# Hoosic River Watershed

## 2009 Stream Biomonitoring Survey Results

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## Background

This report documents the results from the 2009 annual assessment of the benthic macroinvertebrate community within the Hoosic River Watershed sponsored by the Hoosic River Watershed Association (HooRWA). The purpose of the monitoring program is to assess general water quality condition, monitor changes in the water quality over time and in relation to community concerns, and identify high quality streams.

Sites were selected based on citizen concerns and Vermont Department of Environmental Conservation (VT DEC) and Massachusetts Department of Environmental Protection (MA DEP) interests. The Hoosic River sites (02 and 03) were selected to detect any changes in the benthic community structure resulting from upgrades to the Hoosac Treatment Plant in Williamstown, MA and were requested by MA DEP. The Miller Brook sites (01 and 02) were selected to examine the impact, if any, of illegal trash dumping over a steep embankment on Upper E. Hoosac Street. MA DEP requested assessment of the Notch Brook site; this is an example of an unassessed first order high gradient stream. The Ladd Brook site is a follow up assessment from HooRWA's 2008 Vermont Unassessed Waters Project to confirm impairment and supply supportive data for adding the stream to the VT 303(d) impaired water bodies list.

## Methods

*Field Collection*

Benthic macroinvertebrate samples were collected in riffle habitats from five sites following the MA DEP composite kick collection method and sample storage procedures (Nuzzo 2003) and from one site following VT DEC collection methods (Shelton and Blocksom 2004)(Figure 1). Ladd Brook was collected side-by-side with the VT DEC as part of an ongoing effort to share data and ensure accurate and precise data collection. Ambient water quality parameters were collected (i.e. dissolved oxygen, temperature, specific conductance) and qualitative habitat assessments were performed (Barbour et al. 1999).

*Sorting and Organism Identification*

Sample sorting and identification followed MA DEP and VT DEC laboratory methods (Nuzzo 2003, Shelton and Blocksom 2004). Macroinvertebrates were then placed in vials containing 70% alcohol. Organisms were

identified to lowest taxonomic resolution, unless specimens were immature or damaged, and enumerated using a dissecting microscope. Oligochaetes and chironomids were slide-mounted in CMCP-10 mounting medium and viewed using a compound microscope.

*Macroinvertebrate Metrics*

The following metrics were calculated for each sample collected in MA: Taxa Richness, EPT Richness, EPT/Chironomidae ratio, Hilsenhoff Biotic Index, Scraper/Filtering Collector Ratio, Dominant Taxa, Community Loss, Percent Similarity, and Percent Reference Affinity (Table1) (Nuzzo 2003, Shelton and Blocksom 2004). The following metrics were calculated for samples collected in VT: Taxa Richness, EPT Richness, EPT/Chironomidae Ratio, Hilsenhoff Biotic Index, Percent Oligochaeta, Pinkham-Pearson Coefficient of Similarity-Functional Groups, and Percent Model Affinity (Order) (Table 1).

Two sites were examined on both the Hoosic River and Miller Brook to identify any differences in community structure between the upstream and downstream sites. Notch Brook was also sampled; this stream had not been previously assessed by HooRWA or MA DEP.

## Results

*Sorting and Organism Identification*

Ninety-five unique taxa were sorted and identified from the 6 samples (Table 2). Organisms were identified to lowest taxonomic resolution.

*Ambient Water Quality and Physical Habitat Parameters*

Temperature, dissolved oxygen, dissolved oxygen saturation, specific conductance, and pH results were not remarkably different between the upstream and downstream sites (Table 3). The specific conductance value at the downstream site on Miller Brook, Mill01, was higher than the upstream site (Mill02).

There was no notable difference between upstream and downstream physical habitat parameters (width, depth, and substrate) or qualitative habitat assessments (Barbour et al. 1999) among the Hoosic River and Miller Brook sites. Miller Brook sites are located in a high gradient, low order stream with an abundance of bedrock substrate. Hoosic River sites (02 and 03) are in the downstream portion of the mainstem channel near the New York border.

