A1. Title and Approval Sheet

Quality Assurance Project Plan for Central Upper Peninsula Volunteer Stream Monitoring Program

Date: 11/01/07
Version #: 1
Organization: Upper Peninsula Resource Conservation & Development Council

QAPP Prepared by: Elizabeth Coyne and Sarah Janda
Title: Program Managers

Signatures: _____

Other responsible individual: Darcy Rutkowski
Title: Executive Assistant

Signature: _____

MiCorps Staff Use

Tracking Number:

MiCorps Reviewer: _____

☐ Approved ☐ Returned for modifications

_____

Signature of reviewer Date

A2. Table of Contents

SECTION A: PROJECT DESCRIPTION AND QUALITY OBJECTIVES

A3. Distribution List

- Ric Lawson, Huron River Watershed Council
- Jo Latimore, Huron River Watershed Council
- Darcy Rutkowski, Upper Peninsula Resources and Development Council Executive Assistant
- Sarah Janda, Marquette County Conservation District Watershed Manager
- Elizabeth Coyne, Alger Conservation District Watershed Manager

A4. Project Organization

Key individuals involved in the project and their responsibilities include:

Management Responsibilities:
1) Elizabeth Coyne, Program Manager, Alger Conservation District, 101 Court Street, Munising, MI, (906) 387-4076, elizabeth.coyne@macd.org

2) Sarah Janda, Program Manager, Marquette County Conservation District, 780 Commerce Drive, Suite B, Marquette, MI, (906) 226-2461 ext 131, sarah.janda@macd.org

Elizabeth and Sarah are the primary Program Managers for the volunteer stream monitoring project. Their responsibilities include:

- Develop and implement a Quality Assurance Project Plan.
- Attend 8-hour training session provided by MiCorps.
  Promote volunteer stream monitoring activities and solicit volunteers.
- Research and purchase necessary equipment for performing stream monitoring activities.
- Coordinate and conduct volunteer stream monitoring training sessions.
- Coordinate volunteer stream monitoring field data collection sessions.
- Coordinate and implement macroinvertebrate identification review sessions for experts.
- Coordinate and implement indoor macroinvertebrate identification sessions.
- Implement database development, data entry, and data analysis.
- Develop reports for local governments, special interest groups, lake/stream associations.
- Promote information on RC&D and Conservation District web-pages.
- Provide copies of all products and deliverables in both hard copy and electronic formats.

3) Darcy Rutkowski, Executive Assistant, U.P. RC&D Council, 780 Commerce Drive, Suite C, Marquette, MI (906) 226-7487.

Darcy is the program assistant and helps Elizabeth and Sarah in program management when necessary. Darcy's responsibilities include:

- Assist with volunteer stream monitoring training sessions.
- Assist with volunteer stream monitoring field data collection sessions.
- Assist with macroinvertebrate identification review sessions for experts.
- Assist with indoor macroinvertebrate identification sessions.
- Assist with data entry and analysis.
- Provide copies of all products and deliverables in both hard copy and electronic formats.
- Develop quarterly narrative and financial reports.
- Develop and submit a final report, following MiCorps guidance, at the end of the project.
- Submit a release of claims statement at the end of the project.

4) Geraldine Larson, Project Expert/River Science Expertise, Superior Watershed Partnership, 1030 Wright Street, Marquette, MI 49855, (906) 228-6095, geri@superiorwatersheds.org

Geraldine is the project expert and provides her river science expertise in training interested volunteers in macroinvertebrate identification and verifying macroinvertebrate collections.

Field Responsibilities: Field sampling is performed by volunteers. Team Leaders and Collectors receive training in field data collection methods by Program Managers.

1) Team Leaders organize a stream monitoring strategy and delegate monitoring roles of each team member. In the field, Team Leaders completely fill out data sheets, take depth and width measurements, and communicate with the Collector to ensure thorough biological sampling of the site. In addition, Team Leaders provide instruction and guidance to Pickers. After field days, Team Leaders are responsible for returning equipment, biological samples, and data sheets to the Program Managers.
2) Collectors sample all in-stream habitats that exist at the site and provide sample contents to Pickers.
3) Pickers are responsible for sorting through the samples collected by the Collector, picking out the macroinvertebrates from the sorting tray, putting them in a collection jar, and preserving them in alcohol for later identification.

Corrective Action:
1) Elizabeth Coyne

2) Sarah Janda

Elizabeth and Sarah are the primary Program Managers and responsible for initiating, developing, approving, implementing, and reporting corrective actions concerning data quality.

A5. Problem Definition/Background

The Upper Peninsula is generally underserved when it comes to government and citizen water monitoring efforts. Since a large majority of the land area is rural, it is typical for people to view the area as pristine. Compared to the more urban areas downstate, Upper Peninsula streams are not suffering from as much impairment, but that does not mean they are not threatened. Non point source pollution is a major issue. Rural development is typically unregulated and expanding rapidly. County and township governments are not encouraged by the voters to enforce or enact zoning regulations meant to protect resources. This indicates the general public tends to take their high quality natural resources for granted.

The volunteer stream monitoring program addresses the need to increase stewardship of aquatic resources through community involvement and education. As volunteers experience the ecosystems of local streams they will be more likely to pay attention to local streams and spread the word about monitoring results. The monitoring program is designed to provide access to such information and to generate greater interest in the resource among the public. Volunteers, officials and the general public will gain a deeper understanding of human impacts to aquatic ecosystems, resulting in greater attention to policies that protect water quality.

The Central Upper Peninsula Volunteer Stream Monitoring Program trains and utilizes local volunteers to collect baseline water quality data, characterize the current health of the streams and begin tracking changes that may result from human influence.

Using MiCorps stream monitoring protocols ensures the water quality data is scientifically credible and acceptable to both state and local decision makers. Data collected from the field is entered in the MiCorps database and results are distributed at the local and regional level. UPRC&D and the Central Upper Peninsula Volunteer Stream Monitoring Program publicize results through direct mailings and media outlets (newsletters, newspapers, radio, television, and internet). Providing water quality data to government officials, planners and others aids in the decision-making process during activities such as master planning and zoning, helping them be more effective at protecting aquatic resources. The general public and stewardship organizations are able to use the data during educational activities that promote stewardship of aquatic resources, and to identify specific areas of concern. Problem areas uncovered by the monitoring efforts are addressed through collaboration between watershed managers and local, state, federal and tribal aquatic resource professionals.

The watersheds initially targeted for this project were selected because of development pressure, growth patterns, nonpoint source pollution concerns, and interest from local stakeholders. The Dead River Watershed in Marquette County covers 164 square miles and is broken into two sub watersheds. The upper watershed is mostly undeveloped with land ownership largely comprised of corporate forest land. The lower watershed is mostly urban in nature and is faced with stormwater pressures from increasing development. Volunteers will monitor at least four sites in the Dead River watershed selected based on stakeholder recommendations. The Anna River Watershed in Alger

County has a mixture of forested, rural and urban environments. The Munising Bay Watershed Management Plan indicated the coldwater fishery habitat of the Anna River is severely impacted by sediment. At least three sites are to be monitored in order to assess the effectiveness of Best Management Practices installed as part of the CMI funded Munising Bay Watershed Restoration Project.

A6. Project Description

The overall goal of the volunteer monitoring program is to protect and improve the water quality in the streams of the Upper Peninsula of Michigan. The Central Upper Peninsula Volunteer Stream Monitoring Program utilizes the Michigan Clean Water Corps (MiCorps) Volunteer Stream Monitoring Procedures (Latimore 2006). The MiCorps program was created through an executive order by Governor Jennifer M. Granholm to assist the Michigan Department of Environmental Quality in collecting and sharing water quality data for use in water resources management and protection programs and provides standardized assessment and data recording procedures that can be easily used by trained volunteers. Specific objectives of this project include collecting baseline data, characterizing stream ecosystems, identifying water quality problems, determining water quality trends, and informing and educating the public about water quality issues and aquatic ecology. Volunteer stream monitoring activities will continue to be supported by the UPRC&D and conservation districts into the future.

