 | 2.67 | Poor | 3.89 |
| 2003 Spring | lower | 1 | 19 | 4 | 0 | 54.55 | 32.73 | 63.64 | 2.67 | Poor | 3.62 |
| | | 2 | 15 | 5 | 0 | 41.46 | 34.15 | 65.85 | 2.67 | Poor | 3.91 |
| | | 3 | 10 | 4 | 1 | 81.82 | 12.12 | 78.79 | 2.67 | Poor | 2.73 |
| | middle | 1 | 7 | 3 | 1 | 42.86 | 50.00 | 42.86 | 2.00 | Poor | 4.37 |
| | | 2 | 19 | 6 | 0 | 41.94 | 38.71 | 58.06 | 2.67 | Poor | 4.01 |
| | | 3 | 25 | 8 | 1 | 54.55 | 21.21 | 50.00 | 3.33 | Fair | 3.74 |
| | upper | 1 | 7 | 3 | 1 | 50.00 | 10.00 | 80.00 | 2.33 | Poor | 4.55 |
| | | 2 | 5 | 1 | 0 | 45.45 | 0.00 | 100.00 | 2.67 | Poor | 4.48 |
| | | 3 | 10 | 1 | 0 | 57.14 | 23.81 | 57.14 | 2.33 | Poor | 4.12 |
| 2004 Spring | lower | 1 | 29 | 12 | 2 | 55.41 | 7.43 | 84.46 | 4.33 | Good | 3.72 |
| | | 2 | 23 | 12 | 1 | 44.33 | 5.15 | 81.44 | 3.33 | Fair | 3.13 |
| | | 3 | 19 | 10 | 2 | 44.23 | 5.77 | 90.38 | 3.33 | Fair | 3.85 |
| | middle | 1 | 16 | 9 | 1 | 53.45 | 3.45 | 87.93 | 3.67 | Fair | 3.90 |
| | | 2 | 21 | 9 | 1 | 48.42 | 5.26 | 82.11 | 3.00 | Fair | 4.38 |
| | | 3 | 25 | 10 | 2 | 43.85 | 4.51 | 89.34 | 4.00 | Good | 4.47 |
| | upper | 1 | 12 | 8 | 2 | 72.41 | 0.00 | 82.76 | 3.67 | Fair | 3.34 |
| | | 2 | 14 | 7 | 1 | 70.59 | 3.68 | 98.53 | 3.33 | Fair | 3.66 |
| | | 3 | 24 | 7 | 1 | 69.18 | 6.92 | 87.42 | 3.33 | Fair | 3.53 |

Table C-1. 1998-2009 Metrics, Benthic Index of Biotic Integrity (B-IBI) Scores, Hilsenhoff Biotic Index (HBI)

