A1. Title and Approval Sheet

Quality Assurance Project Plan for
Alger Waters Stream Team Monitoring Project

Date: 3/2/2022
Version #: 2
Organization: Alger Conservation District

QAPP Prepared by: Matt Watkeys
Title: District Manager

Signature: _____

Other responsible individual: Christy Foye
Title: Conservation Program Coordinator

Signature: _____

Name of MiCorps Reviewer:_____

Signature of Reviewer:_____

Date:_____

Upon signing, this QAPP is approved for 2 years from the date given. After the date given, the QAPP will need to be reapproved.

A2. Table of Contents

SECTION A: PROJECT DESCRIPTION AND QUALITY OBJECTIVES

A3. Distribution List

- Paul Steen, MiCorps Stream Program Manager, Huron River Watershed Council
- Matt Watkeys, Alger Conservation District Manager
- Teri Grout, ACD Executive Director
- Christy Foye, ACD Program Coordinator

A4. Project Organization

Key individuals involved in the project and their responsibilities include:

Management Responsibilities:
1) Matt Watkeys, District Manager, Alger Conservation District, 101 Court Street, Munising, MI, (906) 387-2222, matt.watkeys@macd.org

2) Christy Foye, Program Coordinator, Alger Conservation District, 101 Court Street, Munising, MI, (906) 387-2222, Christy.foye@macd.org

Matt and Christy 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 social media and Conservation District web-pages.
- Provide copies of all products and deliverables in both hard copy and electronic formats.

3) Teri Grout, Executive Director, Alger Conservation District 101 Court St, Munising, MI 49862; (906)387-2222; teri.grout@macd.org

Teri helps Matt and Christy in program management when necessary. Teri'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.

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) Matt Watkeys
2) Christy Foye

Matt and Christy are the primary Program Managers and are 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 enact or enforce 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.

Alger Waters Stream Team Monitoring Project 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 are entered in the MiCorps database and results are distributed at the local and regional level. ACD publicizes 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. Many Alger County residents and landowners are aware of the importance of healthy waters, as indicated by Alger Conservation District's countywide survey conducted in 2011. This survey named water quality as the second most important resource concern second only to invasive species. Respondents to that survey also ranked stream monitoring as an important activity of local conservation districts, and many indicated willingness to volunteer time. In view of that fact, in 2012 Alger Conservation District applied for and received a MiCorps startup grant to explore further the feasibility of establishing a long-term volunteer stream monitoring program in some of the county's key and most threatened watersheds—to provide the education, training and opportunity for stakeholders to put their money where their mouths are, so to speak, and step up to active stewardship of the streams they value.

Although many water bodies in Alger County are not highly degraded and many enjoy protected status, streams in several populated areas of the county have been affected by human activities such as agriculture, road motorized recreation, commercial use and industrial ventures, and the introduction of invasive species. Historical laissez-faire attitudes toward a seemingly endless water resource have created both real problems and potential threats in these areas. These hotspots of potential contamination threaten not only the immediate area, but protected areas downstream, and it is important to monitor them to detect incipient or ongoing problems and to prioritize restorations.

A6. Project Description

The overall goal of the volunteer monitoring program is to protect and improve the water quality in the streams of Alger County.

The goals of the Alger Waters Stream Team Monitoring Project are as follows:

1. Educate residents about threats to our waters. 'Non-point source pollution' should be in everyone's vocabulary.
2. Recruit residents, and new partners into a cohesive effort to identify threats to and monitor the health of our streams.
3. Acquire useful data through a series of spring and fall volunteer monitoring events in key watersheds and to make that data available to local governments and stakeholders, as well as incorporate it into the Alger Conservation District's own larger watershed protection and prioritization effort.
4. Ensure that the monitoring program is sustainable after the course of this MiCorps grant by providing adequate training, oversight, and motivation to volunteers and seeking new partnerships and funding.

To accomplish these goals, the Alger Waters Stream Team Monitoring Project utilizes the Michigan Clean Water Corps (MiCorps) Volunteer Stream Monitoring Procedures (Steen, Latimore 2020), https://micorps.net/wp-content/uploads/2021/01/VSMP-MonitoringProcedures.pdf. 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 conservation district into the future.

The first goal of the Volunteer Stream Monitoring Program is to foster public awareness, stewardship and surveillance of Alger County surface waters and increase citizen participation in these efforts. The program recruits and trains a minimum of eight volunteer monitors. Program staff and volunteers attend meetings of local governments and service clubs to promote the program and recruit volunteers. Promotional work focuses on securing the sustainability of volunteer stream monitoring. 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. The quality-assured data may be used by EGLE 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 stream, monitoring a minimum of two 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.