The first goal of the Central Upper Peninsula Volunteer Stream Monitoring Program is to foster public awareness, stewardship and surveillance of Upper Michigan surface waters and increase citizen participation in these efforts. The program recruits and trains a minimum of eight volunteer monitors (4 in each county). Program staff and volunteers attend meetings of local governments and service clubs to promote the program and recruit volunteers. Promotional work focuses on expanding the volunteer stream monitoring program to other UP watersheds. Program Managers refer to the monitoring grant work plan (Appendix 1) to assure the objectives are met and the program stays on track.

Another goal is to generate baseline water quality data on at least two UP watersheds. The quality-assured data may be used by DEQ biologists to identify sites where more detailed assessment by the Department is needed. To accomplish this, program staff and volunteers conduct spring and fall monitoring sessions in each watershed, monitoring a minimum of three sites in each watershed. The program furnishes the necessary equipment to sample benthic macroinvertebrates and conduct physical habitat assessments.

The procedures and data forms include two types of assessments: stream habitat assessment (Appendix 2) and macroinvertebrate identification and assessment (Appendix 3). The stream habitat assessment is a visual assessment of stream conditions and watershed characteristics. The macroinvertebrate sampling procedure is used in conjunction with the stream habitat assessment and provides a measure of stream health. The assessments cover approximately 300 linear feet of stream at each site.

Four macroinvertebrate communities in the Dead River watershed and three in Anna River watershed are sampled annually in the spring (mid April or before leaf out) and fall (mid September or after leaf drop). Sites are monitored more frequently if a population appears to be changing. The project is intended to continue indefinitely. New sites are added on an irregular basis, as volunteer and community interest occurs or problems are detected. Sites are sampled during the same time frame each year to minimize seasonal variability in macroinvertebrate distribution or abundance.

Data collected by volunteers includes benthic macroinvertebrate diversity and physical habitat. Aquatic macroinvertebrates are the primary focus of this monitoring program. Aquatic macroinvertebrates are collected, identified to the order level and tallied to determine diversity in the benthic community and gauge the health of the stream reach. Volunteers conduct a habitat assessment once a year every fall to get an indication of the physical characteristics of the stream reach.

The next step is to make results available to interested parties. Data are entered into the MiCorps database and results are analyzed using a statistical program (Microsoft Excel) and summarized for use by interested parties. Program staff and volunteers get the word out by making presentations to organizations and publishing informational brochures, reports in newspapers, newsletters and local broadcast news. The Central Upper Peninsula Volunteer Stream Monitoring Program is to host an annual meeting of volunteers to present the results to them and explain how to utilize the data to document water quality changes over time, measure impacts of nonpoint source pollution and influence policy and behavior changes.

A7. Data Quality Objectives

Precision/Accuracy: Accuracy is the degree of agreement between the sampling result and the true value of the parameter or condition being measured. Accuracy is most affected by the equipment and the procedure used to measure the parameter. Precision refers to how well you are able to reproduce the result on the same sample, regardless of accuracy. Human error in sampling techniques plays an important role in estimating precision.

The primary goal of this project is to gauge stream health by measuring the total diversity of macroinvertebrate taxa. To ensure precision and accuracy, designated Project Experts (usually a Project Manager and one or two team leaders) accompany teams to observe their collection techniques and note any divergence from protocols. The Project Expert(s) also perform an independent collection (duplicate sample) after the first monitoring event no less than a week after the team's original collection and no more than two weeks later. Project Experts accompany new teams during their first macroinvertebrate sampling event or to a new monitoring site and collect duplicate samples.

Techniques under review shall include:

- collecting style (must be thorough and vigorous)
- habitat diversity (must include all available habitats and be thorough in each one)
- picking style (must be able to pick thoroughly through all materials collected and pick all sizes and types of macroinvertebrates)
- variety and quantity of organisms (must ensure that diversity and abundance at site is represented in sample)
- the transfer of collected macroinvertebrates from the net to the sample jars (specimens must be properly handled and jars correctly labeled).

Resulting diversity measures by teams are compared to expert results and each should have a relative percent difference (RPD) of less than 40%. This statistic is measured using the following formula:

RPD = [(Xe - Xv) / (mean of Xe and Xv)] x 100, where Xe is the expert measurement and Xv is the volunteer measurement for each parameter.

Volunteer teams that meet quality standards are allowed to conduct future field collection without expert oversight, though they are “recertified” after about every five sampling events. Teams that do not meet quality standards are retrained in the relevant methods and the Project Expert will re-evaluate their collection during the subsequent sampling event.

Macroinvertebrate samples are stored in alcohol to be identified at an indoor identification session. The accuracy of specimen identification is dependent upon the abilities of the experts aiding in the indoor identification session. Identifications made by volunteers that have not received course work or training in order level aquatic macroinvertebrate identification or better are reviewed by the Project Expert. At least 10% of the samples processed by experts in question are reviewed to verify results. If more than 10% of specimens were misidentified, then Program Managers review all the samples processed by that expert. Additionally, MiCorps staff conducts a method validation review with the designated Project Expert to ensure his or her expertise, preferably prior to the first training session held by the Project Expert (note that this must be conducted with each new Project Expert added to a MiCorps monitoring program). This review consists of a joint duplicate sampling event, with MiCorps sorting and identification. RPD statistics are calculated as above.

All cases of collecting deficiencies are promptly followed (during that visit) by additional training in the deficient tasks and a subsequent method validation review may be scheduled for the following collecting season. Upon request MiCorps staff also verifies a subset of the volunteer’s identification. If a problem arises with the subset in review a thorough check may be requested.

Bias: Sites are sampled by different teams at least once every two years to examine the effects of bias in individual collection styles. An RPD between the new measure and the mean of past measures should be less than 40% for all parameters. Sites not meeting this data quality objective are evaluated as above by the Program Expert.

Completeness: Completeness is a measure of the amount of valid data actually obtained versus the amount expected to be obtained as a specified in the original sampling design. It is usually expressed as a percentage. For example, if 100 samples were scheduled but volunteers sampled only 90 times due to bad weather or broken equipment, the completeness record would be 90 percent.

Following a QA/QC review of all collected and analyzed data, data completeness is assessed by dividing the number of measurements judged valid by the number of total measurements performed. The data quality objective for completeness for each parameter for each sampling event is 95%. If the program does not meet this standard, the Program Manager consults with MiCorps staff to determine the main causes of data invalidation and develops a course of action to improve the completeness of future sampling events.

Representativeness: Representativeness is the degree to which collected data actually represent the stream condition being monitored. It is most affected by site location. Study sites for the program are selected following the methodology described in section B1. As indicated, all available habitats are sampled and documented to assure that the site is representative of other stream segments in the subwatershed. Resulting data from the monitoring program is used to summarize the biological conditions of the contributing subwatershed, as an initial screening mechanism. Since not enough resources are available to allow the program to cover the entire watershed, some subwatersheds are not initially represented. Additional subwatershed sites will be added as resources and volunteers allow.

Comparability: Comparability represents how well data from one stream or stream site can be compared to data from another. Most managers compare sites as part of a statewide or regional report on the volunteer monitoring program; therefore, sampling methods should be the same from site to site. To ensure comparability, all volunteers participating in the program follow the same sampling methods and use the same units of reporting. The methods are based on MiCorps standards, which increase comparability with other MiCorps programs. Periodic reviews of sampling events by the Program Expert ensure adherence to these standard methods.

A8. Special Training/Certifications

The Program Managers coordinate trainings and ensure that all program personnel and volunteers are properly trained. Program Managers receive Volunteer Stream Monitoring Grantee Training provided by MiCorps staff. The training provides information about basic stream monitoring methods established by MiCorps. Topics covered include stream macroinvertebrate sampling and identification (to the order level), habitat assessment, data management and entry into the MiCorps database, attracting and retaining volunteers, and program evaluation. The training includes both

indoor and field components, and is currently conducted by Huron River Watershed Council staff. Program managers attended this training in June of 2007.