| Year/Season | Station | Replicate | nTaxa | nEPT Taxa | nEph Taxa | % IntUrb Taxa | % Chironomidae | % Clingers | B-IBI Urban | B-IBI Rating | HBI |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 2005 Spring | lower | 1 | 0 | 0 | 0 | 0.00 | 0.00 | 0.00 | 1.67 | Very Poor | 0.00 |
| | | 2 | 22 | 8 | 1 | 79.84 | 2.71 | 96.12 | 3.67 | Fair | 2.85 |
| | | 3 | 26 | 10 | 2 | 57.35 | 9.80 | 89.71 | 4.00 | Good | 3.78 |
| | middle | 1 | 22 | 9 | 1 | 75.78 | 7.03 | 91.41 | 3.33 | Fair | 2.94 |
| | | 2 | 3 | 3 | 0 | 75.00 | 0.00 | 100.00 | 3.00 | Fair | 3.40 |
| | | 3 | 17 | 9 | 1 | 65.82 | 5.06 | 92.41 | 3.33 | Fair | 3.18 |
| | upper | 1 | 4 | 3 | 0 | 87.50 | 0.00 | 87.50 | 3.00 | Fair | 2.76 |
| | | 2 | 22 | 7 | 1 | 58.76 | 11.34 | 87.63 | 3.33 | Fair | 3.69 |
| | | 3 | 7 | 1 | 0 | 27.27 | 45.45 | 54.55 | 2.00 | Poor | 5.18 |
| 2006 Summer | lower | 1 | 17 | 5 | 1 | 39.29 | 29.76 | 69.05 | 2.67 | Poor | 4.23 |
| | | 2 | 21 | 6 | 1 | 14.78 | 7.23 | 91.19 | 3.00 | Fair | 5.73 |
| | | 3 | 23 | 6 | 1 | 41.84 | 20.92 | 73.47 | 2.67 | Poor | 4.06 |
| | middle | 1 | 7 | 3 | 0 | 44.44 | 2.78 | 97.22 | 2.67 | Poor | 4.68 |
| | | 2 | 10 | 6 | 1 | 77.27 | 6.82 | 90.91 | 3.00 | Fair | 2.96 |
| | | 3 | 14 | 4 | 0 | 25.00 | 7.50 | 93.75 | 2.33 | Poor | 5.49 |
| | upper | 1 | 16 | 8 | 1 | 87.59 | 2.92 | 95.62 | 3.67 | Fair | 2.47 |
| | | 2 | 15 | 7 | 1 | 39.06 | 15.63 | 90.63 | 3.00 | Fair | 4.65 |
| | | 3 | 15 | 7 | 1 | 67.81 | 1.37 | 97.95 | 3.67 | Fair | 3.11 |
| 2007 Spring | lower | 1 | 22 | 9 | 1 | 30.93 | 29.55 | 65.29 | 2.67 | Poor | 4.87 |
| | | 2 | 12 | 8 | 0 | 29.87 | 16.88 | 83.12 | 2.67 | Poor | 4.91 |
| | | 3 | 27 | 9 | 1 | 12.94 | 29.37 | 68.88 | 3.00 | Fair | 5.92 |
| | middle | 1 | 22 | 8 | 1 | 21.77 | 31.45 | 66.94 | 2.67 | Poor | 5.25 |
| | | 2 | 23 | 9 | 1 | 30.53 | 27.37 | 69.47 | 2.67 | Poor | 5.07 |
| | | 3 | 22 | 10 | 1 | 16.67 | 21.43 | 67.86 | 2.67 | Poor | 5.56 |
| | upper | 1 | 18 | 2 | 0 | 27.27 | 46.97 | 48.48 | 2.33 | Poor | 5.37 |
| | | 2 | 21 | 4 | 0 | 33.33 | 41.03 | 48.72 | 2.33 | Poor | 5.10 |
| | | 3 | 26 | 6 | 0 | 36.89 | 45.15 | 63.59 | 3.00 | Fair | 4.95 |

Table C-1. 1998-2009 Metrics, Benthic Index of Biotic Integrity (B-IBI) Scores, Hilsenhoff Biotic Index (HBI)