*Macroinvertebrate Metrics*

Metric results were not strikingly different between the upstream and downstream sites (Table 3). The Miller Brook upstream site (Mill02) had a higher percent of dominant taxa (43.69%) than the downstream site (16.82%). The calculated metric scores indicated that the downstream sites were not impaired relative to the upstream sites (Table 5).

Although the community metrics cannot be related to a reference site to assess overall water quality condition, the taxa list of Notch Brook may make it a suitable candidate for reference condition. The presence of *Rhyacophila torva, Diplectrona sp, Hydropsyche ventura, Tallaperla sp, Malirekus iroquois, Paragnetina immarginata,* and *Polypedilum aviceps* indicate this, as well as the large taxa list in general (33 taxa) and low dominance (<20%).

Ladd Brook benthic community metrics were calculated following VT DEC methods (Shelton and Blocksom 2004) and the results were compared to the metric results calculated by VT DEC. Metric results were comparable (VT DEC results are reported in Table 6). The metric results indicate the community assessment is fair to poor at Ladd Brook. Taxa richness was high, but the EPT richness was lower than expected for a VT Class B stream. Moderately tolerant to tolerant taxa were Oligochaeta Lumbriculidae, *Eukiefferella claripennis*, *Orthocladius* and *Baetis tricaudatus*. The Percent Model Affinity of Orders (PMA-O), however, was very good; the percent Oligochaeta (primarily Lumbriculidae) was very high (>25%).

## Discussion

Benthic macroinvertebrate community multi-metric analyses indicate the downstream sites on the Hoosic River and Miller Brook are not impaired relative to their upstream control sites.

Higher specific conductance values at the downstream Miller Brook site may be related to the presence of a dump site, other anthropogenic sources or natural changes; however the benthic community metrics did not indicate impairment relative to the upstream Miller Brook site.

Water quality of the Hoosic and Miller Brook upstream sites and of Notch Brook were not determined because MA DEP metric calculation methodology requires comparison with a reference site in order to make a

water quality determination (Nuzzo 2003, Shelton and Blocksom 2004). In order to make water quality determinations at these sites, future assessments should include suitable reference sites. The Ladd Brook assessment indicates biological impairment; the VT DEC recommended that it be listed on the VT 303(d) impaired water bodies list.

## Literature Cited


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## Tables and Figures

Table1. MA DEP* and VT DEC† benthic macroinvertebrate community metrics and calculation methods (adapted from Shelton and Blocksom 2004).

| Metric | Description | Predicted response to increasing perturbation |
|---|---|---|
| **Density**† | Relative abundance of taxa in a sample. This is best compared to a "reference site". | Variable |
| **Taxa Richness***† | Total number of distinct taxa in a sample | Decrease |
| **EPT Richness**† | Number of taxa in the sample in the orders of Ephemeroptera, Plecoptera, and Trichoptera | Decrease |
| **EPT/Chironomidae***† | Ratio of the abundance of EPT organisms/ abundance of EPT + Chironomidae | Decrease |
| **HBI***† | Hilsenhoff Biotic Index (Hilsenhoff 1987), is calculated by multiplying the number of individuals of each species or taxa by its assigned tolerance value, summing these products, and dividing the total number of individuals. | Increase |
| **Scraper/Filtering Collector*** | Ratio of the abundance of scrapers to filter-collecting organisms | Decrease |
| **Dominant Taxa (%)*** | Percent of most common taxon within the sample | Increase |
| **Community Loss*** | Measure of the dissimilarity between a test site and reference site. | Decrease |
| **Percent Similarity*** | Measure of similarity (community composition and abundance) between the reference site and the samples. | Decrease |
| **Percent Reference Affinity*** | Measure of similarity of seven faunal groups (adapted from Bode et al. 2002) between the reference site and the samples. | Decrease |
| **Percent Model Affinity (Order)** † | Measure of order level similarity to a model based on NYS reference streams (Novak and Bode 1992) | Decrease |
| **% Oligochaeta**† | Percent of macroinvertebrate community made up of the order Oligochaeta | Increase |
| **Pinkham-Pearson Coefficient of Similarity-Functional Groups**† | Measure of functional feeding group (scrapers, filterers, predators) similarity to a model based on reference streams. | Decrease |