Streams are sampled annually in the spring (mid-May to early June, preferably before leaf out) and fall (late 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 two-week 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 a hybrid order/family identification system created by MiCorps 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, social and electronic media, and local broadcast news.

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. Since there is inherent variability in accessing the less common taxa in any stream site and program resources do not allow program managers to perform independent (duplicate) collections of the sampling sites, our goal for quality assurance is conservative. A given site's Stream Quality Index (SQI) score or total diversity (D) measure across macroinvertebrate taxa will be noted as "preliminary" until three spring sampling events and three fall sampling events have been completed. At least two of these six measures will be collected by different volunteer teams. The

resulting measures of D and SQI for each site will be compared to the composite (median) results and each should be within two standard deviations of the median.
If a group fails to meet the criteria above, program leaders will conduct side by side monitoring, described below:

To improve precision and accuracy, if necessary, 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) may also perform an independent collection (duplicate sample) no less than a week after the team's original collection and no more than two weeks later.

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)
- 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 family level aquatic macroinvertebrate identification or better are reviewed by the Program Experts. At least 10% of the samples processed by experts in question are reviewed to verify results. If more than 40% of specimens were misidentified, then Program Managers review all the samples processed by that expert.

MiCorps staff conducts a method validation review with the program leaders to ensure their expertise, preferably prior to the first training session. This review consists of

supervising the program leader's macroinvertebrate sampling and sorting methodology to ensure that they are consistent with MiCorps protocol.

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 90%. 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 a virtual training in June of 2021 and will attend refresher trainings at least every three years as scheduled by MiCorps staff.

Program Managers will have a side-by-side field training session with MiCorps staff prior to the first volunteer training and sampling event. The Program Managers then train volunteer Team Leaders in a one-day training session before their first fall or spring monitoring event. Team Leaders are required to attend re-training at least once every three years. The first part of the training 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 ACD office. Original field data sheets are filed at the ACD office. All electronic data are backed up regularly, and 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 EGLE 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 hydroloy (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 if feasible.

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.

The Alger Waters Stream Team Project will focus on five watersheds that span a wide range of potential trouble spots across our rather large county. Two sites will be selected from each of four watersheds (Anna River, Werner Creek, the west branch of the Whitefish River, and the Sucker River) plus four from Slapneck Creek, for a total of twelve sites.

1. The Anna River is located entirely within Alger County (T46N-R19W), and it drains into Lake Superior at Munising Bay and the city of Munising. Paper mills, historical logging operations, railroad grades both active and abandoned, poorly-maintained gravel roads, and urban runoff have all contributed over the years to sediment pollution and other forms of contamination. In recent years, a city of Munising infrastructure replacement project has reduced new sediment load in some areas by repairing damaged curbs, but much of the old sediment still sits in the streambed, and runoff from other sections such as Cemetery Hill still contributes a large amount of sediment. Some monitoring was performed under a 2008 grant to UPRC&D, and that data will be compared to new data collected.

2. Slapneck Creek (T46N-R21 and 22W) is located entirely within Alger County. It flows into the Au Train Basin, a hydro dam impoundment which drains via the Au Train River into Lake Superior. Slapneck Creek flows within a quarter mile of a former sawmill which the County Brownfield Authority has targeted for environmental assessment pending funding. Both are also adjacent to and/or downstream of agricultural operations and are crossed by State Highway M-94, snowmobile trails, and an abandoned railroad grade. All of these factors contribute to a potential for chemical and sediment contamination of the nearby surface waters. In addition to two sites which had been monitored since the inception of Alger CD’s program in 2011, two more sites were added in 2020 to acquire baseline preconstruction data for a culvert replacement which was completed in summer 2021. Subsequent data will demonstrate stream health improvements stemming from this restoration.

3. Baker Creek, a tributary of the Sucker River (T49N R13W) is also entirely within Alger County. The sites being monitored are upstream and downstream of a perched culvert with severely erosive slopes. This culvert was replaced in the summer of 2021, and subsequent monitoring will be used to quantify stream health improvements resulting from this restoration.

4. The west branch of the Whitefish River at King Road lies in southwest Alger County (T45N R22W sec 29). Rain events had caused large amounts of sediment from the gravel roadway to wash over the bridge, through the bridge

drainage gaps, and into the river. The sediment load was estimated to be at least 20 tons annually, and the effects on the river during and after rain events have negatively impacted fish populations throughout the entire river. The culvert was replaced in summer 2021. Preconstruction monitoring was conducted in 2020 and 2021 to establish baseline macro data, and it is anticipated that subsequent monitoring will demonstrate stream health improvement.