Program Managers will have a side-by-side field training session with MiCorps staff in August of 2007, prior to the first volunteer training and sampling event. The Program Managers then train volunteer Team Leaders in a one-day training session before the first fall monitoring event. At least two training sessions are offered before the first monitoring event (one in Marquette County and one in Alger County), and again in the spring before the spring monitoring event. The first part of the day offers indoor instruction on the following topics:

1. Goals of the monitoring program
2. Potential uses for the data
3. Quality assurance and data management
4. Introduction to macroinvertebrates
5. Team structure in volunteer stream monitoring
6. Field techniques
7. Explanation of MiCorps field data sheets
8. Stream habitat characteristics and assessment

After the indoor session, participants visit a stream to practice assessing physical habitat characteristics, sampling of macroinvertebrates and familiarity with identification to the order level. At the end of the training, volunteers fill out an evaluation assessing how they felt about the information presented. Program managers maintain a database of all trained volunteers with the date they completed the training.

Training in macroinvertebrate identification takes place in the morning of the indoor identification session. Volunteer Experts in need of review will be trained prior to indoor identification sessions. Volunteers trained in identification are included in a database to track trainings and ensure that experts have reviewed/learned all macroinvertebrate orders.

A9. Documentation and Records

Volunteers are recorded in a separate database that tracks trainings and skills. Field data collected by volunteers is entered and managed in a Microsoft Access database. Data are uploaded to the MiCorps Data Exchange Network and stored indefinitely at the UPRC&D office. Original field data sheets are filed at the UPRC&D office. All data are backed up weekly and a back-up tape is stored off premises. Computer passwords provide data security.

SECTION B: PROJECT DESIGN AND PROCEDURES

B1. Study Design & Methods

Parameters: Our biological evaluation of stream water quality is based upon community diversity, in that we attempt to include a complete sample of the different groups of macroinvertebrates present rather than a random subsample. Instead of assuming that

a single collection represents all the diversity in the community, results are considered reliable only after repeated collections spanning at least three years.

During field data collection efforts, volunteers collect specimens from the benthic community from all habitats present at the site. At the indoor identification session macroinvertebrates collected from the benthic community are identified to the order level and tallied to provide data for the calculation of diversity indices. Diversity scores are used to rate the health of the stream ecosystem and provide a basis for trend analyses. Results are compared with other data sets available through DEQ and other agencies/organizations for the site in question and compared with locations in the same river system included in this program.

Site selection: General guidelines

- Sites are distributed such that each subwatershed, and in turn their subwatersheds are assessed to provide a representative depiction of conditions found throughout the watershed.
- At least one site should be surveyed in each tributary, with the location of this site being near the mouth of the tributary.
- The distribution of sampling stations within the watershed should also achieve adequate geographic coverage.
- Consider establishing stations upstream and downstream of suspected pollutant source areas, or major changes in land use, topography, soil types, water quality, and stream hydrology (flow volume, velocity or sinuosity).
- If the intent of monitoring is to meet additional, watershed-specific objectives, then additional data may be needed.
- In all cases, the site should:
  - be representative of the area of stream surveyed,
  - contain a diverse range of the available in-stream cover,
  - contain some gravel/cobble bottom substrates if possible
  - allow for the assessment of 300 feet of stream length.

Study Locations: Sample sites were chosen to assess water quality in areas of concern and to monitor various projects concerning streambed restoration and aquatic habitat recovery.

Monitoring sites in the Dead River watershed:

- Connors Creek, tributary of the Dead River
  Critical Information
  - Marquette County, Champion Township
  - T 49N R 28W, Section 31
  - Grapevine Road stream crossing

  Context Information
  - Connors Creek stretches 10 stream miles through the Upper Dead River watershed and drains dominantly upland wooded terrain. The watershed is undeveloped with land ownership comprised largely of corporate forest land. Connors Creek is a high quality groundwater, low gradient stream

with excellent potential as a brook trout fishery but suffered major devastation as a result of a flood in 2003. A monitoring site has been chosen on Connors Creek to validate streambed restoration efforts conducted by the local chapter of Trout Unlimited in the summer of 2007 and to demonstrate success as a model for restoration in other tributary streams.

- Brickyard Creek, tributary of the Dead River
  Critical Information
  - Marquette County, Marquette Township
  - T 48N R 25W, Sections 18 & 19
  - Highway US 41 road-stream crossing

  Context Information
  - Brickyard Creek stretches through the growing urban landscape of Marquette Township. New subdivisions and big box stores are creating more impervious surface. Highway US41 is a known contributor of sedimentation as sand is used to maintain winter roads. In the fall of 2007 nearly 500 linear feet of Brickyard Creek were relocated and reconstructed north of US41 to prepare the site for Lowe's Home Improvement Store. Monitoring north and south of US41 Brickyard Creek road-stream crossing will help volunteers gauge the impacts of non point source pollution and evaluate the effectiveness of stream restoration efforts.
- Nordwald Creek, tributary of the Dead River
  Critical Information
  - Marquette County, Marquette Township
  - T 48N R 25W, Sections 18 & 19
  - Brickyard Road stream crossing

  Context Information
  - Nordwald Creek is another perennial stream threatened by expanding development in Marquette Township. The parcel of land that contains the headwaters is currently being sold as commercial property. Sand from US41 and parking lot runoff are some issues of concern. The stream is host to a brook trout though a perched culvert at the end Brickyard Road separates the two populations. Volunteers will monitor at a location near upstream of the road-stream crossing and another near the mouth to measure the impacts of non point source pollution on aquatic communities.
- Reany Creek, tributary of the Dead River
  Critical Information
  - Marquette County, Negaunee Township
  - T 48N R 26W, Section 10
  - Downstream of White Bear Road stream crossing

  Context Information
  - Reany Creek stretches seven miles through Negaunee and Marquette Townships before emptying into the Dead River near the UPPCO Forestville Hydroplant. Land use is dominantly forested and comprised of

large commercial and private parcels. Reany Creek is a high quality coldwater fishery with an abundant Brook Trout habitat. Volunteers from the White Bear Road Landowners Association have committed to monitor Reany Creek and engage other landowners in watershed awareness.

Monitoring sites in the Anna River watershed:

- Site 1. North Branch Anna River

  Critical information:
  - Site one is downstream of the culvert over the North Branch of the Anna River on Perch Lake road, in AuTrain Township of Alger County.
  - Latitude 46.38372, Longitude -86.71142
  - STORET# 020134
  - The North Branch crossing is the second major stream crossing on Perch Lake Road. Perch Lake Road is a private gravel road south of Munising, off M-94 directly across from Valley Spur Inn.

  Context Information:
  - The site is a primary contributor of nonpoint source pollution in the Anna River Watershed. It has been identified as a priority in the Munising Bay Watershed Restoration Plan and is scheduled for BMP installation with help from a CMI NPS implementation grant. The existing culvert is too small, which constricts flow and causes ponding during high flow conditions. The dirt road slopes steeply toward the crossing and there are no side slopes to hold rip rap. Previous monitoring conducted as part of the watershed planning effort indicated the site is suffering from severe impacts associated with the inadequate culvert. Monitoring at this should detect any improvements resulting from BMP installations.

- Site 2. Joe's Creek at Brook Street

Critical Information
- Monitoring will take place upstream of the snowmobile bridge, just before the stream exits the forest.

Context Information:
- Joe's creek is a tributary to the Anna. It exits the woods and runs parallel to Brook Street, across the street from the Citgo station on the east end of Munising. For three blocks the channel is straightened and at least three feet of sediment fills the streambed right along the city street, and curb cuts direct runoff straight into the stream. Just upstream where it runs through the forests at the base of the hill the stream looks to be in good condition. The City of Munising and the Munising Bay Watershed Restoration Project are looking at options for restoring this segment of stream to a more natural condition.

- Site 3. Anna River, Passinault Buffer Strip Site

Critical Information:
- Autrain Township; T 46N, R 19W Section 16
- Latitude 46.38390 Longitude -86.68460

- STORET# 020133

Context Information:

- The Passinault Buffer is another priority site in the Munising Bay Watershed Restoration Plan. The railroad used this site to trap sediment after a major culvert failure, but the sediment has not been cleaned out for several years. Immediately downstream of the Passinault property the stream returns to a more natural state and monitoring here will help evaluate the effectiveness of the buffer strip that will be implemented in spring of 2008 as part of the CMI implementation grant.