*Benthic community metrics calculated by MA DEP

†Benthic community metrics calculated by VT DEC

Table 2. Taxa sorted and identified from the 6 benthic samples.

| Stream | Ladd Brook | Notch Brook | Hoosic River | | Miller Brook | | |
|---|---|---|---|---|---|---|---|
| | | | Upstream | Downstream | Upstream | Downstream | |
| **Taxa determination** | **Ladd01** | **Notch01** | **HR03** | **HR02** | **Mill02** | **Mill01** | ***Total*** |
| Acentrella/Plauditus sp. | 4 | 0 | 0 | 0 | 0 | 0 | *4* |
| Acentrella turbida | 0 | 0 | 12 | 14 | 0 | 0 | *26* |
| Adicrophleps hitchcocki | 0 | 0 | 0 | 0 | 5 | 1 | *6* |
| Agnetina capitata | 0 | 2 | 0 | 1 | 0 | 0 | *3* |
| Antocha sp. | 48 | 1 | 1 | 0 | 0 | 0 | *50* |
| Baetis tricaudatus | 56 | 1 | 5 | 10 | 2 | 11 | *85* |
| Baetis flavistriga | 0 | 0 | 1 | 1 | 0 | 0 | *2* |
| Baetis intercalaris | 0 | 0 | 0 | 2 | 0 | 0 | *2* |
| Bezzia/Palpomyia sp. | 0 | 0 | 0 | 0 | 6 | 0 | *6* |
| Brillia flavifrons | 0 | 0 | 0 | 0 | 0 | 1 | *1* |
| Brillia sp. | 4 | 1 | 0 | 0 | 0 | | *5* |
| Cardiocladius obscurus | 0 | 0 | 0 | 2 | 0 | 0 | *2* |
| Cardiocladius sp. | 0 | 0 | 0 | 0 | 1 | 0 | *1* |
| Chaetocladius sp. | 0 | 0 | 0 | 0 | 0 | 1 | *1* |
| Cheumatopsyche sp. | 0 | 0 | 0 | 1 | 0 | 0 | *1* |
| Clinocera sp. | 0 | 1 | 0 | 0 | 0 | 0 | *1* |
| Cricotopus bicinctus | 0 | 0 | 7 | 1 | 0 | 0 | *8* |
| Cricotopus trifascia gr. | 0 | 0 | 17 | 3 | 0 | 0 | *20* |
| Cricotopus/Orthocladius | 0 | 0 | 23 | 21 | 0 | 0 | *44* |
| Diamesa sp. | 0 | 1 | 0 | 0 | 0 | 0 | *1* |
| Dicranota sp. | 8 | 0 | 0 | 0 | 4 | 0 | *12* |
| Dicrotendipes sp. | 0 | 0 | 1 | 0 | 0 | 0 | *1* |
| Diphetor hageni | 0 | 0 | 0 | 0 | 0 | 1 | *1* |
| Diplectrona sp. | 12 | 2 | 0 | 0 | 0 | 0 | *14* |
| Dixa sp. | 4 | 0 | 0 | 0 | 3 | 1 | *8* |
| Dolophilodes sp. | 0 | 2 | 0 | 0 | 3 | 4 | *9* |
| Ectopria sp. | 0 | 6 | 0 | 0 | 1 | 2 | *9* |
| Empididae | 8 | 0 | 0 | 0 | 0 | 0 | *8* |
| Enchytraeidae | 0 | 1 | 0 | 0 | 0 | 0 | *1* |
| Epeorus (Iron) sp. | 24 | 0 | 0 | 0 | 0 | 0 | *24* |
| Ephemerella sp. | 144 | 0 | 4 | 4 | 0 | 0 | *152* |
| Ephemerella subvaria | 72 | 0 | 0 | 0 | 0 | 0 | *72* |
| Ephemerellidae | 240 | 0 | 0 | 0 | 0 | 0 | *240* |
| Eukiefferiella brevicalcar gr. | 8 | 0 | 0 | 0 | 0 | 0 | *8* |
| Eukiefferiella claripennis gr. | 76 | 3 | 0 | 0 | 0 | 0 | *79* |
| Eukiefferiella pseudomontana gr. | 0 | 0 | 2 | 2 | 0 | 0 | *4* |
| Eurylophella sp. | 0 | 0 | 0 | 0 | 1 | 0 | *1* |
| Glossosoma sp. | 0 | 0 | 0 | 3 | 0 | 0 | *3* |
| Helichus sp. | 4 | 2 | 0 | 0 | 0 | 0 | *6* |