5. Werner Creek (T45N-R22W) is a tributary of the West Branch of the Whitefish River, whose headwaters originate in Alger & Marquette Counties and flow south to Lake Michigan through Delta County. Werner Creek occupies the farthest southwest corner of Alger County, which has historically had a larger agricultural footprint than the northern and eastern sections of the county. This area has non-point source issues stemming from inadequately maintained gravel roads and bridges as well as potential contamination from agricultural operations.

Frequency and timing: Macroinvertebrate communities are sampled annually in the spring (mid-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 two-week 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 three or 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 35-45 minutes while those on large streams will be sampled for at least one hour. 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 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.

Either only one site is sampled in one day and all of the equipment is air dried for at least one month to ensure that any invasive species is dead prior to reuse, or, if more than one crew is out in the same day, the second crew will sample a separate site with completely separate equipment. If needed, decontamination kits are also available, received through the Lake 2 Lake CISMA office in Marquette.

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 if requested by MiCorps.

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 ACD 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 ACD 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 (e.g. 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 Water Quality Rating, 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

Program leaders make sure that quality assurance protocols are followed and report any issues possibly affecting data quality. Program Managers periodically accompany groups in the field to perform side-by-side sampling and verify the quality of work by the volunteer team 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 60% or greater (i.e., 40% discrepancy). 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 (e.g. Aquatic Insects of Wisconsin by Hilsenhoff and Aquatic Insects of North America, Merritt and Cummins).

Experts who assist in Macroinvertebrate identification quality control include:

1. Matt Watkeys, BS in Professional Forestry, AS in Ag. And Natural Resources
2. Geoff Smith, BS in Fisheries Science and Environmental Science; Aquatics Specialist (retired), Voyageurs National Park.
3. Rob Wiener, Natural Resource Educator, Michigan State University Extension, Munising

C3. Reconciliation with Data Quality Objectives

Data quality objectives are reviewed 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 database 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 MiCorps, when under an active grant. Data is submitted to the MiCorps data exchange for public sharing and use by EGLE. 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 conservation district's web pages.

APPENDIX 1 – Work Plan

Task 1: <u>Increase citizen awareness and participation</u> (15% of time)
1a. Publish quarterly news articles about monitoring program
1b. Promote monitoring events on local TV news (DM, PC)
1c. Attend meetings (i.e. local government, service clubs) to promote monitoring program and recruit volunteers (DM, PC)
1d. Create volunteer monitoring brochure (PC, DM)
Products: Print news articles, TV news stories, volunteer commitments, and electronic/social media outreach.

Task 2: <u>Train volunteer monitors</u> (20% of time)
2a. Attend a one-day MiCorps training session in the first half of 2022 (PC)
2b. Conduct two volunteer training sessions per year per watershed (PC)
2c. Assemble training materials and curriculum (PC)
Products: Training session handouts, training syllabus, training materials

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

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

Task 5: <u>Administer the grant</u> (5% of time)
5a. Develop and submit quarterly status and financial reports (DM, ED)
5b. Develop and submit final report (ED, DM, PC)
5c. Develop release of claims statement (ED)
5d. Provide hard and electronic copies of products and deliverables (ED)
Products: Quarterly status and financial reports, hard and electronic copies of final report, release of claims statement, hard and electronic copies of products and deliverables

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

PC= Program Coordinator
ED= Executive Director
DM= District Manager

APPENDIX 2 – Timetable

Task Number & Description	2022			2023				2024
	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	X		
1d. Create/update volunteer monitoring brochure		x			x			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
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		x		x		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 HABITAT ASSESSMENT