Frequency and timing: Macroinvertebrate communities are sampled annually in the spring (early May before leaf out) and fall (Early October after leaf drop) for the first three years, after which the sites are monitored at a frequency between 1 and 2 years. Sites are sampled during the same time frame each year to minimize seasonal variability in macroinvertebrate distribution or abundance. Sites are monitored more frequently if a population appears to be changing. The project is intended to continue indefinitely. New sites are added on an irregular basis, as volunteer and personal community interest occurs or problems are detected.

For each sampling event, monitoring by volunteers is completed within the same two week period each year. If a site is temporarily inaccessible, due to factors such as prolonged high water, the monitoring time may be extended for two additional weeks. If the issue concerning inaccessibility is continued beyond the extended dates, then no monitoring data will be collected during that time and there will be a gap in the data. If a team is unable to monitor their site during the specified time, Team Leaders contact the Program Managers as soon as possible and no later than the end of the first week in the sampling window in order for the Managers to arrange for another team to complete the monitoring. If no team is available, the Program Managers are responsible to see that the site is monitored unless sufficient redundancy has been included in the monitoring schedule that additional data is not needed.

Study Methods: The following is a list of study methods that will be used to measure the different parameters:

- Stream Habitat Assessment
- Macroinvertebrate Assessment
- Indoor Identification
- Data Storage

Procedure for Stream Habitat Assessment: Teams of at least four monitors arrive at the site, verify the location with GPS and record the stream name, location, date, start time, and monitoring team names on the datasheets. It is not necessary for the habitat assessment and Macroinvertebrate collection to happen at the same time on the same event. Before teams begin to assess stream habitat, it is important to reference general safety guidelines promoted during the monitoring training (implement the buddy system, always use caution, note any floods or stream warnings, always carry a first aid kit, leave wildlife alone).

Teams begin recording location information such as county, township, latitude, longitude, and GPS coordinates. A member of the team creates a site sketch including direction of flow, location of road or closest road-stream crossing, and any important landmarks such as an eroding bank, large tree, or deep pool. Photos are taken both upstream and downstream to best represent site conditions as teams work. Stream event conditions (high/low flow, days since last rain, temperature, color, type) are noted on the data sheet. Teams record stream depth and width measurements of the site and categorize stream flow as dry, stagnant, low, medium, or high. Teams conduct a visual assessment of the stream's substrate and quantify the percent boulder, gravel, sand, detritus, and bedrock (substrate total to equal 100%). Teams also note the location's morphology to indicate the presence of riffles, pools, they type of channel, and the highest water mark. A cross-section sketch is drawn to show the dimensions of the stream channel. Additional data that is collected on the stream habitat assessment sheet includes physical appearance (presence of algae, oil sheens, foam, trash), instream cover (undercut banks, overhanging vegetation, pools, boulders, woody debris), stream corridor (riparian width, severity of bank erosion, streamside land cover), adjacent land uses seen and potential sources of stream degradation.

Procedure for Macroinvertebrate Sample Collection:
Before entering the stream, the Team Leader and Collector inspect the sampling gear to ensure that it is clean. If there is debris or aquatic life on any of the equipment, use water withdrawn from the stream with a clean container to clean the equipment at a distance of not less than 100 feet from any water body.

One trained Collector wades the stream and use a D-frame kick net to get samples from each habitat type present at the site, including riffle, rocks or other large objects, leaf packs, submerged vegetation or roots, and depositional areas, making sure to thoroughly sample each habitat type. The Collector or a streamside assistant empties the contents of the nets into shallow white trays after each sample. Pickers remove debris and place samples into jars of ethanol. As the designated recorder, the Team Leader records all the information onto the MiCorps datasheets. Sites on small streams should be sampled for a minimum of 30 minutes while those on large streams will be sampled for at least one hour. Identification to Order level may occur streamside or indoors. The number of sites monitored each day depends on the number of trained volunteers available. The goal is to have enough teams of three or four to monitor all sites on a stream in one day and all sites in the project within a two week time period.

Volunteers pick aquatic organisms from the tray, and place them in containers of with 70% ethanol for later identification. Volunteer teams are encouraged to collect a minimum of 100 specimens, but an emphasis will be placed upon collecting a variety of aquatic organisms as opposed to quantity. The Team Leader instructs and assists team members in detecting and collecting macroinvertebrates in the sorting pans, including looking under bark and inside of constructions made of sticks or other substrates.

While at the monitoring site the Team Leader makes a site sketch depicting the locations and types of habitats sampled. The Team Leader marks the locations on the sketch and records on the datasheet the number of each habitat type sampled within the monitored reach. The team leader reads aloud the questions on the datasheet and writes the answer on the datasheet. The Collector provides information to the Team Leader in response to questions from the data sheet. The Team Leader and Collector work together to cite all habitats that are sampled, stream conditions, and any changes in methodology or unusual observations. Potential sources of variability such as weather, stream flow, turbidity, and erosion are noted on the data sheet during each field session and discussed in study results.

The field data sheet includes sections to record unusual procedures or accidents, such as losing part of the collection by spilling. Team Leaders report any variations in procedure or other issues possibly affecting data quality to program managers, who will follow corrective actions described below. Before leaving the site, the Collector thoroughly rinses the net to ensure that no organisms are transported to the next site. To avoid contamination or to ensure that bugs are no longer attached to the kick net, dip the net into the stream with the opening facing upstream. Take hands and clean off any debris clinging to the net. Make sure this is done after every monitoring event prior to leaving the site. The Team Leader inspects the site to make sure that no equipment or refuse is left behind.

Procedure for Indoor Identification: Following the field data collection session an indoor identification session is held, bringing volunteers and aquatic scientists together to sort, identify, and tally specimens collected in the field. Volunteers sort preserved aquatic organisms into groups based on physical similarities. Aquatic scientists with macroinvertebrate taxonomic identification skills assist volunteers with the identification of specimens to the order level. All identifications are verified by qualified experts. Volunteers record taxa names and the number of specimens belonging to each taxon on the ID data sheet. A subset (percentage of total in accordance with MiCorps standards) of the biological samples is sent to MiCorps staff for identification verification.

Procedure for Data Storage: Data sheets along with collected specimens are returned to program leaders after each monitoring event. Raw data are entered and managed in Microsoft Excel spreadsheets. All data are backed up weekly and tapes are kept offsite in a secure location. Computer passwords also provide data security. Electronic data are entered into the online MiCorps database by a Program Manager or Team Leader and stored and updated annually on the MiCorps database exchange system. Data sheets are filed at the RC&D office for a period of at least five years.

Variability: Inconsistent macroinvertebrate scores or habitat assessments between monitoring sites or collection events may raise a red flag. It is the responsibility of Program Managers to take note of sources of variability such inconsistencies and address whether variability is due to human error or a recent environmental impact such as change in land use or the presence of non point source pollutants. Re-sampling is

conducted if warranted and feasible, given that the deviation is noted soon after occurrence and volunteers are available.

Monitoring Equipment: Monitoring equipment was selected based on the recommendation of MiCorps and the suggested equipment needed for a successful program. Monitoring equipment is inventoried yearly by program staff or volunteers and tracked in an Excel spreadsheet (See Appendix 4).

Equipment Storage: All equipment is stored in the UP RC&D office and made available for pick-up by Team Leaders prior to sampling events. Equipment is returned to the UP RC&D office on indoor identification days. Equipment is maintained by UP RC&D staff.

Sample Storage: Macroinvertebrates samples are preserved in 70% ethanol solution in perpetuity. Samples are checked yearly and solution changed every five years.

Disposal: Old ethanol is diluted with water and emptied down drain.

Data Confirmation: A standardized data-collection form is used to facilitate spot-checking to ensure that forms are completely and correctly filled out. A Program Manager or a single trained volunteer reviews the data before it is stored in a computer or file cabinet. After data has been compiled and entered into a computer file, it is verified with raw data from field survey forms. Biological monitoring results are confirmed by identification from trained entomologists. If necessary experts may conduct identification with the aid of dissecting microscopes (with a maximum enlargement of 65x) and consultation with dichotomous keys (Aquatic Insects of Wisconsin by Hilsenhoff and Aquatic Insects of North America by Merritt and Cummins).

