

METHODOLOGY

The following parameters were utilized in 2009.

Several parameters were tested on site with field equipment as follows:

Volume Flow	Flow Mate, Global Water Flow Probe
Temperature	HANNA Instruments- Multiparameter HI 9828
D.O.	HANNA Instruments- Multiparameter HI 9828
pH	HANNA Instruments- Multiparameter HI 9828
Conductivity	HANNA Instruments- Multiparameter HI 9828
O.R.P.	HANNA Instruments- Multiparameter HI 9828

The following is a list of test parameter methodologies and detection limits which were utilized by Prosser Laboratories in the analysis of the stream samples.

<u>TEST</u>	<u>METHOD</u>	<u>REPORT LIMIT</u>
Acidity	SM18 2310B	5.00 mg/l
Alkalinity	SM 2320B	2.00 mg/l
Ammonia-N	QC10-107-06-1-K	0.100 mg/l
BOD-5	SM 5210B	2.00 mg/l
Calcium	EPA 200.7	2.00 mg/l
Chloride	EPA 325.3	2.00 mg/l
Fecal Coliform	SM 9222D	10 CFU/100 ml
Magnesium	EPA 200.7	1.00 mg/l
Nitrate + Nitrite as N	SM 4500F AUTO	0.050 mg/l
Nitrate-N	SM 4500F AUTO	0.050 mg/l
Nitrite-N	SM 4500B SPEC.	0.005 mg/l
Sulfate	EPA 300	2.0 mg/l
Total Kjeldahl Nitrogen	SM 4500-NORG-B	0.200 mg/l
Total Hardness	SM 2340C	2.00 mg/l
Total Dissolved Solids	SM 2540C	25.0 mg/l
Total Phosphorous	SM 4500 - PF	0.050 mg/l
Total Suspended Solids	SM 2540D	2.00 mg/l
Total Organic Carbon	SM 25-5310B	1.0 mg/l

The following methodologies were utilized in 2009:

Monroe County implemented two progressive stream evaluation surveys, the riffle-run and the multihabitat protocols, which are conducted within a 100 meter stream reach. These biological screening protocols were modified from the United States Environmental Protection Agency Rapid Bioassessment Protocols (RBPs), for assessing stream macroinvertebrate communities (PADEP 2009). These biological screening protocols are specifically designed per stream type, to provide intensive field surveys and water quality assessment approaches.

The riffle-run Index of Biological Integrity (IBI) applies to benthic macroinvertebrate samples collected using a handheld 500-micron mesh D-frame net, which employed the semi-quantitative (PADEP-RBP) method, applied for each Instream Comprehensive Evaluation (ICE). Staff conducted six kicks from shallow, fast and slow riffle areas within a 100-meter stream reach. Each kick disturbs approximately one square meter, immediately upstream of the net for approximately one minute, to an approximate depth of 10 cm, as substrate permits (PADEP 2009). The second sampling protocol is the multihabitat approach for low gradient streams, which required 10 jabs utilizing a 500-micron mesh D-frame net distributed between five possible habitat types: (Cobble/Gravel Substrate; Snag; Coarse Particulate Organic Matter (CPOM); Submerged Aquatic Vegetation (SAV); Sand/Fine Sediment) (PADEP 2007).

For the riffle-run dominated streams, each sample is composited into one container preserved with 95% ethanol in the field and transported to the contracted entomologist for enumeration and identification and placed into a pan marked with 28 four square inch grids. Debris from four grids is randomly selected and extracted using a four-square inch circular "cookie cutter," then placed into another identical empty pan. From this second pan, organisms are randomly selected from the grids until a 200-organism sub-sample (+/- 40 organisms) is obtained. Organisms in the sub-sample are identified according to taxonomic groupings and enumerated. Midges are identified to the family level of Chironomidae. Roundworms and proboscis worms are identified to the phylum level, flatworms and segmented worms, aquatic earthworms, and tubificids are identified to class. Water mites are identified as Hydracarina, and all other macroinvertebrates are identified to genus level (PADEP 2009).

For low gradient dominated streams, each sample is composited into one container preserved with 95% ethanol in the field and transported to the contracted entomologist for enumeration and identification and placed into a pan marked with 28 2" x 2" grids. Debris from four grids is randomly selected and extracted until a 200-organism sub-sample (+/- 20 %) is obtained. Organisms in the sub-sample are identified according to taxonomic groupings. Midges are identified to the family level of Chironomidae. Roundworms and proboscis worms are identified to the phylum level; flatworms are identified to Phylum Turbellaria; segmented worms, aquatic earthworms and tubificids are identified to Class Oligochaeta. Water mites are identified as Hydracarina, weevils to family, sand flies to family Ceratopogonidae, Decapoda, Gastropoda, and Pelecypoda to family, and all other macroinvertebrates are identified to genus level (PADEP 2007). The specifics of the macroinvertebrate analyses are discussed in Appendix A of this report.