| Stream | Ladd Brook | Notch Brook | Hoosic River | | Miller Brook | | |
|---|---|---|---|---|---|---|---|
| | | | Upstream | Downstream | Upstream | Downstream | |
| **Taxa determination** | **Ladd01** | **Notch01** | **HR03** | **HR02** | **Mill02** | **Mill01** | ***Total*** |
| Hemerodromia sp. | 0 | 0 | 1 | 0 | 0 | 0 | *1* |
| Hexatoma sp. | 8 | 2 | 0 | 0 | 1 | 1 | *12* |
| Hydropsyche bronta | 0 | 0 | 0 | 2 | 0 | 0 | *2* |
| Hydropsyche morosa | 0 | 0 | 5 | 6 | 0 | 0 | *11* |
| Hydropsyche ventura | 76 | 10 | 0 | 0 | 1 | 15 | *102* |
| Isoperla sp. | 28 | 0 | 0 | 0 | 0 | 0 | *28* |
| Lepidostoma sp. | 8 | 1 | 0 | 0 | 0 | 2 | *11* |
| Leucotrichia pictipes | 0 | 0 | 1 | 0 | 0 | 0 | *1* |
| Leuctra sp. | 0 | 1 | 0 | 0 | 0 | 0 | *1* |
| Lumbricina | 4 | 1 | 0 | 0 | 0 | 0 | *5* |
| Lumbriculidae | 436 | 2 | 1 | 0 | 0 | 0 | *439* |
| Malirekus iroquois | 12 | 1 | 0 | 0 | 4 | 13 | *30* |
| Micropsectra sp. | 4 | 0 | 0 | 0 | 2 | 1 | *7* |
| Muscidae | 4 | 0 | 0 | 0 | 0 | 0 | *4* |
| Nematoda | 0 | 0 | 0 | 0 | 1 | 0 | *1* |
| Nematomorpha | 0 | 0 | 0 | 0 | 1 | 0 | *1* |
| Neostempellina reissi | 4 | 0 | 0 | 0 | 0 | 0 | *4* |
| Optioservus ovalis | 0 | 8 | 0 | 8 | 0 | 0 | *16* |
| Optioservus sp. | 16 | 0 | 0 | 0 | 0 | 0 | *16* |
| Optioservus trivittatus | 0 | 0 | 5 | 0 | 0 | 0 | *5* |
| Orthocladius sp. | 32 | 0 | 0 | 0 | 0 | 0 | *32* |
| Oulimnius latiusculus | 20 | 0 | 0 | 0 | 1 | 8 | *29* |
| Parachaetocladius sp. | 0 | 0 | 0 | 0 | 1 | 0 | *1* |
| Paragnetina immarginata | 0 | 2 | 0 | 0 | 0 | 0 | *2* |
| Paraleptophlebia sp. | 0 | 0 | 0 | 1 | 0 | 1 | *2* |
| Parametriocnemus sp. | 4 | 0 | 0 | 0 | 3 | 4 | *11* |
| Paraphaenocladius sp. | 4 | 0 | 0 | 0 | 0 | 0 | *4* |
| Parapsyche apicalis | 0 | 0 | 0 | 0 | 1 | 0 | *1* |
| Plauditus sp. | 0 | 0 | 1 | 5 | 0 | 0 | *6* |
| Polypedilum aviceps | 4 | 1 | 2 | 6 | 0 | 0 | *13* |
| Polypedilum flavum | 0 | 0 | 1 | 0 | 0 | 0 | *1* |
| Polypedilum halterale gr. | 0 | 0 | 1 | 0 | 0 | 0 | *1* |
| Potthastia gaedii gr. | 0 | 0 | 2 | 0 | 0 | 0 | *2* |
| Promoresia tardella | 0 | 1 | 0 | 0 | 0 | 2 | *3* |
| Psephenus herricki | 0 | 1 | 0 | 1 | 0 | 0 | *2* |
| Psychomyia flavida | 0 | 0 | 1 | 1 | 0 | 0 | *2* |
| Pteronarcys proteus | 8 | 0 | 0 | 0 | 0 | 0 | *8* |
| Pteronarcys sp. | 0 | 9 | 0 | 0 | 0 | 3 | *12* |
| Rhyacophila atrata | 4 | 0 | 0 | 0 | 0 | 0 | *4* |
| Rhyacophila fuscula | 8 | 9 | 0 | 0 | 1 | 0 | *18* |
| Rhyacophila mainensis | 0 | 0 | 1 | 1 | 0 | 0 | *2* |