Corrective Action: Volunteer Team Leaders make sure that quality assurance protocols are followed and report any issues possibly affecting data quality to program managers. If deviation from the QAPP is noted at any point in the sampling or data management process, the affected samples may be deleted from the data set. Re-sampling is conducted if warranted and feasible, given that the deviation is noted soon after occurrence and volunteers are available. Otherwise, a gap may be left in the monitoring record. All corrective actions, such as above, are documented and communicated to MiCorps.

B2. Sample Handling and Custody

At the collecting site, all invertebrate sample jars receive a label written in pencil, stating date, location, name of collector, and number of jars containing the collection from this site. The label is placed inside the jar. The data sheet also states the number of jars containing the collection from this site. The Team Leader is responsible for labeling, securely closing the jars and the returning all jars and all equipment to program managers. When turned over to the Program Managers, the collections are checked for labels, the data sheets are checked for completeness and for correct information on the number of jars containing the collection from the site, and the jars are secured together

with a rubber band and site label and placed together in one box. They are stored in the Conservation District office until they are examined and counted on the day of identification (one or two weeks later).

Data sheets are checked for completeness and to verify that the correct number of containers from the sample site is indicated on the data sheet. The data sheets are used on the identification day, after which they remain on file at UPRC&D office indefinitely. At the time of identifying the sample, the sample identifier checks the data sheet and jars to ensure that all the jars, and only the jars, from that collection are present prior to emptying them into a white pan for sorting. If any specimens are separated from the pan during identification, a site label accompanies them.

For identification, volunteers sort all individuals from a single jar into look-alike groups, and then are joined by an identification expert who confirms the sorting and provides identification of the taxa present. These identifications are then verified by the Program Expert. When identification of a sample is complete, ethanol used in the field sample jars is discarded and the entire collection of identified specimens from each site will be stored in a single jar of fresh 70% ethanol, sealed with a poly-seal cap. A printed label with sample ID (corresponding to database), sample site location, and date collected is placed inside the jar. For future reference the samples are stored at the UPRC&D office for at least five years. The preserved samples are inspected yearly to guarantee long-term storage and the alcohol is changed in the jars every few years.

B3. Analytical Methods

Information collected on the datasheets is used to estimate abundance and calculate MiCorps Stream Quality Index, allowing comparison between sites to help locate and identify impacts. All biotic diversity index scores are calculated in Microsoft Excel.

Macroinvertebrates: Additional metrics and statistical analyses used to analyze the aquatic community data are:

1. Percent Mayfly Composition. This is the ratio of the number of individuals in the order Ephemeroptera to the total number of organisms collected. As with the number of mayfly taxa, the percent abundance of mayflies in the total invertebrate sample can change dramatically and rapidly to minor environmental disturbances or fluctuations.

2. Percent Caddisfly Composition. This is the ratio of the number of individuals in the order Trichoptera to the total number of organisms collected. As with the number of caddisfly taxa, percent abundance of caddisflies is strongly related to stream size with greater proportions found in larger order streams. Optimal habitat and availability of appropriate food type seem to be the main constraints for large populations of Caddisflies.

3. Percent Contribution of the Dominant Taxon. This is the ratio of the number of individuals in the most abundant taxon to the total number of organisms collected. The abundance of the numerically dominant taxon is an indication of community balance. A

community dominated by relatively few taxa for example, would indicate environmental stress, as would a community composed of several taxa but numerically dominated by only one or two taxa.

4. Percent Isopods, Snails, and Leeches. This is the ratio of the sum of the number of individuals in the order Isopoda, class Gastropoda, and class Hirudinea to the total number of organisms collected. These three taxa, when compared as a combined percentage of the invertebrate community, can give an indication of the severity of environmental perturbation present. These organisms show a high tolerance to a variety of physical and chemical parameters. High percentages of these organisms at a sample site are very good evidence for stream degradation.

Physical habitat assessment: The habitat assessment provides a subjective rating of habitat characteristics. Information from the datasheets allows for comparing results over time and is a good way to monitor change, examine variation between sample sites and indicate trends.

Performance criteria and validation: See section B5.

Procedures for addressing failures: Consult MiCorps staff and/or local experts.

B4. Quality Control

Equipment Quality Control:

1. Thermometers must be physically inspected for damage prior to use and immersed into both boiling and ice water to verify they are functioning correctly. If the thermometer is damage or not working correctly, it is disposed of and replaced with a new unit.
2. D-frame nets must be inspected for damage or holes and replaced if necessary.
3. All equipment must be cleaned, dried and stored securely after each sampling event.
4. Check the equipment that requires batteries and replace them if necessary.

Field Procedures Quality Control:

1. Repeat benthic macroinvertebrate sampling is performed when a new volunteer team starts monitoring and then every 3-5 years thereafter as a review. A Program Manager or qualified expert accompanies the team and collects benthic Macroinvertebrate data to compare diversity indices that verify quality control in collection techniques and thoroughness.
3. Volunteer monitoring teams alternate streams and/or sample sites on a 2-3 year basis to maintain objectivity and minimize individual bias.
4. Analyze and review field records before submitting to the MiCorps database to minimize errors.

Indoor Identification Quality Control:

1. Macroinvertebrate specimens are checked by a Program Manager upon receiving them from a volunteer team to assure they contain labels, their lids are securely screwed to the jar, and are all placed together in one box.
2. Field data sheets used by volunteers must be checked for completeness and to verify the correct number of containers from the sample site is indicated on the form.
3. Prior to identification, data sheets and jars must be checked to ensure that only jars from that collection are present prior to emptying them into a white pan for sorting.
4. Any specimens that are separated from the pan during identification are accompanied by a site label indicating where it came from.
5. All samples must be checked and verified by a qualified expert.

Data Analysis Quality Control:

1. Upon receiving data from volunteers, field records are reviewed by a program leader to minimize errors before entering it into the MiCorps database.
2. Calculations for diversity and other variables will be calculated through a computer formula and verified with manual calculations by a program leader.
3. Data entered into the computer is reviewed by comparing hard copy print outs with field data sheets.
4. Data analysis methods are reviewed by qualified professionals on a five year basis.

B5. Instrument/Equipment Testing, Inspection, and Maintenance

D-frame nets are inspected before each sampling event to ensure they are intact. If holes are found in the netting, nets are replaced prior to use. Thermometers are inspected for damage and compared to other thermometers to verify they are functioning properly prior to each sampling event. If equipment has been damaged or is malfunctioning, replacement thermometers are provided by the RC&D Council. All equipment is stored in the RC&D Council office.

B6. Instrument/Equipment Calibration and Frequency

Not applicable.

B7. Inspection/Acceptance for Supplies and Consumables

The following is a list of supplies and consumables:

- Monitoring procedures and field data sheets
- D-Frame collection nets (mesh size = 20x24 mesh/inch)
- Sorting trays
- Forceps
- Eye droppers
- Preservative (70% ethanol)
- Jars and lids
- Measuring tape
- Yardsticks
- Clipboards
- Pencils
- Waders
- Map

- Camera

Optional equipment may also include: GPS unit, communication plan, insect repellent, first aid kit, sunscreen, water, string and stakes. For inventory purposes, an equipment inventory list, including the date of purchase (if applicable), projected date of replacement, and date of use will be developed in a Microsoft Excel spreadsheet and appended to the QAPP (Appendix 4). Supplies are maintained by Program Managers and stored in the RC&D office. Upon retrieval, volunteers inspect the supplies for holes or damage. Any damaged or misused equipment is noted to the Program Managers and replaced if necessary.

B8. Non-direct Measurements

Not applicable.

SECTION C: System Assessment, Correction and Reporting

C1. System Audits and Response Actions

Volunteer team leaders trained by MiCorps make sure that quality assurance protocols are followed and report any issues possibly affecting data quality. Program Managers accompany groups in the field to perform side-by-side sampling and verify the quality of work by the volunteer team. A performance audit to evaluate how well people are doing their jobs of collecting and analyzing the data is accomplished through side-by-side sampling and identification. During side-by-side sampling a team of volunteers and an outside expert sample the same stream. Agreement in sample composition between the two should be 70% or greater. A system audit is conducted following each spring and fall monitoring event to evaluate the process of the project, including on-site reviews of field sites and facilities where data is processed and analyzed.