Michigan Clean Water Corps

Volunteer Stream Monitoring Program

I. Stream, Team, Location Information

Site ID:_____ Date:_____ Time:_____

Site Name:_____ Lat/Long _____

Names of Team members:_____

II. Stream and Riparian Habitat

	A. General Information *Circle one or more answers as appropriate*					Notes and Observations: Give further explanation when needed.
1	Average Stream Width (ft)	< 10	10-25	25-50	>50	
2	Average Stream Depth (ft)	<1	1-3	>3	>5	
3	Has this stream been channelized? (Stream shape constrained through human activity- look for signs of dredging, armored banks, straightened channels)	Yes, currently	Yes, sometime in the past	No	Don't know	
4	Estimate of current stream flow	Dry or Intermittent	Stagnant	Low	Medium	High
5	Highest water mark (in feet above the current level)	<1	1-3	3-5	5-10	>10
6	Which of these habitat types are present?	Riffles	Pools	Large woody debris	Large rocks	Undercut bank
		Overhanging vegetation	Rooted Aquatic Plants	Other:	Other:	Other:
7	Estimate of turbidity	Clear	Slightly Turbid (can partially see to bottom)		Turbid (cannot see to bottom)	
8	Is there a sheen or oil slick visible on the surface of the water?	No	Yes			
9	If yes to #8, does the sheen break up into pieceswhen poked with a stick?	Yes (sheen is most likely natural)		No (sheen could be artifical)		
10	Is there foam present on the surface of the water?	No	Yes			
11	Does the foam smell soapy and look white and pillow like or look gritty with dirt mixed in?	Soapy (foam could be artifical)		Gritty (foam is most likely natural)		
The following are optional measurements not currently funded by MiCorps						
8	Water Temperature					
9	Dissolved Oxygen					
10	pH					
11	Water Velocity					

MiCorps Site ID#:_____ Date:_____

II. Stream and Riparian Habitat (continued)

B. Streambed Substrate

Estimate percent of stream bed composed of the following substrate.

Leave blank if group will take transects and pebble counts (in Section IV).

Substrate type	*Size*	*Percentage*
Boulder	>10" diameter	
Cobble	2.5 - 10" diameter	
Gravel	0.1 - 2.5" diameter	
Sand	coarse grain	
Silt/Detritus/Muck	fine grain/organic matter	
Hardpan/Bedrock	solid clay/rock surface	
Artificial	man-made	
Other (specify)		
Can't see		

You may wish to take photos of unstable or eroded banks for your records. Record date and location.

Comments:

C. Bank stability and erosion.

Summarize the extent of erosion along each bank separately on a scale of 1 through 10, by circling a value below. Left/right banks are identified by looking downstream.

Excellent	Good	Marginal	Poor
Banks Stable. No evidence of erosion or bank failure. Little potential for problems during floods. < 5% of bank affected.	Moderately stable. Small areas of erosion. Slight potential for problems in extreme floods. 5-30% of bank in reach has areas of erosion.	Moderately unstable. Erosional areas occur frequently and are somewhat large. High erosion potential during floods. 30-60% of banks in reach are eroded.	Unstable. Many eroded areas. > 60% banks eroded. Raw areas frequent along straight sections and bends. Bank sloughing obvious.
LEFT BANK 10 - 9	LEFT BANK 8 - 7 - 6	LEFT BANK 5 - 4 - 3	LEFT BANK 2 - 1 - 0
RIGHT BANK 10 - 9	RIGHT BANK 8 - 7 - 6	RIGHT BANK 5 - 4 - 3	RIGHT BANK 2 - 1 - 0

MiCorps Site ID#:_____ Date:_____

II. Stream and Riparian Habitat (continued)

D. Plant Community

What percentage of the stream is covered by overhanging vegetation/tree canopy?

<10% 10-50% 50-90% >90%

Using the given scale, estimate the relative abundance of the following:

Plants in the stream:		*Plants on the bank/riparian zone:*	
Algae on Surfaces of Rocks or Plants, or floating	Filamentous Algae (Streamers)	Shrubs	Trees
Macrophytes (Standing Plants)	**0= Absent 1= Rare 2= Common 3= Abundant**	Herbaceous plants	**0= Absent 1= Rare 2= Common 3= Abundant**
Identified species (optional)		Identified species (optional)	

E. Riparian Zone

The riparian zone is the vegetated area that surrounds the stream. Right/Left banks are identified by looking downstream.

1. Left Bank

Circle those land-use types that you can see from this stream reach.

Wetlands Forest Mowed Grass Park Shrubby/Grassy Field Agriculture
Construction Commercial Industrial Highways Golf Course Other_____

2. Right Bank

Circle those land-use types that you can see from this stream reach.

Wetlands Forest Mowed Grass Park Shrubby/Grassy Field Agriculture
Construction Commercial Industrial Highways Golf Course Other_____

3. Summarize the size and quality of the riparian zone along each bank separately on a scale of 1 through 10, by circling a value below.

Excellent	Good	Marginal	Poor
Width of riparian zone >150 feet, dominated by vegetation, including trees, understory shrubs, or non-woody macrophytes or wetlands; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	Width of riparian zone 75-150 feet; human activities have impacted zone only minimally.	Width of riparian zone 10-75 feet; human activities have impacted zone a great deal.	Width of riparian zone ,10 feet; little or no riparian vegetation due to human activities.
LEFT BANK 10 - 9	LEFT BANK 8 - 7 - 6	LEFT BANK 5 - 4 - 3	LEFT BANK 2 - 1 - 0
RIGHT BANK 10 - 9	RIGHT BANK 8 - 7 - 6	RIGHT BANK 5 - 4 - 3	RIGHT BANK 2 - 1 - 0

MiCorps Site ID#:_____ Date:_____

III. Sources of Degradation

1. Does a team need to come out and collect trash?

2. Based on **what you can see** from this location, what are potential causes and level of severity of any degradation at this stream?