| Year/Season | Station | Replicate | nTaxa | nEPT Taxa | nEph Taxa | % IntUrb Taxa | % Chironomidae | % Clingers | B-IBI Urban | B-IBI Rating | HBI |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 2008 Spring | lower | 1 | 16 | 11 | 0 | 25.83 | 9.17 | 94.17 | 3.33 | Fair | 5.22 |
| | | 2 | 24 | 11 | 0 | 41.99 | 20.99 | 80.11 | 3.33 | Fair | 4.14 |
| | | 3 | 19 | 10 | 1 | 25.49 | 19.61 | 82.35 | 3.00 | Fair | 4.88 |
| | middle | 1 | 31 | 9 | 0 | 32.21 | 48.74 | 51.26 | 3.00 | Fair | 4.29 |
| | | 2 | 29 | 8 | 0 | 36.17 | 33.62 | 64.68 | 3.00 | Fair | 4.15 |
| | | 3 | 22 | 9 | 0 | 34.17 | 15.83 | 82.50 | 3.00 | Fair | 4.29 |
| | upper | 1 | 24 | 8 | 0 | 39.23 | 27.69 | 71.54 | 2.67 | Poor | 4.34 |
| | | 2 | 7 | 5 | 0 | 18.18 | 36.36 | 63.64 | 2.33 | Poor | 5.27 |
| | | 3 | 22 | 8 | 0 | 23.81 | 39.39 | 60.17 | 2.67 | Poor | 4.63 |
| 2009 Spring | lower | 1 | 4 | | 0 | | 20.00 | 20.00 | 1.33 | Very Poor | 6.44 |
| | | 2 | 11 | 5 | 0 | 30.77 | 7.69 | 69.23 | 2.33 | Poor | 4.53 |
| | | 3 | 22 | 6 | 0 | 34.68 | 28.23 | 78.23 | 3.00 | Fair | 4.67 |
| | middle | 1 | 16 | 7 | 0 | 40.54 | 0.00 | 83.78 | 3.33 | Fair | 4.21 |
| | | 2 | 5 | 3 | 0 | 25.00 | 0.00 | 91.67 | 2.67 | Poor | 4.79 |
| | | 3 | 20 | 7 | 0 | 42.31 | 9.62 | 84.62 | 3.00 | Fair | 4.12 |
| | upper | 1 | 16 | 8 | 0 | 31.82 | 4.55 | 90.91 | 3.33 | Fair | 4.84 |
| | | 2 | 11 | 5 | 0 | 23.08 | 23.08 | 61.54 | 2.33 | Poor | 5.32 |
| | | 3 | 16 | 5 | 0 | 42.86 | 14.29 | 88.10 | 3.00 | Fair | 4.87 |

n = number
EPT = Ephemeroptera, Plecoptera, and Trichoptera
Eph = Ephemeroptera
Int = Intolerant

# APPENDIX D
# SUMMARY OF PHYSICAL HABITAT INDEX (PHI)

Table D-1 Summary of Physical Habitat Metrics
Used to Calculate the Physical Habitat Index (PHI)
Harford County Department of Publics Works, June 2005.

| | Station | | | | | |
|---|---|---|---|---|---|---|
| | Upper | | Middle | | Lower | |
| Metric | Metric Score | Scaled Metric Score | Metric Score | Scaled Metric Score | Metric Score | Scaled Metric Score |
| Embeddedness | 75 | 27.78 | 50 | 55.56 | 50 | 55.56 |
| Remoteness | 10 | 62.50 | 10 | 62.50 | 9 | 56.25 |
| Shading | 100 | 95.57 | 100 | 98.97 | 90 | 76.29 |
| Epifaunal substrate | 3 | 11.76 | 11 | 58.82 | 12 | 64.71 |
| Instream Habitat | 2 | 11.69 | 14 | 85.54 | 13 | 79.04 |
| Woody Debris + Rootwads | 2 | 16.67 | 2 | 16.67 | 4 | 33.33 |
| Bank Stability | 8 | 215.85 | 16 | 462.53 | 13 | 370.03 |
| Riffle/Run Quality | 6 | 59.96 | 12 | 87.57 | 12 | 87.38 |
| Physical Habitat Index | | 63 partially degraded | | 116 minimally degraded | | 103 minimally degraded |

Table D-2 Summary of Physical Habitat Metrics
Used to Calculate the Physical Habitat Index (PHI)
Harford County Department of Publics Works, September 2006.