| Stream | Ladd Brook | Notch Brook | Hoosic River | | Miller Brook | | |
|---|---|---|---|---|---|---|---|
| | | | Upstream | Downstream | Upstream | Downstream | |
| **Taxa determination** | **Ladd01** | **Notch01** | **HR03** | **HR02** | **Mill02** | **Mill01** | ***Total*** |
| Rhyacophila minor | 16 | 4 | 0 | 0 | 0 | 3 | *23* |
| Rhyacophila torva | 0 | 1 | 0 | 0 | 7 | 0 | *8* |
| Simulium sp. | 0 | 5 | 5 | 4 | 45 | 18 | *77* |
| Simulium tuberosum | 16 | 0 | 0 | 0 | 0 | 0 | *16* |
| Soyedina sp. | 4 | 0 | 0 | 0 | 0 | 0 | *4* |
| Sperchon sp. | 4 | 0 | 1 | 0 | 1 | 0 | *6* |
| Stenelmis crenata | 4 | 0 | 0 | 0 | 0 | 0 | *4* |
| Stenelmis sp. | 0 | 0 | 0 | 1 | 0 | 0 | *1* |
| Sweltsa sp. | 88 | 20 | 0 | 0 | 3 | 8 | *119* |
| Tallaperla sp. | 0 | 1 | 0 | 0 | 2 | 5 | *8* |
| Thienemanniella sp. | 4 | 0 | 0 | 0 | 0 | 0 | *4* |
| Thienemannimyia gr. Spp. | 0 | 0 | 0 | 1 | 0 | 0 | *1* |
| Tipula sp. | 8 | 1 | 0 | 0 | 0 | 0 | *9* |
| Tvetenia bavarica | 12 | 0 | 0 | 0 | 0 | 0 | *12* |
| Tvetenia paucunca | 0 | 2 | 0 | 0 | 2 | 1 | *5* |
| *Total individuals* | *1552* | *106* | *101* | *102* | *103* | *107* | *2071* |

Table 3. Ambient water quality parameters collected.

| Site | Ladd01 | Notch01 | HR03 Upstream | HR02 Downstream | Mill02 Upstream | Mill01 Downstream |
|---|---|---|---|---|---|---|
| **Temperature (°C)** | 8.9 | 14.8 | 18.4 | 18.5 | 14 | 13.6 |
| **pH** | 8.17 | 8.1 | 8.6 | 8.6 | 8.6 | 7.8 |
| **Specific Conductance ($\mu S$/cm)** | 308 | 178 | 283 | 296 | 45 | 149 |
| **Dissolved oxygen (mg/L)** | 10.8 | 9.4 | 12.1 | 12.3 | 7 | 9.5 |
| **Oxygen saturation (%)** | 92.9 | 92 | 129 | 131 | 70 | 91 |

