Michigan Trout Unlimited *River Keepers Program* Volunteer Manual

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Chapter 1 – *River Keepers Program* Overview

1.1 Scope of this Manual

This manual contains methods and tools for volunteer monitoring of water temperature, in-stream habitat characteristics, aquatic macroinvertebrate based water quality indices, in-stream flow, and fisheries populations. Some of the methods and training techniques are specific to Michigan; in these instances chapters outside of Michigan should consult with their local agency biologists about modifying methods to meet their needs. This manual is intended for use by Trout Unlimited (TU) chapters across the country, although it was written specifically for Michigan and includes examples and methods specific to Michigan.

The methods included in this manual are standard to governmental agencies in Michigan. For most types of data the methods presented should work across the country. Methods for water temperature, in-stream flow, and in-stream habitat are standard and should work throughout the nation with little modification unless otherwise noted. However, methods for sampling macroinvertebrates and fisheries survey techniques are specific to those required by the Michigan Departments of Natural Resources and Environment (MI DNRE). Chapters outside of Michigan interested in monitoring macroinvertebrates and/or fish should contact local agencies to determine what methods are standard for stream monitoring in their area.

It is a good idea to contact local agencies and fisheries biologists early on in the planning process regardless of which variables you are monitoring. Maintaining a good relationship and open communication with agency staff is very beneficial. It will make setting up most aspects of a volunteer stream monitoring program easier. In addition, in most cases, one of the goals of stream monitoring is to provide data to state and/or federal agencies. Communication about how they would like the data collected and delivered is critical to ensuring that the data will get used in future fisheries and habitat management decisions.

1.2 Stream Monitoring, A New Opportunity for TU Volunteers

One of the important identities of TU is the hands-on stream restoration that its members achieve through volunteer efforts. Through the past decades this has been a hallmark of TU, incredibly beneficial to our rivers and streams, and has provided a critical means for TU volunteers to directly contribute to our mission in a meaningful and valuable manner. In many parts of the country, this hands-on stream restoration work is still the foundation of TU work. Michigan Trout Unlimited (MITU) is fortunate to have a wealth of highly productive partners in conservation and in particular, stream restoration. Many of our watershed councils and conservation districts (and the RC&D's) possess a high level of capacity, have many fulltime technical staff, and are very productive in performing stream restoration projects. We are fortunate for this, as performing stream restoration projects in Michigan has become administratively demanding (engineering design requirements, grant subcontracting, etc.), at least for a volunteer-based organization such as TU. Hands-on volunteer involvement is not always needed for these projects. Fortunately, volunteer stream monitoring offers TU members an ideal opportunity to contribute in a hands-on manner while capitalizing on the greatest strength of TU, its large number of members who are knowledgeable about specific trout streams. The volunteer stream monitoring program also comes at a time when governmental agencies need this type of assistance more than at any other time in history. MITU's large number of members and wide distribution across Michigan provide MITU with a unique opportunity to conduct widespread stream monitoring. Monitoring coldwater streams across the state will provide a wealth of valuable information.

Volunteer stream monitoring engages members, educates them about coldwater resources, and contributes needed information that is the foundation to achieving any component of our conservation mission. The MITU *River Keepers* stream monitoring program was created with this premise in mind. The three primary goals of the *River Keepers Program* are to collect data that will help guide future coldwater conservation and restoration efforts, to provide hands-on volunteer opportunities for Trout Unlimited members, and to provide meaningful data to the MI DNRE. This program will allow MITU to conduct conservation and restoration projects based in science. The ultimate goal of the *River Keepers Program* is to improve coldwater conservation in MI while strengthening MITU's working relationship with the MI DNRE.

Each subsequent chapter of this manual focuses on one type of monitoring: 2) temperature, 3) river habitat mapping, 4) Adopt-A-Station habitat monitoring, 5) macroinvertebrates, 6) in-stream flow, and 7) fish. Objectives and methods for monitoring each type of data can be found in subsequent chapters.

1.3 Recording Volunteer Time and Travel

It is very important to know how many active volunteers are participating in *River Keepers*, how many hours each volunteer is putting in, and how far each volunteer is traveling by car. This information is very important for leveraging funds and for use as match when writing grants. Please keep track of your time and travel each time you volunteer for the *River Keepers Program*. A volunteer time and travel log can be found in Appendix 1A.

Appendix 1A – Volunteer Time and Travel Log

Volunteer Time and Travel Log

Name ___________________________________ **Email or Phone Number**_________________________

Date	Activity	Start Time	End Time	Miles Traveled by Car

Please send an electronic copy of this sheet to Kristin Thomas kthomas@michigantu.org

Chapter 2 – Temperature Monitoring

The methods presented in this chapter are standard (Bain and Stevenson 1999) and should work in most parts of the country. Chapters should consult with local agencies regarding temperature logging intervals, length of logger deployment, and methods for securing temperature loggers in local streams.

2.1 Objectives

These standard protocols for temperature monitoring are intended to be used to increase the amount of water temperature data available for Michigan's coldwater streams. This document is designed to provide standard protocols for monitoring water temperature that can be used by trained volunteers participating in the Michigan Trout Unlimited (MITU) *River Keepers Program*.