Precision Quantification

To quantify precision methods, two of the biological samples were replicated and collected by the same investigator to minimize variability, and complies with the PADEP's quality assurance manual to verify identification work performed on macroinvertebrates. The Field data sheets are available for review at the MCPC office.

Quality Assurance

Accuracy was determined through the use of routine laboratory protocols that required random spiking of samples as per *consistency with the Quality Assurance Manual for PADEP*. Data quality requirements were maintained in the field throughout the collections and duplicate water samples were collected for chemical analysis at 3 sites and 1 field blank sample. A field blank consists of 500 mls of deionized distilled water, which is opened in the field and transported to the laboratory to be processed as a regular sample. The result of the field blank is located in Table 8. This was to determine and ensure data completeness through quality assurance checks designed for testing laboratory analysis techniques. Calibration of field equipment was performed daily.

During the field sampling, water samples were collected at mid-depth and mid-channel. These water samples were stored in coolers with ice packs in order to stabilize the samples and then transported to Prosser Laboratories, which is EPA certified for analysis. The specifics of the chemical parameters are discussed in Appendix B of this report.

For a particular site, a habitat assessment was conducted within a 100 meter stream reach. During the 2009 study, two types of habitat assessments were conducted to coincide with the different protocols discussed previously. The riffle-run habitat assessment involved ranking twelve parameters as excellent, good, fair, or poor with a range of 0-20 for each. The twelve parameters include: instream cover (fish), epifaunal substrate, embeddedness, velocity/depth regime, channel alteration, sediment deposition, riffle frequency, channel flow status, conditions of banks, bank vegetative protection, grazing or other disruptive pressures, and riparian vegetative zone widths. A total habitat score is evaluated by ranges and there are intended gaps within the categories that are left to the discretion of the investigator. The optimal category range is from 240 – 192, suboptimal range 180 – 132, marginal range 120 – 70 and poor is ranked at 60 and below. The multihabitat assessment involved ranking nine parameters as excellent, good, fair, or poor with a range of 0-20 for each, with a total top score of 180. These nine parameters are documented utilizing the EPA Glide/Pool Prevalence Habitat Assessment Field Data Sheets (PADEP 2007). The specifics of the habitat analyses are discussed in Appendix C of this report.

Pebble Counts were conducted on the cross section of each stream (wetted area), generally in close proximity to the individuals conducting the flow study. Streambed particle-size distribution is determined from a pebble count conducted throughout the selected stream reach. The individual measuring the particles takes a step, reaches down without looking and measures the first particle touched along its indeterminate axis. These particles were measured with an Al-Sci Field Sieve/Gravelometer and sand gauge. This modified pebble method was repeated, making several trips back and forth across the stream in a zigzag pattern until 100 particles were measured. The percentages are calculated and graphed in the office using a Microsoft Excel spread sheet. The specifics of the Pebble Count analyses are discussed in Appendix D of this report.

Stream discharge is a volume estimation. There are three required dimensions for measurement which are width, depth and velocity. Stream width and stream depth are measurements equivalent to the cubical width and height and since streams are flowing, the cubical length equivalent becomes a distance/time dimension (velocity) (PADEP 2009). The flow measurements were conducted by stretching a tape measure across the stream to determine the width of the stream (wetted area). The stream is then divided into sections allowing for a minimum of ten measurement points. The average velocity is recorded at each of the measurement points. If the measurement points are less than two feet in depth, one reading is taken at six tenths of the depth from the bottom. If the measurement point is greater than two feet in depth, two readings are taken, one at two tenths of the depth from the bottom and one at eight tenths of the depth from the bottom. When measuring the average velocity, if no flow registers on the meter it is recorded as a zero. The cross sectional area is calculated in the office using the computer program GraphPad Prism. The average velocity measurements are multiplied by the cross sectional area to determine the volume of flow for each stream.

In order to maintain consistency, sampling was completed during low flow to continue the long-term flow data analysis of Monroe County streams. The end of summer tends to be the period of lowest flow, optimal biological activity and streams are most vulnerable to pollution at this time.

The Planning Commission Staff correlated the final data.