(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)	S	M	H
Highway/Road/Bridge Maintenance and Runoff	S	M	H	Resource Extraction (Mining)	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
Invasive Species	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	S	M	H	Source(s) Unknown	S	M	H

Additional comments:

Michigan Clean Water Corps

MiCorps Site ID#:_____ Date:_____

IV. Optional quantitative measurements

A. Transects and Pebble Counts

To take quantitative stream habitat measurements, conduct 10 transects of your stream reach. Required equipment: tape measure long enough to stretch across the stream, and graduated rod or stick to measure water depth. Data sheet is on the next page.

Directions:
1) Determine stream width.
2) Use the rod to measure depth (D) and substrate (S) at more than 10 but less than 20 regular intervals along the entire transect. (For streams less than 10 feet wide, measure every ½ foot, for streams about 10 feet wide, measure every foot, etc.)
3) At every depth measurement, identify the single piece of substrate that the rod lands on. If it is a mix of substrates, randomly pick one of them, and the next time you find a similar grouping, pick the other(s).
4). For every measurement, enter the reading on the tape measure, the depth, and the substrate on the data sheet on the next page.

Data use: The depth and tape measure reading can be used to produce stream cross-section profiles. The pebble count can be used to give a more accurate percentage breakdown of the stream substrate than simply making an eyeball estimate (see Section II-B).

B. Bank Height

Vertical banks higher than 3 feet are usually unstable, while banks less than 1 foot, especially with overhang, provide good habitat for fish. While doing the transects, measure bank heights and record the angle of the bank (right, acute, or obtuse) as indicated on the data sheet. Left/right banks are identified by looking downstream.

Data use: Calculate the percentage of banks with right, obtuse, and acute angles. Right angles indicate higher erosive potential, while acute angles improve the habitat structure of a stream.

V. Final Check

This data sheet was checked for completeness by: _____

Name of person who entered data into data exchange: _____

Date of data entry:_____

VI. Credits

This habitat assessment was created for the MiCorps Volunteer Stream Monitoring Program from a combination of habitat assessments from the Huron River Watershed Council, the Friends of the Rouge River, and the Michigan Department of Environmental Quality. Version 1.0, June 2009. Version 2.0, November 2020.

MiCorps Site ID#:_____ Date:_____

Michigan Clean Water Corps

STREAM TRANSECT DATASHEET

B: Boulder -- more than 10"
C: Cobble -- 2.5 - 10"
G: Gravel – 0.1 – 2.5"
S: Sand -- fine particles, gritty

F: Fines: Silt/Detritus/Muck
H: Hardpan/Bedrock
A: Artificial
O: Other (specify)

T= Reading on tape
D = Depth
S = Substrate

	EXAMPLE			Transect #			Transect #			Transect#		
Stream Width	13.3 feet											
	T	D	S	T	D	S	T	D	S	T	D	S
Beginning Water's Edge:	1.5											
1	2.5	0.4	G									
2	3.5	0.4	G									
3	4.5	0.4	G									
4	5.5	0.2	C									
5	6.5	0	S									
6	7.5	0.6	S									
7	8.5	0.7	G									
8	9.5	0.7	G									
9	10.5	0.6	C									
10	11.5	0.7	B									
11	12.5	0.4	G									
12	13.5	0.3	F									
13	14.5	0.2	F									
14												
15												
16												
17												
18												
19												
Ending Water's Edge	14.8											
Bank Side	L	R		L	R		L	R		L	R	
Bank Height	1.7 feet	0.5 feet										
Does the bank have an undercut?	N	Y										
If so, how wide is it?		1 ft										
Bank Angles: Sketch												

Sketch examples:

Undercut (Acute) Obtuse Right

APPENDIX 4 – Site sketch

MiCorps Site ID#:_____

Michigan Clean Water Corps

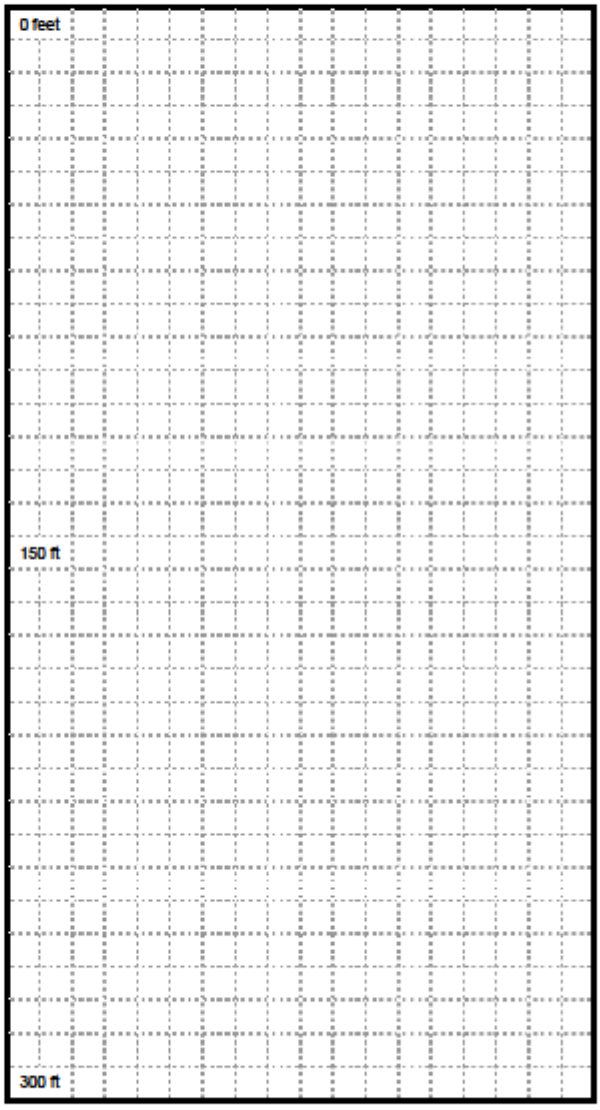
Site Sketch

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



Datasheet version 6/22/05

APPENDIX 5 – Stream Macroinvertebrate Data Sheet

MiCorps Site ID #: _____

Site Name: _____

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

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

Latitude: _____ Longitude: _____

Names of Team members: _

Stream Conditions:

Average water depth: _____ feet

Notable weather conditions of the last week: _____

Are there any current site conditions that may impede normal macroinvertebrate sampling? (weather, flooding, poor visibility, etc?)

Habitat Types: Check the habitats that were sampled. Include as many as possible.

____Riffles ____Backwater areas ____Submerged Wood
____Rocks ____Leaf Packs
_____Aquatic Plants _____Pools _____Runs _____Undercut banks/Overhanging Vegetation

Did you see any crayfish? #:_____, Clams/mussels? #_____
remember to include them in the assessment on the other side!

Do not take crayfish, fish, clams, and mussels from the water.

Collection Finish Time: _____ (AM/PM) Picking Finish Time:_____(AM/PM)

Identifications made/supervised by:_____

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

Datasheet checked for completeness by:_____ Datasheet version 11/13/2020
Data entered into MiCorps database by:_____ Date:_____

MiCorps Site ID #: _____

IDENTIFICATION AND ASSESSMENT

*** Do NOT count empty shells, pupae, or terrestrial macroinvertebrates***
Taxa are listed from most pollution sensitive to most pollution tolerant

Count	Common Name	Scientific Taxa	Sensitivity Rating (0-10)	Count x Sensitivity
	Hellgrammite (Dobsonfly)	Megaloptera, Corydalidae	0.0	
	Clubtail Dragonfly	Odonata, Gomphidae	1.0	
	Sensitive True Flies (water snipe fly,netwinged midge, dixid midge)	Athericidae, Blephariceridae, Dixidae,	1.0	
	Stonefly	Plecoptera	1.3	
	Caddisfly	Trichoptera	3.2	
	Mayfly	Ephemeroptera	3.5	
	Alderfly	Megaloptera, Sialidae	4.0	
	Scud	Amphipoda	4.0	
	Dragonfly	Odonata	4.0	
	Beetle	Coleoptera	5.1	
	Somewhat Sensitive True Flies	Dipterans (those not listed elsewhere)	6.0	
	Crayfish	Decapoda	6.0	
	Bivalves/Snails	Pelecypoda, Gastropoda	6.9	
	True Bug	Hemiptera	7.7	
	Damselfly	Odonata	7.7	
	Sowbug	Isopoda	8.0	
	Tolerant True Fly (mosquito, rat-tailed maggot, soldier fly)	Culicidae, Syrphidae, Stratiomyidae	8.7	
	Leech	Hirudinae	10.0	
	Aquatic Worm	Oligochaeta	10.0	