If deviation from the QAPP is noted at any point in the sampling or data management process, the affected samples will be flagged and brought to the attention of Program Managers and the team that collected the sample. Re-sampling is conducted as long as the deviation is noted soon after occurrence and volunteers are available. Otherwise, a gap must be left in the monitoring record and the cause noted. All corrective actions is documented and communicated to MiCorps.

Details of the process for assessing data quality are outlined in section A7. Response to quality control problems is also included in section A7.

C2. Data Review, Verification, and Validation

A standardized data-collection form is used to facilitate spot-checking to ensure that forms are completely and correctly filled out. A Program Manager or a single trained volunteer reviews the data forms before they are stored in a computer or file cabinet. After data has been compiled and entered into a computer file, it is verified with raw data from field survey forms. Biological monitoring results are confirmed by identification from trained entomologists. Experts may conduct identification with the aid of dissecting microscopes (with a maximum enlargement of 65x), consultation with dichotomous keys

(Aquatic Insects of Wisconsin, Hilsenhoff and Aquatic Insects of North America, Merritt and Cummins).
Experts who assist in Macroinvertebrate identification quality control include:

1. Elizabeth Coyne, BS in Physical Geography
2. Sarah Janda, BS in Human Geography
3. Geraldine Larson, MS in Fisheries Ecology
4. Luke Langsraff, USFS biologist

C3. Reconciliation with Data Quality Objectives

Data quality objectives are reviewed on an annually to ensure that objectives are being met. Deviations from the data quality objectives are reported to Program Managers and MiCorps for assessment and corrective action. Also, data quality issues are recorded as a separate item in the data base and provided to Program Managers and data users. Response to and reconciliation of problems that occur in data quality are outlined in Section A7.

C4. Reporting

Throughout the duration of this project quality control reports are included with quarterly project reports that are submitted to the Great Lakes Commission and DEQ. After, quality control reports are generated as quality control issues occur and shared with staff and MiCorps. Quality control reports provide information regarding problems or issues arising in quality control of the project. These could include, but are not limited to: deviation from quality control methods outlined in this document relating to field data collection procedures, indoor identification, data input, diversity calculations and statistical analyses. Program staff generates yearly reports sharing results of the program with volunteers, special interest groups, and local municipalities. Data and reports are made available via the RC&D and conservation district's web pages.

APPENDIX 1 – Work Plan

Task 1: Increase citizen awareness and participation (15% of time)
1a. Publish quarterly news articles about monitoring program (ACD, MCCD)
1b. Promote monitoring events on local TV news (ACD, MCCD)
1c. Attend meetings (i.e. local government, service clubs) to promote monitoring program and recruit volunteers (ACD, MCCD)
1d. Create volunteer monitoring brochure (ACD, MCCD)
Products: 8 quarterly news articles, TV news stories, volunteer commitments, and one tri-fold monitoring brochure

Task 2: Train volunteer monitors (20% of time)
2a. Attend a one-day MiCorps training session in the first half of 2007 (ACD, MCCD)
2b. Conduct two volunteer training sessions per year per watershed (ACD, MCCD)
2c. Assemble training materials and curriculum (ACD, MCCD)
Products: Training session handouts, training syllabus, training materials

Task 3: Generate baseline water quality data on two UP watersheds (45% of time)
3a. Develop and submit a quality assurance project plan (ACD, MCCD)
3b. Conduct two monitoring sessions per year per watershed (ACD, MCCD)
3c. Monitor a minimum of three sites per watershed (ACD, MCCD)
3d. Purchase and provide equipment for macroinvertebrate and habitat assessments (ACD, MCCD)
3e. Enter monitoring results into the MiCorps Data Exchange Network (ACD, MCCD)
Products: QAPP, data sheets, inventory of equipment, completed data sheets

Task 4: Make results available to local residents (10% of time)
4a. Create a volunteer monitoring report (ACD, MCCD)
4b. Promote data results in newspaper, television, and websites (ACD, MCCD)
4c. Participate in the annual MiCorps conference (ACD, MCCD)
4d. Host a year end meeting and invite volunteers, local government, sportsmen groups, service clubs, etc. (ACD, MCCD)
Products: data report, newspaper articles, television news stories, two annual meeting notices, agendas, and minutes

Task 5: Administer the grant (5% of time)
5a. Develop and submit quarterly status and financial reports (UPRC&D)
5b. Develop and submit final report (UPRC&D)
5c. Develop release of claims statement (UPRC&D)
5d. Provide hard and electronic copies of products and deliverables (UPRC&D)
Products: 8 quarterly status and financial reports, hard and electronic copies of final report, one release of claims statement, hard and electronic copies of products and deliverables

Task 6: Evaluate the project (5% of time)
6a. Develop and finalize pre-training and post-training surveys (ACD, MCCD)
6b. Complete a side by side evaluation session with MiCorps staff (ACD, MCCD)
Products: pre-training and post-training surveys, MiCorps evaluation

APPENDIX 2 – Timetable

Task Number & Description	2007			2008				2009
	Apr May June	July Aug Sept	Oct Nov Dec	Jan Feb Mar	Apr May June	July Aug Sept	Oct Nov Dec	Jan Feb Mar
Task 1: Increase citizen awareness and participation								
1a. Publish quarterly news articles	X	X	X	X	X	X	X	X
1b. Promote monitoring events on TV news		X	X		X	X	X	
1c. Attend meetings to recruit volunteers	X	X			X	X		
1d. Create volunteer monitoring brochure	X							
Task 2: Train volunteers								
2a. Attend one-day MiCorps training session	X							
2b. Conduct two volunteer training sessions per year per watershed		X		X		X		X
2c. Assemble training materials and curriculum	X		X		X		X	
Task 3: Generate water quality data								
3a. Develop and submit QAPP	X							
3b. Conduct two monitoring sessions per year per watershed			X		X		X	
3c. Monitor a minimum of three sites per watershed			X		X		X	
3d. Purchase and provide equipment	X							
3e. Enter monitoring results into MiCorps Data Exchange Network				X		X		X
Task 4: Make results available								
4a. Create volunteer monitoring report				X		X		X
4b. Promote data results in newspaper, television, and websites				X	X	X	X	X
4c. Participate in the annual MiCorps conference			X				X	
4d. Host year end meeting			X				X	
Task 5: Administer the grant								
5a. Develop and submit quarterly status and financial reports	X	X	X	X	X	X	X	X
5b. Develop and submit final report								X
5c. Develop release of claims statement								X

Task 6: Evaluate the project								
6a. Develop and finalize pre-training and post-training survey			**X**		**X**		**X**	
6b. Complete a side by side evaluation with MiCorps staff			**X**					

APPENDIX 3 – Stream Habitat Assessment

Stream Name:_____

Location:_____ (Circle one: *Upstream* or *Downstream* of road?)

Date:_____ Start Time:_____ (AM/PM)

Monitoring Team:

Name of Person Completing Datasheet: _____

Other Team Members:_____

_____

_____

Location Information:

Major Watershed:_____ HUC Code (if known):_____

County:_____ Township: _____ Sec T R ¼ ¼

Latitude: _____ Longitude: _____

Lat./Long. Coordinate Determination Method (check one):
___ GPS ___ GPS w/ DBR ___ Digital mapping software ___ Topographic map

___ Other (describe _____) Map Scale (if known _____)

Did you assess 300 feet of stream? _____ If not, how much? _____ Why?_____

Stream Name:_____ Location:_____

PHYSICAL HABITAT

BACKGROUND INFORMATION

Storm Event Conditions noted at site?	None	Light	Moderate		Heavy
Days since Rain	≤ 1	2	≥ 3		Unknown
Water Temp./D.O./pH *					
Water Color	Clear	Gray	Brown	Black	Green
Water body Type-upstream	Stream	Lake	Impound		Wetland
Water body Type-downstream	Stream	Lake	Impound		Wetland
Stream Width (ft.)	<10	10-25	25-50		>50
Avg. Stream Depth (ft.)	<1	1-3	>3		Unknown
Water Velocity (ft/s) *					
Stream Flow Type	Dry	Stagnant	L	M	H

PHYSICAL APPEARANCE
(Circle all that apply)