Table 4. Metric results for the Hoosic River Watershed 2009 sampling locations. *Values indicate calculations relative to site values.

| Stream Name | | Ladd Brook | Notch Brook | Hoosic River | | Miller Brook | |
|---|---|---|---|---|---|---|---|
| | | | | Upstream | Downstream | Upstream | Downstream |
| **Metric** | | **Ladd01** | **Notch01** | **HR03** | **HR02** | **Mill02** | **Mill01** |
| **Taxa Richness** | | 38 | 33 | 24 | 25 | 26 | 23 |
| **EPT Richness** | | 14.5 | 15 | 9 | 14 | 11 | 12 |
| **EPT/Chironomidae Ratio** | | 0.79 | 0.89 | 0.36 | 0.59 | 0.77 | 0.89 |
| **HBI** | | 3.94 | 2.60 | 5.26 | 4.72 | 3.77 | 3.39 |
| **Scraper/Filterer-Collector Ratio** | | NA | 0.95 | 1.30 | 1.08 | 0.04 | 0.31 |
| **Dominant taxa (%)** | | NA | 18.87 | 22.77 | 20.59 | 43.69 | 16.82 |
| **Percent Oligochaeta** | | 21.3 | NA | NA | NA | NA | NA |
| **Percent Model Affinity** | | 61.1 | NA | NA | NA | NA | NA |
| **Pinkham-Pearson Coefficient of Similarity-Functional Groups**[†] | | 0.42 | NA | NA | NA | NA | NA |
| **Density** | | 1548 | NA | NA | NA | NA | NA |
| **Community Similarity Metrics** | **Reference Affinity (%)** | NA | 100* | 100* | 75 | 100* | 58 |
| | **Community Loss** | NA | 0* | 0* | 0.4 | 0* | 0.5 |
| | **Percent Similarity (%)** | NA | 100* | 100* | 62 | 100* | 41 |

Table 5. Metric scores relative to upstream sites based on scoring range defined in Shelton and Blocksom 2004.

| Site | HR03 | HR02 | Mill02 | Mill01 |
|---|---|---|---|---|
| **Metric** | Upstream | Downstream | Upstream | Downstream |
| **Taxa richness** | 6 | 6 | 6 | 6 |
| **EPT richness** | 6 | 6 | 6 | 6 |
| **EPT/Chironomidae Ratio** | 6 | 6 | 6 | 6 |
| **HBI** | 6 | 6 | 6 | 6 |
| **Scraper/Filterer-Collector Ratio** | 6 | 6 | 6 | 6 |
| **Dominance (%)** | 6 | 6 | 0 | 6 |
| **Reference Affinity** | 6 | 6 | 6 | 4 |
| **Community Loss** | 6 | 6 | 6 | 6 |
| **% Similarity** | 6 | 4 | 6 | 2 |
| ***Sum of metrics*** | *54* | *52* | *48* | *48* |
| **Relative similarity to upstream site** | | 96.3 | | 100 |
| **Impairment category** | | Not impaired | | Not impaired |

Table 6. Metric scores of side by side samples collected by VTDEC and HooRWA

| **Station** | **Ladd01** | **Ladd01** | |
|---|---|---|---|
| **Metric** | VTDEC | HooRWA | Mean |
| **Density** | 1556 | 1540 | 1548 |
| **Taxa Richness** | 42 | 34 | 38 |
| **EPT Richness** | 15 | 14 | 14.5 |
| **PMA-O1** | 60.5 | 61.7 | 61.1 |
| **HBI** | 3.58 | 4.30 | 3.94 |
| **Oligochaeta %** | 28.3 | 14.3 | 21.3 |
| **EPT/EPT Chironomidae Ratio** | 0.84 | 0.74 | 0.79 |
| **PPCS-F1** | 0.41 | 0.42 | 0.42 |
| **Impairment category** | F-Poor | Fair | F-Poor |

Figure 1. Map of 2009 Hoosic River Watershed Association monitoring sites.