First: If your total abundance is
Less than 30 ❼ Automatically give it a WQR of 10 (Very Poor rating)
Less than 60 ❼ Automatically give it a WQR of 7 (Poor rating)

Water Quality Rating =

Sum of (Count x Sensitivity) Divided By Total Abundance

= _____

	Total Abundance

Sum of (Count x Sensitivity):	

Datasheet checked for completeness by:_____ Datasheet version 11/13/2020

Data entered into MiCorps database by:_____ Date:_____

Water Quality Rating			Degree of Organic Pollution
0.0-3.50	excellent		Pollution unlikely
3.51-4.50	very good		Slight pollution possible
4.51-5.50	good		Some pollution possible
5.51-6.50	fair		Fairly substantial pollution likely
6.51-7.50	fairly poor		Substantial pollution likely
7.51-8.50	poor		Very substantial pollution likely
8.51-10.0	very poor		Severe pollution likely

APPENDIX 6 – Equipment Inventory List

Supplies:	**Purchased from:**	**Date of purchase:**	**Date of replacement:**	**Dates of use:**								
				2013 SP/F	2014SP/F	2015 SP/F	2016 SP/F	2017 SP/F	2018 SP/F	2019 SP/F	2020 SP/F	2021 SP/F
D-frame nets	Forestry Suppliers	June 2013	N/A	X	X	X	X	X	X	X	X	X
Sorting trays	Carolina Scientific	June 2013	June 2016	X	X	X	X	X	X	X	X	X
Forceps	BioQuip	June 2013	N/A	X	X	X	X	X	X	X	X	X
Eye droppers	BioQuip	June 2013	N/A	X	X	X	X	X	X	X	X	X
Preservative	Madigan's Ace	June 2013	June 2020	X	X	X	X	X	X	X	X	X
Jars and lids	Carolina Scientific	June 2013	June 2021	X	X	X	X	X	X	X	X	X
Measuring tape	Madigan's Ace	June 2013	N/A	X	X	X	X	X	X	X	X	X
Yardstick	Madigan's Ace	June 2013	N/A	X	X	X	X	X	X	X	X	X
Clipboard	Madigan's Ace	June 2013	September 2018	X	X	X	X	X	X	X	X	X
Pencils	Madigan's Ace	June 2013	As needed	X	X	X	X	X	X	X	X	X
Waders	Forestry Suppliers	June 2013	N/A	X	X	X	X	X	X	X	X	X

APPENDIX 7: MiCorps Stream Monitoring: Suggested Equipment and Possible Sources

Michigan Clean Water Corps

For each monitoring team, you will want the following gear.

ITEM	PRICE (2020)	SOURCE	NOTES
Five-gallon bucket	$5-10	Hardware stores	To store your gear, and also makes for decent stools. A bucket is convenient, but other storage systems of your choice can work just as well.
D-Frame Collection Net	$134.57	https://bioquipinc.com/	Expensive, but can last many, many years.
Waders	$50-$100	Amazon or sporting goods stores	Get a variety of sizes. The Cabela's Three Fork Lug Sole Chest Waders are a classic choice that can last 10+ years with proper care, but you can find cheaper alternatives nowadays.
Sorting Tray Option 1 (Standard White Tray)	$25.95	https://www.wardsci.com/store/, Tray with Pour Lip	This is the classic macroinvertebrate sorting tray option but not cheap. Buy 3-4 per team.
Sorting Tray Option 2 (Refrigerator Tray)	$20-$30	Stores that sell refrigerators. (These are the trays that go under a fridge or freezer in case of leakage).	This is a cheaper alternative option that works well; a really big white tray that takes up considerable room in a vehicle and in storage but is easy to find bugs on. Buy 2 per team.
Featherweight Forceps	$6.25	https://bioquipinc.com/	These lightweight forceps won't cut your specimens in half. Buy 4 per team.
Eye Droppers	$3.99 for 20	Amazon, Rienar White 3 ML Plastic Eye Dropper	Get plastic eyedroppers so you can cut off the tips to make the openings wide enough to capture small insect