Aquatic Plants	None	Present	Abundant
Floating Algae	None	Present	Abundant
Filamentous Algae	None	Present	Abundant
Bacterial Sheen/Slimes	None	Present	Abundant
Turbidity	None	Present	Abundant
Oil Sheen	None	Present	Abundant
Foam	None	Present	Abundant
Trash	None	Present	Abundant

SUBSTRATE (%)
(add to 100%)

Boulder – 10" diameter	
Cobble/Gravel – 0.08" to 10" diameter	
Sand – coarse grain	
Silt/Detritus/Muck - fine grain/organic matter	
Hardpan/Bedrock – solid clay/rock surface	
Artificial – manmade	
Unknown	

INSTREAM COVER
(circle one)

Undercut Banks	Yes	No
Overhanging Vegetation	Yes	No
Deep Pools	Yes	No
Boulders	Yes	No
Aquatic Plants	Yes	No
Logs or Woody Debris	Yes	No

RIVER MORPHOLOGY

Riffle	Present			Abundant		
Pool	Present			Abundant		
Channel	Natural	Recovering			Maintained	
Designated Drain	?	Y			N	
Highest Water Mark (ft)	?	<1	1-3	3-5	5-10	>10

STREAM CORRIDOR

Riparian Veg Width (feet - Left Bank)	<10	10-30	30-100	>100
Riparian Veg Width (feet - Right Bank)	<10	10-30	30-100	>100
Bank Erosion	0	L	M	H
Streamside Land Cover	Bare	Grass	Shrub	Trees
Stream Canopy %	<25	25-50		>50

Typical Stream Cross Section Sketch

Adjacent Land Uses Seen
(circle all that apply)

	Left	Right
Wetlands	L	R
Shrub or Old Field	L	R
Forest	L	R
Pasture	L	R
Crop Residue	L	R
Row Crop	L	R
Residential Lawns, Parks	L	R
Impervious Surface	L	R
Disturbed Ground	L	R
No Vegetation	L	R

POTENTIAL SOURCES OF STREAM DEGRADATION (Severity: S – slight; M – moderate; H – high) (Indicate all that apply)							
Crop Related Sources	S	M	H	Land Disposal	S	M	H
Grazing Related Sources	S	M	H	On-site Wastewater Systems	S	M	H
Intensive Animal Feeding Operations	S	M	H	Silviculture (Forestry NPS)	S	M	H
Highway/Road/Bridge Maintenance and Runoff (Transportation NPS)	S	M	H	Resource Extraction (Mining NPS)	S	M	H
Channelization	S	M	H	Recreational/Tourism Activities (general)	S	M	H
Dredging	S	M	H	• Golf Courses	S	M	H
Removal of Riparian Vegetation	S	M	H	• Marinas/Recreational Boating (water releases)	S	M	H
Bank and Shoreline Erosion/ Modification/Destruction	S	M	H	• Marinas/Recreational Boating (bank or shoreline erosion)	S	M	H
Flow Regulation/ Modification (Hydrology)	S	M	H	Debris in Water	S	M	H
Upstream Impoundment	S	M	H	Industrial Point Source	S	M	H
Construction: Highway, Road, Bridge, Culvert	S	M	H	Municipal Point Source	S	M	H
Construction: Land Development	S	M	H	Natural Sources	S	M	H
Urban Runoff (Residential/ Urban NPS)	S	M	H	Source(s) Unknown	S	M	H

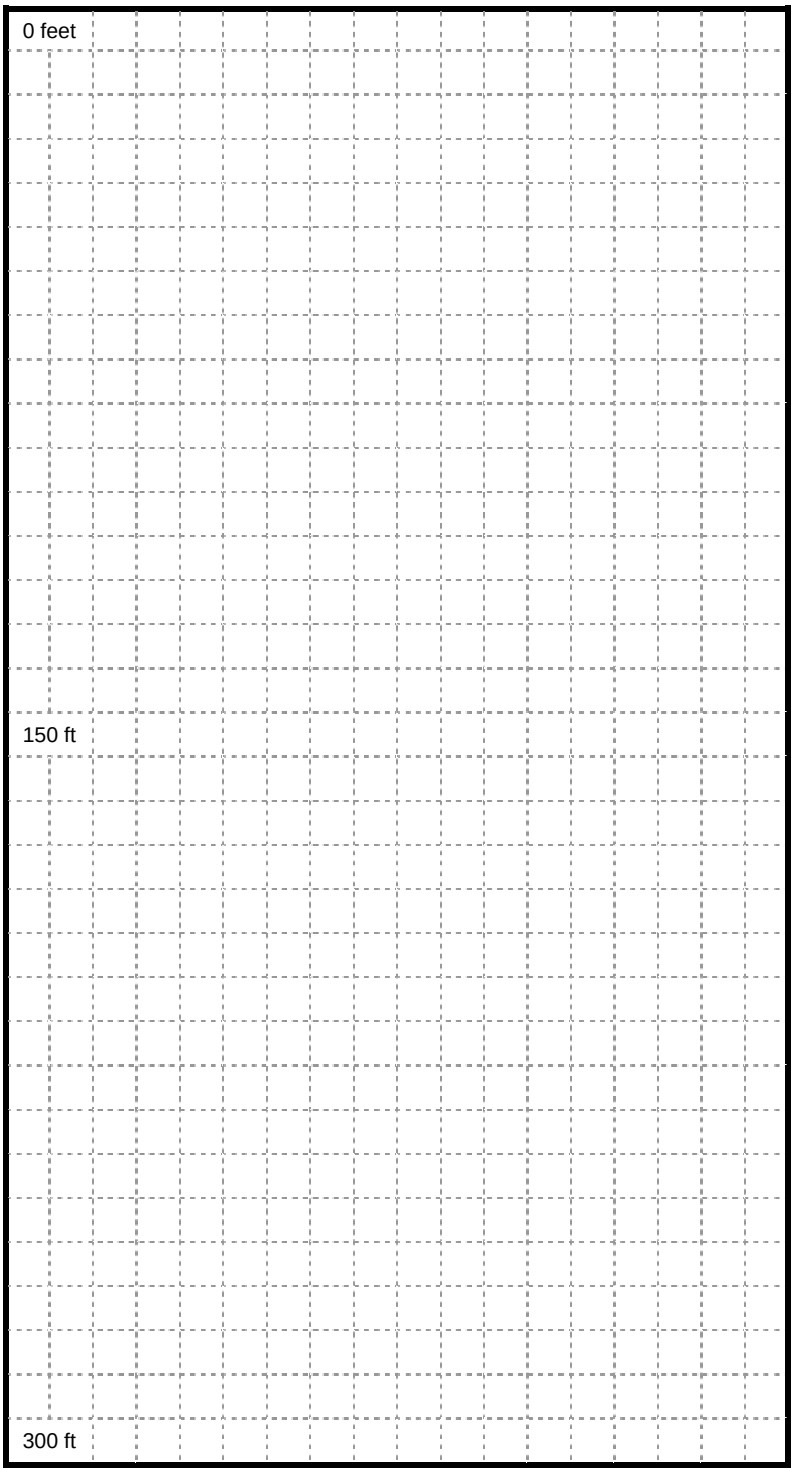
APPENDIX 4 – Site sketch

Stream Name:_____ Location:_____

Date:_____ Drawn by:_____

Draw a bird's-eye view of the study site. Include enough detail that you can easily find the site again! Include the following items in the sketch:

- Direction of water flow
- Which way is north
- Large wood in the water
- Vegetation
- Bank features
- Areas of erosion
- Riffles
- Pools
- Location of road
- Trees
- Fences
- Parking lots
- Buildings
- Any other notable features



APPENDIX 4 – Stream Macroinvertebrate Data Sheet

Stream Name: _____

Location:_____ (Circle one: *Upstream* or *Downstream* of road?)

Date:_____ Collection Start Time:_____ (AM/PM)

Major Watershed:_____ HUC Code (if known):_____

Latitude:_____ Longitude:_____

Monitoring Team:

Name of Person Completing Datasheet:_____

Collector:_____

Other Team Members:_____

Stream Conditions: Average Water Depth:_____ feet

Is the substrate covered with excessive silt? ____ No ____ Yes (describe:_____)

Substrate Embeddedness in Riffles: ____ 0-25% ____ 25-50% _____ > 50% ____ Unsure

Did you observe any fish or wildlife? ( ) Yes ( ) No If so, please describe:_____

Macroinvertebrate Collection: Check the habitats that were sampled. Include as many as possible.