| | Station | | | | | |
|---|---|---|---|---|---|---|
| | Lower | | Middle | | Upper | |
| Metric | Metric Score | Scaled Metric Score | Metric Score | Scaled Metric Score | Metric Score | Scaled Metric Score |
| Embeddedness | 50 | 55.56 | 50 | 55.56 | 50 | 55.56 |
| Shading | 95 | 79.52 | 100 | 98.97 | 100 | 99.19 |
| Epifaunal substrate | 7 | 35.29 | 11 | 58.82 | 11 | 58.82 |
| Instream Habitat | 11 | 68.85 | 12 | 72.84 | 12 | 72.69 |
| Woody Debris + Rootwads | 6 | 50.00 | 5 | 41.67 | 5 | 41.67 |
| Riffle/Run Quality | 6 | 59.96 | 13 | 92.66 | 12 | 87.38 |
| Physical Habitat Index | | 58 partially degraded | | 70 degraded | | 69 degraded |

Table D-3 Summary of Physical Habitat Metrics
Used to Calculate the Physical Habitat Index (PHI)
Harford County Department of Publics Works, June 2007.

| | Station | | | | | |
|---|---|---|---|---|---|---|
| | Upper | | Middle | | Lower | |
| Metric | Metric Score | Scaled Metric Score | Metric Score | Scaled Metric Score | Metric Score | Scaled Metric Score |
| Embeddedness | 50 | 55.56 | 50 | 55.56 | 50 | 55.56 |
| Shading | 100 | 95.57 | 100 | 98.97 | 100 | 99.19 |
| Epifaunal substrate | 11 | 58.82 | 11 | 58.82 | 11 | 58.82 |
| Instream Habitat | 9 | 56.15 | 11 | 66.49 | 11 | 66.34 |
| Woody Debris + Rootwads | 6 | 50.00 | 3 | 25.00 | 4 | 33.33 |
| Riffle/Run Quality | 7 | 65.06 | 9 | 72.29 | 13 | 92.48 |
| Physical Habitat Index | | 64 partially degraded | | 63 partially degraded | | 68 degraded |

Table D-4 Summary of Physical Habitat Metrics
Used to Calculate the Physical Habitat Index (PHI)
Harford County Department of Publics Works, June 2008.

| | Station | | | | | |
|---|---|---|---|---|---|---|
| | Upper | | Middle | | Lower | |
| Metric | Metric Score | Scaled Metric Score | Metric Score | Scaled Metric Score | Metric Score | Scaled Metric Score |
| Embeddedness | 50 | 55.56 | 50 | 55.56 | 50 | 55.56 |
| Shading | 100 | 95.57 | 100 | 98.97 | 100 | 99.19 |
| Epifaunal substrate | 11 | 58.82 | 12 | 64.71 | 11 | 58.82 |
| Instream Habitat | 10 | 62.50 | 11 | 66.49 | 12 | 72.69 |
| Woody Debris + Rootwads | 6 | 50.00 | 6 | 50.00 | 6 | 50.00 |
| Riffle/Run Quality | 9 | 59.96 | 10 | 77.38 | 12 | 87.30 |
| Physical Habitat Index | | 64 partialy degraded | | 69 degraded | | 71 degraded |

# APPENDIX E
# MBSS STREAM HABITAT ASSESSMENT DATA SHEET

ATTACHMENT 16

# MBSS SUMMER HABITAT DATA SHEET

Page 1 Of 1

SITE: Watershed Code W I N T; Segment; Type; Year

Reviewed By:

BASIN: B V (see back for codes)

2nd Reviewer:

DATE: Year 0 9; Month 0 6; Day 2 2

CREW: MD BW

TIME: 1 0 3 0 (Military)

Lower Ambient

## BANK EROSION

| | Left Bank | Right Bank |
|---|---|---|
| Extent (m) | 0 5 | 1 5 |
| Severity (1=min 2=mod 3=severe) | 2 | 2 |
| Eroded Area ($m^2$) x 10 | | |

## BAR FORMATION & SUBSTRATE

- [ ] None
- [ ] Minor
- [X] Moderate
- [ ] Extensive
- [X] Cobble
- [X] Gravel
- [X] Sand
- [X] Silt/Clay

## EXOTIC PLANTS

Relative Abundance (A, P, E)

- P Multiflora Rose
- A Mile-a-Minute
- P Japanese Honeysuckle
- A Phragmites
- A Thistle
- A Japanese Stilt Grass
- P garlic mustard