Specimen Jars	~$0.75 each, purchasing a case (288 jars) may be required	www.mjspackaging.com, 2 oz. flint glass AC jar, 38-400	2 oz jars; glass or plastic, but they need to have airtight seals. The linked jars are expensive but high quality; alternatives are welcome at your discretion.
Lids for the Jars	~0.31 each	www.mjspackaging.com, 38400 black Phenolic closure with polyseal cone liner	These poly-seal lids fit the recommended jars above.
Ice Cube Trays	$5-10	Amazon or most general merchandise stores	Optional. Useful if the volunteers want to sort their macros on site.
Reusable water bottles	$2-10	Everywhere; ask for donations from volunteers	Optional. Have some river water in a bottle is useful for wetting the samples, washing debris from the bottom of your next, and getting
			macros to swim & be more visible. Use a plastic, squeezable bottle that can expel water with some force (like a bike water bottle).
Tarps/plastic sheeting	$20	Hardware stores.	Optional. A tarp is something for the volunteers to sit on instead of the wet ground. Buy a roll of plastic sheeting from a hardware store and cut it into usable pieces. Spray, dry and refold it after every event.
Garbage Bags	$10-20	Hardware and general merchandise stores.	Optional. For small scale trash that your volunteers will find while doing their monitoring work.
1 Decontamination Kit (see below)			Required. Clean your gear before you go to any other location to prevent spread of nonnative species.

DECONTAMINATION KIT CONTENTS (See: https://www.hrwc.org/volunteer/decontaminate/ for instructions and full list of gear. The below equipment makes up the barebones required elements)

ITEM	PRICE (2020)	SOURCE	NOTES

ITEM	PRICE (2020)	SOURCE	NOTES
Ethanol (preservative)	$38/gallon.	Amazon	Many scientific supply companies' sell ethanol; currently Amazon seems to sell it for the cheapest because of the free

Three to fivegallon bucket	$5-10	Any hardware store	Contains your decontamination gear.
Lint Roller	$2-4	Amazon and general merchandise stores	
Spray bottle for diluted bleach (8 oz or larger)	$1-5	Amazon and general merchandise stores	
Spray bottle for tap water (16 oz or larger)	$1-5	Amazon and general merchandise stores	
Soft-bristled scrub brush	$4-6	Amazon and general merchandise stores	
Hoof pick	$5-10	Amazon and farming stores	

OTHER GEAR TO HAVE HANDY:

			shipping. Use 70% ethanol as an insect preservative. You can buy higher strength and dilute it down.
Spare net bags	$41.66	Bioquip.com	Your net pole will last for decades; your net bags will last 5-10 years. These are replacements.
Reel-style measuring tapes	$20	Hardware store	Optional. Useful in MiCorps habitat studies.
Yardsticks	$10-20	Hardware store	Optional. Useful as a depth measurement.
Bleach		General merchandise store	Replace it every year as bleach goes bad. Used in the decontamination kits.

MACROINVERTEBRATE BIBLIOGRAPHY (sorted from least to most technical):

ITEM	SOURCE
Voshell, J.R. Jr. 2002. A guide to common freshwater invertebrates of North America. McDonald & Woodward, Blacksburg, VA. 442 pp.	Widely available.
Bouchard, R.W., Jr. 2004. Guide to Aquatic Invertebrates of the Upper Midwest: Identification Manual for Students, Citizen Monitors, and Aquatic Resource	https://midge.cfans.umn.edu/midwestguide

Professionals. University of Minnesota.	
Hilsenhoff, W.L. 1995. Aquatic insects of Wisconsin: Keys to Wisconsin genera and notes on biology, habitat, distribution and species. Publication #3 of the Natural History Museums Council, University of Wisconsin-Madison. 79 pp.	An older key that was once the go to, it is becoming increasingly harder to find. As of now, available on amazon.com.
Merritt, R.W., Cummins, K.W. An Introduction to the Aquatic Insects of North America. 5th ed. (highly technical)	Widely available.

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.

Site Name	Site Number	Latitude	Longitude	Road Crossings	Monitoring Dates
W Branch Whitefish River	1	46.26339	-87.09290	King Road	2020, 2021
W Branch Whitefish River	2	46.26339	-87.09290	King Road	2020, 2021
Anna Creek	3	46.379111	-86.712203	Perch Lake Rd	2013-2021
Anna Creek	4	46.379111	-86.712203	Perch Lake Rd	2013-2021
Slapneck Creek	5	46.343205	-86.887201	Samuelson Rd	2013-2021
Slapneck Creek	6	46.365553	-86.960297	Akkala Rd	2013-2021
Baker Creek	7	46.635507	-85.954271	Airport Rd	2013-2021
Baker Creek	8	46.635507	-85.954271	Airport Rd	2013-2021
Werner Creek	9	46.166687	-87.067334	Thorton Rd (Cr 201)	2013-2021
Werner Creek	10	46.166687	-87.067334	Thorton Rd (Cr 201)	2013-2021
Slapneck Creek	11	46.362053	-87.01765	Kolpack Road	2020, 2021
Slapneck Creek	12	46.362053	-87.01765	Kolpack Road	2020, 2021