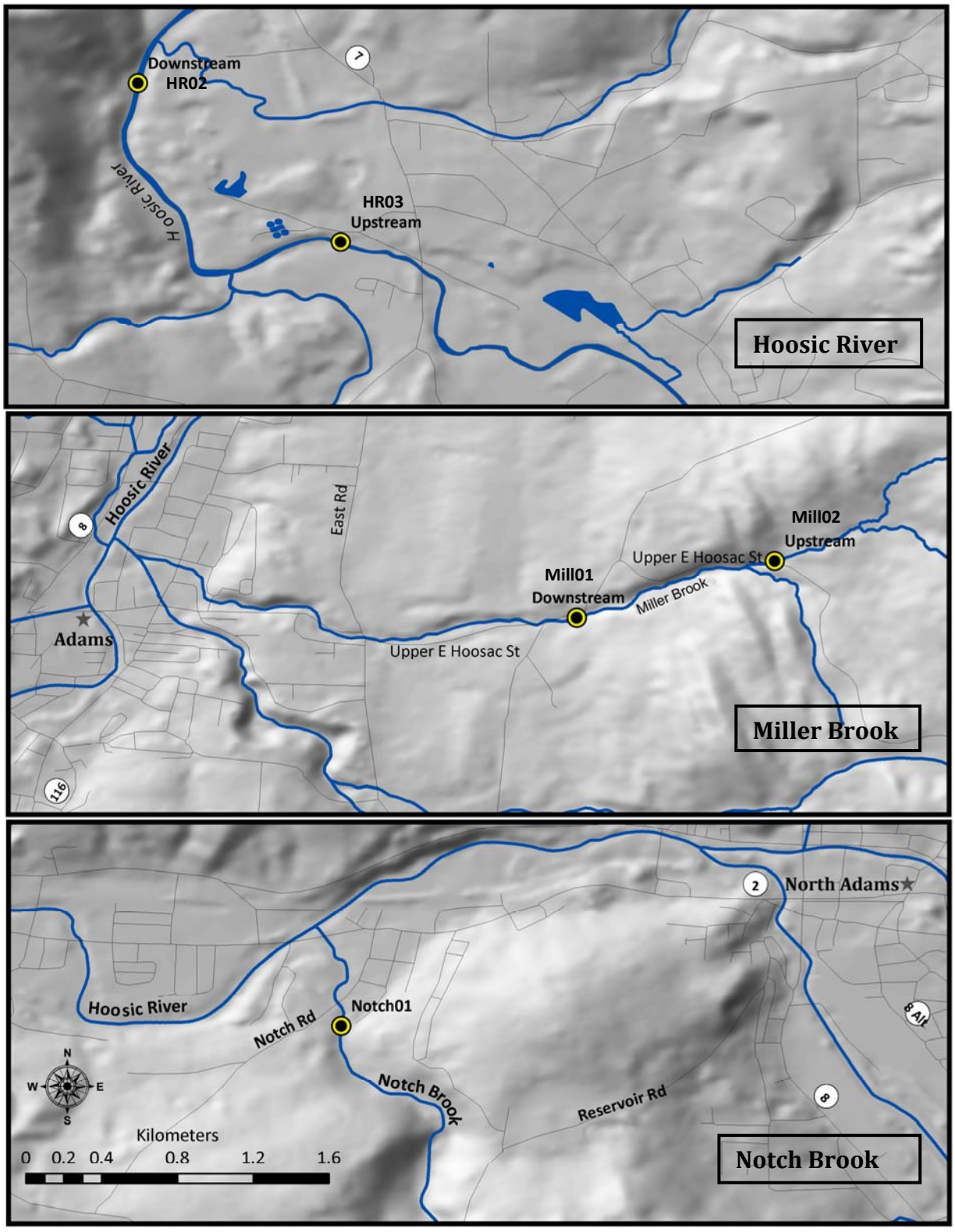

Figure 1. Continued.