- 0 0 No. of Instream Woody Debris
- 0 1 No. of Dewatered Woody Debris
- 0 0 No. of Instream Rootwads
- 0 2 No. of Dewatered Rootwads

## HABITAT ASSESSMENT

1. Instream Habitat (0-20) ..... 1 3
2. Epifaunal Substrate (0-20) ..... 1 1
3. Velocity/Depth Diversity (0-20) ..... 1 4
4. Pool/Glide/Eddy Quality (0-20) ..... 1 1
   Extent (m) ..... 0 3
5. Riffle/Run Quality (0-20) ..... 1 2
   Extent (m) ..... 2 0
6. Embeddedness (%) ..... 7 5
7. Shading (%) ..... 1 0 0

## STREAM CHARACTER

- A Braided
- P Riffle
- P Run/Glide
- A Deep Pool(>= .5m)
- P Shallow Pool(< .5m)
- P Boulder >2m
- P Boulder <2m
- P Cobble
- A Bedrock
- E Gravel
- P Sand
- P Silt/Clay
- A Undercut Bank
- P Overhead Cover
- A Beaver Pond

A = Absent
P = Present
E = Extensive

## FLOW

| Lat Loc (m) | Depth (cm) | Velocity (m/s) |
|---|---|---|
| 0 0 | 0 0 | 0 0 |
| 0 0 | 0 0 | 0 0 |

Maximum Depth (cm)

| | Wetted Width (m) | Thalweg Depth (cm) | Thalweg Velocity (m/s) |
|---|---|---|---|
| 0 m | | | |
| 25 m | | | |
| 50 m | | | |
| 75 m | | | |

## Alternative Flow Measurements

Distance

Depth (cm)

Width (cm)

Time (sec) 1. 2. 3.

COMMENTS

ATTACHMENT 16

# MBSS SUMMER HABITAT DATA SHEET

Page ___ Of ___

SITE: Watershed Code W I N T; Segment ___; Type ___; Year ___

Reviewed By: ___

BASIN: B U (see back for codes)

2nd Reviewer: ___

DATE: Year 0 9; Month 0 6; Day 2 2

CREW: MGD EAW

TIME: 1 1 2 2 (Military)

Ambient Middle

## BANK EROSION

| | Left Bank | Right Bank |
|---|---|---|
| Extent (m) | 0 | 0 |
| Severity (1=min 2=mod 3=severe) | | |
| Eroded Area ($m^2$) x 10 | | |

## BAR FORMATION & SUBSTRATE

| | | | |
|---|---|---|---|
| | None | X | Cobble |
| | Minor | X | Gravel |
| X | Moderate | X | Sand |
| | Extensive | X | Silt/Clay |

## EXOTIC PLANTS
### Relative Abundance
(A, P, E)

| | |
|---|---|
| P | Multiflora Rose |
| A | Mile-a-Minute |
| A | Japanese Honeysuckle |
| A | Phragmites |
| A | Thistle |
| P | Japanese Stilt Grass |
| | |

| | |
|---|---|
| 1 | No. of Instream Woody Debris |
| 1 | No. of Dewatered Woody Debris |
| 0 | No. of Instream Rootwads |
| 2 | No. of Dewatered Rootwads |

## HABITAT ASSESSMENT

| | |
|---|---|
| 1. Instream Habitat (0-20) | 13 |
| 2. Epifaunal Substrate (0-20) | 11 |
| 3. Velocity/Depth Diversity (0-20) | 7 |
| 4. Pool/Glide/Eddy Quality (0-20) | 8 |
| Extent (m) | 3 |
| 5. Riffle/Run Quality (0-20) | 11 |
| Extent (m) | 20 |
| 6. Embeddedness (%) | 75 |
| 7. Shading (%) | 100 |