____ Riffles	____ Stream Margins	____ Submerged Wood
____ Cobbles	____ Leaf Packs	____ Other (describe:_____
____ Aquatic Plants	____ Pools	_____)
____ Runs	____ Undercut banks/Overhanging Vegetation	

Did you see, but not collect, any **live crayfish**? (___ Yes ___ No), or **large clams**? (___ Yes ___ No)
remember to include them in the assessment on the other side!

Collection Finish Time: _____(AM/PM)

IDENTIFICATION AND ASSESSMENT

Use letter codes [**R** (rare) = 1-10, **C** (common) = 11 or more] to record the approximate numbers of organisms in each taxa found in the stream reach.

*** Do NOT count empty shells, pupae, or terrestrial macroinvertebrates***

Group 1: Sensitive

____ Caddisfly larvae (Trichoptera)
EXCEPT Net-spinning caddis
____ Hellgrammites (Megaloptera)
____ Mayfly nymphs (Ephemeroptera)
____ Gilled (right-handed) snails (Gastropoda)
____ Stonefly nymphs (Plecoptera)
____ Water penny (Coleoptera)
____ Water snipe fly (Diptera)

Group 2: Somewhat-Sensitive

____ Alderfly larvae (Megaloptera)
____ Beetle adults (Coleoptera)
____ Beetle larvae (Coleoptera)
____ Black fly larvae (Diptera)
____ Clams (Pelecypoda)
____ Crane fly larvae (Diptera)
____ Crayfish (Decapoda)
____ Damselfly nymphs (Odonata)
____ Dragonfly nymphs (Odonata)
____ Net-spinning caddisfly larvae
(Hydropsychidae; Trichoptera)
____ Scuds (Amphipoda)
____ Sowbugs (Isopoda)

Group 3: Tolerant

____ Aquatic worms (Oligochaeta)
____ Leeches (Hirudinea)
____ Midge larvae (Diptera)
____ Pouch snails (Gastropoda)
____ True bugs (Hemiptera)
____ Other true flies (Diptera)

STREAM QUALITY SCORE

Group 1:
____ # of R's * 5.0 = ____
____ # of C's * 5.3 = ____
Group 1 Total = _____

Group 2:
____ # of R's * 3.0 = ____
____ # of C's * 3.2 = ____
Group 2 Total = _____

Group 3:
____ # of R's * 1.1 = ____
____ # of C's * 1.0 = ____
Group 3 Total = _____

Total Stream Quality Score = _____
(Sum of totals for groups 1-3; round to nearest whole number)

Check one:
____ Excellent (>48)
____ Good (34-48)
____ Fair (19-33)
____ Poor (<19)

Identifications made by:_____

Rate your confidence in these identifications: Quite confident 5 4 3 2 1 Not very confident

APPENDIX 5 – Equipment Inventory List

Supplies:	Purchased from:	Date of purchase:	Date of replacement:	Date of use:		
				Fall '07	Spring '08	Fall '08
D-frame nets						
Sorting trays						
Forceps						
Eye droppers						
Preservative						
Jars and lids						
Measuring tape						
Yardstick						
Clipboard						
Pencils						
Waders						

APPENDIX 6: MiCorps Stream Monitoring: Suggested Equipment and Possible Sources

Michigan Clean Water Corps

For Invertebrate Sampling:

Item	Source	Description	Item #	Price	Notes
D-Frame Collection Nets	BioQuip	Aquatic Net 12" D Shape	7412D	$53.80/ea	
		Aquatic Net Bag D-Shape, 12"	7212DD	$12.70 ea.	Nets and frames sold separately
Sorting Trays	Ward's	Tray with Pour Lip	189918	$12.25 ea.	Any shallow white pan will do
Forceps	BioQuip	Featherweight Forceps, narrow tip	4748	$4.45/ea	Flexible forceps won't damage inve
Eye droppers					For catching small invertebrates
Preservative	Carolina Biological Supply	70% ethanol	86-1263	$20.95/4 L	
Jars	Ward's	Plastic Jars, 4 oz., pkg. of 12	181633	$4.20/pkg	Heavy glass sample jars also work
	M. Jacob & Sons	2 oz. Glass Jars, case of 288	321502	$124.54/case	Very reasonable prices
Lids	M. Jacob & Sons	Bakelite Jar Cap w/ Polyseal Liner			Jar caps must have a "poly-seal"-ty prevent evaporation

MiCorps Stream Monitoring: Suggested Equipment and Possible Sources*

For Measuring Habitat:

Item	Source	Description	Item #	Price	Notes
Reel-style measuring tapes	Hardware stores	Fiberglass 100'		Under $20	For measuring width and length
Yardsticks					For measuring depths; Preferably with reinforced ends

General Stream Monitoring Supplies:

Item	Source	Description	Item #	Price	Notes
Waders	Cabela's	Three Forks 420-Denier Featherlight Chest Waders		Under $60	These are rugged yet inexpensive. Lug-sole boots seem to hold up better than felt soles.

Contact List:

Cabela's	www.cabelas.com
BioQuip	www.bioquip.com
Ward's Natural Science	www.wardsci.com
Carolina Biological Supply	www.carolina.com
M. Jacob & Sons	www.mjacobandsons.com

APPENDIX 8: Team Roles

Roles of People on the Team

Team Structure: Each team includes a Collector, a Streamside Leader and generally 1-3 other team members.
1. The **Collector** is the person who has been trained to collect samples with the net from all the different habitats in the creek.
2. The **Streamside Leader** is responsible for recording data on the data sheet and can explain about the monitoring program, and each team member's role in it.
3. The **Manager** is responsible for the equipment.
4. The other team members are "**Pickers**," who sort through the samples, usually sitting on the bank.

Picker:

- New volunteers typically start out as Pickers. This job does not require getting into the stream and is a good way to get introduced to monitoring and the interesting creatures that live in the stream.
- No training is required to be a Picker.
- Pickers are responsible for sorting through the samples collected by the Collector, picking out the macroinvertebrates from the rocks and leaves and putting them in a collection jar.

How to be Successful:

- The challenge is to learn to see small creatures hidden in the debris and clinging to rocks and leaves. Your Leader or Collector will help you learn to have patience until they start to move and to recognize what may be in a clump of pebbles.
- Keeping everything in the jar seems easy, but it will turn over if you put it down.

Assistant:

- On a large site it is helpful to have one team member in waders assisting the Collector by carrying the trays to the team and the empties back to the Collector.
- The only training required to be an Assistant is experience wading in moving water on slippery rocks.

How to be Successful: Keep your footing on the sometimes slippery, uneven bottom while carrying a tray full of water and material to the people on the bank.

Collector:

- Collectors must attend a four-hour training session in order to learn the techniques for sampling in the river.
- The Collector is the only person that enters the water (unless there is an Assistant). They are responsible for sampling all of the habitats, and bring the samples to the rest of the team to sort through.

How to be Successful:

- Do not rely on anyone else to collect.
- Listen to the Leader in order to be thorough.

- Use your net aggressively.
- Be sure someone picks every bug off of the net before leaving the first site.

Streamside Leader:

- The Leader instructs the team and is responsible for filling out the data sheets, labeling the jars, and reminding the Collector which habitats still need to be found.
- Requires a one-hour training, usually offered three weeks before the monitoring day.

How to be Successful:

- Tell people about the study before there is too much to do.
- Show people how a little water can encourage the bugs to move. Encourage them to look long enough find the slow movers and tiny creatures.
- Fill in every blank on the data sheet. Put numbers (not a check) in the boxes for habitat types.

Manager:

- The Manager is a person who is willing to take responsibility for the equipment and will check the list to be sure everything leaves each site with the team and that it all returns to the NEW Center.

How to be Successful:

- Take the manager's sheet with you and use it to check that all the equipment is taken from each site
- Follow the instructions for handling the equipment when you return.