## STREAM CHARACTER

| | | | |
|---|---|---|---|
| A | Braided | P | Gravel |
| P | Riffle | P | Sand |
| P | Run/Glide | P | Silt/Clay |
| A | Deep Pool(>= .5m) | P | Undercut Bank |
| P | Shallow Pool(< .5m) | P | Overhead Cover |
| A | Boulder >2m | A | Beaver Pond |
| P | Boulder <2m | | |
| P | Cobble | | |
| A | Bedrock | | |

A = Absent
P = Present
E = Extensive

## FLOW

| Lat Loc (m) | Depth (cm) | Velocity (m/s) |
|---|---|---|
| 0 0 0 0 | 0 0 0 | 0 0 0 |

## Maximum Depth (cm)

| | Wetted Width (m) | Thalweg Depth (cm) | Thalweg Velocity (m/s) |
|---|---|---|---|
| 0 m | | | |
| 25 m | | | |
| 50 m | | | |
| 75 m | | | |

## Alternative Flow Measurements

| | |
|---|---|
| Distance | |
| Depth (cm) | |
| Width (cm) | |
| Time (sec) 1. | |
| 2. | |
| 3. | |

COMMENTS ___

ATTACHMENT 16

# MBSS SUMMER HABITAT DATA SHEET

Page ___ Of ___

SITE: Watershed Code W1N7 | Segment ___ | Type ___ | Year ___

Reviewed By: ___

BASIN: BU (see back for codes)

2nd Reviewer: ___

DATE: Year 09 | Month 06 | Day 22

CREW: MGD EAW

TIME: 1201 (Military)

Ambient Upper

## BANK EROSION

| | Left Bank | Right Bank |
|---|---|---|
| Extent (m) | 2 | 4 |
| Severity (1=min 2=mod 3=severe) | | 1 |
| Eroded Area ($m^2$) x 10 | | |

## BAR FORMATION & SUBSTRATE

- [ ] None
- [x] Minor
- [ ] Moderate
- [ ] Extensive
- [x] Cobble
- [x] Gravel
- [x] Sand
- [x] Silt/Clay

## EXOTIC PLANTS
### Relative Abundance
(A, P, E)

- F Multiflora Rose
- A Mile-a-Minute
- A Japanese Honeysuckle
- A Phragmites
- A Thistle
- A Japanese Stilt Grass
- P Barberry

- 0 No. of Instream Woody Debris
- 2 No. of Dewatered Woody Debris
- 0 No. of Instream Rootwads
- 2 No. of Dewatered Rootwads

## HABITAT ASSESSMENT

1. Instream Habitat (0-20) ..... 11
2. Epifaunal Substrate (0-20) ..... 11
3. Velocity/Depth Diversity (0-20) ..... 7
4. Pool/Glide/Eddy Quality (0-20) ..... 7
   Extent (m) ..... 3
5. Riffle/Run Quality (0-20) ..... 9
   Extent (m) ..... 20
6. Embeddedness (%) ..... 85
7. Shading (%) ..... 100

## STREAM CHARACTER

- P Braided
- P Riffle
- P Run/Glide
- A Deep Pool(>= .5m)
- P Shallow Pool(< .5m)
- A Boulder >2m
- A Boulder <2m
- P Cobble
- A Bedrock
- P Gravel
- P Sand
- P Silt/Clay
- P Undercut Bank
- P Overhead Cover
- A Beaver Pond

A = Absent
P = Present
E = Extensive

## FLOW

| Lat Loc (m) | Depth (cm) | Velocity (m/s) |
|---|---|---|
| 0 0 0 0 | 0 0 0 | 0 0 0 |

## Maximum Depth (cm)

| | Wetted Width (m) | Thalweg Depth (cm) | Thalweg Velocity (m/s) |
|---|---|---|---|
| 0 m | | | |
| 25 m | | | |
| 50 m | | | |
| 75 m | | | |

## Alternative Flow Measurements

Distance

Depth (cm)

Width (cm)

Time (sec) 1. 2. 3.

COMMENTS