This temperature monitoring procedure is designed to address several objectives:

- Increase available temperature information for Michigan's coldwater streams for use by MI DNRE staff.
- Provide consistent temperature monitoring methods.
- Serve as a tool to identify and classify Michigan's coldwater streams
- Identify dams that are a priority for removal

2.2 Training

All temperature monitoring program leaders must have received training from a MITU staff member or fellow program leader. Temperature team leaders will be trained in logger deployment, data downloading, and downloading data into HOBOware. Leaders are then qualified to train volunteers to collect temperature data.

2.3 Equipment

Sampling will be conducted using Onset Computer HOBO Water Temp Pro v2 water temperature data loggers. The software required to download data from HOBO temperature loggers is HOBOware Pro or HOBOware lite. A Universal Optic USB Base Station is also required to transfer data. All software and necessary equipment are available from Onset Computer (http://www.onsetcomp.com/). Loggers will be housed inside PVC pipe secured to rebar in the stream bed. Complete lists of materials can be found in Appendices 2A, 2B, and 2C.

2.4 Preparation

a. Set Logging Interval

The logging interval must be set when the logger in connected to a computer prior to deployment. The logging interval will be set at 1 hour. This is the interval typically used by the MI DNRE. There may be sites at which a different interval has been determined to be more appropriate. If there is a question about the appropriate logging interval, use 1 hour.

b. Site Selection

Local DNRE biologists should be contacted to help determine priority watersheds in your area. Watersheds that are of particular interest to your chapter are also good candidates for temperature monitoring. Streams with very little available data and watersheds with dams or other stressors are good candidates for temperature monitoring. Make sure the site being monitored has not recently been monitored by the MI DNRE.

The general location of each logger within a watershed should be determined prior to deployment. In addition, access to planned sites should be verified prior to a deployment trip.

Before the deployment date several volunteers should go out and document the sites where loggers are to be placed. This involves taking photographs of each site, marking the spot where the logger should be placed with flagging, and recording GPS coordinates for each site. Flagging should be removed when loggers are deployed to minimize attention. When each logger is installed, take a photograph of a person standing in the stream pointing at the location of the logger. This provides a landmark for the logger, but does not attract attention to the actual deployment location.

If placing data loggers above and below a dam make sure the upstream logger is located above the dam impoundment in flowing water and the downstream logger is located no more than ½ mile below the dam.

2.5 Deployment

a. In-stream placement

Selecting a good location within the stream to place each logger is crucial. Each logger should be placed in a position so that it will remain submerged for the duration of the year. If possible, it is best to place each logger in an area that is, and will be, well-mixed and free from sedimentation (a riffle or run is preferred to a pool). If you are monitoring temperature for an entire year, make sure each logger is in an area of the stream where it will most likely not be vulnerable to damage of dislodgement due to ice or flooding. Loggers should be placed in an area that is also easily accessible at all times of year (winter excluded).

b. Deployment Apparatus

Loggers will be placed in a piece of PVC pipe to protect them. The PVC pipe will allow water to flow through to ensure accurate temperature readings. The PVC will be connected to a piece of re-bar with zip ties. The re-bar will be pounded into the stream bottom. The re-bar will act as the logger anchor and will prevent it from moving downstream. Figure 1 (Appendix 2A).

- Position the re-bar in the stream making sure it is as close to the bank as possible.
- Attach the PVC pipe containing the logger to the re-bar making sure that water can flow through the pipe and the logger will remain submerged.

Extra precautions may be necessary if temperature is being monitored for an entire year. It is a good idea to cable or wire the loggers and the PVC to something on shore (i.e. tree, root wad, etc.) to minimize the chance losing the logger.

If your chapter currently has a logger deployment technique that works well it can be used. If you are monitoring year round for the first time it is probably a good idea to take extra precautions to minimize the chances of losing each logger.

c. Documentation of Placement

The location of each logger should be carefully documented. GPS coordinates; landmarks, pictures, and/or maps should be used to clearly mark each location. Make sure all information about the location is written down in a manner that will allow a person who was not present at the time of deployment to locate the logger. Keep in mind that vegetation will not be the same during all seasons, so refrain from relying on grasses or forbs to locate the logger.

d. Label

Do Not Disturb Tag

Loggers should be disguised as well as possible; however, a sign explaining who the logger belongs to and its purpose may be a good idea. This information can be attached to the re-bar or written on the PVC pipe/logger. The tag should include a caution statement and contact information for a chapter member. An example of a tag follows:

CAUTION DO NOT DISTURB
Temperature monitoring project
If you have questions please contact
John Smith, Schrems West Michigan Chapter of Trout Unlimited
Phone and/or email of contact person

Temperature Verification

In stream temperature should be measured with a hand-help thermometer at the time of deployment, when data is downloaded, and when loggers are removed. This information allows us to verify the accuracy of temperature logger readings. To measure water temperature: select a shaded area of the stream towards the middle of the channel, hold a thermometer below the water for at least 60 seconds, read the thermometer while the tip is still in the water, record the water temperature and air temperature. Air temperature should also be taken in a shaded area.

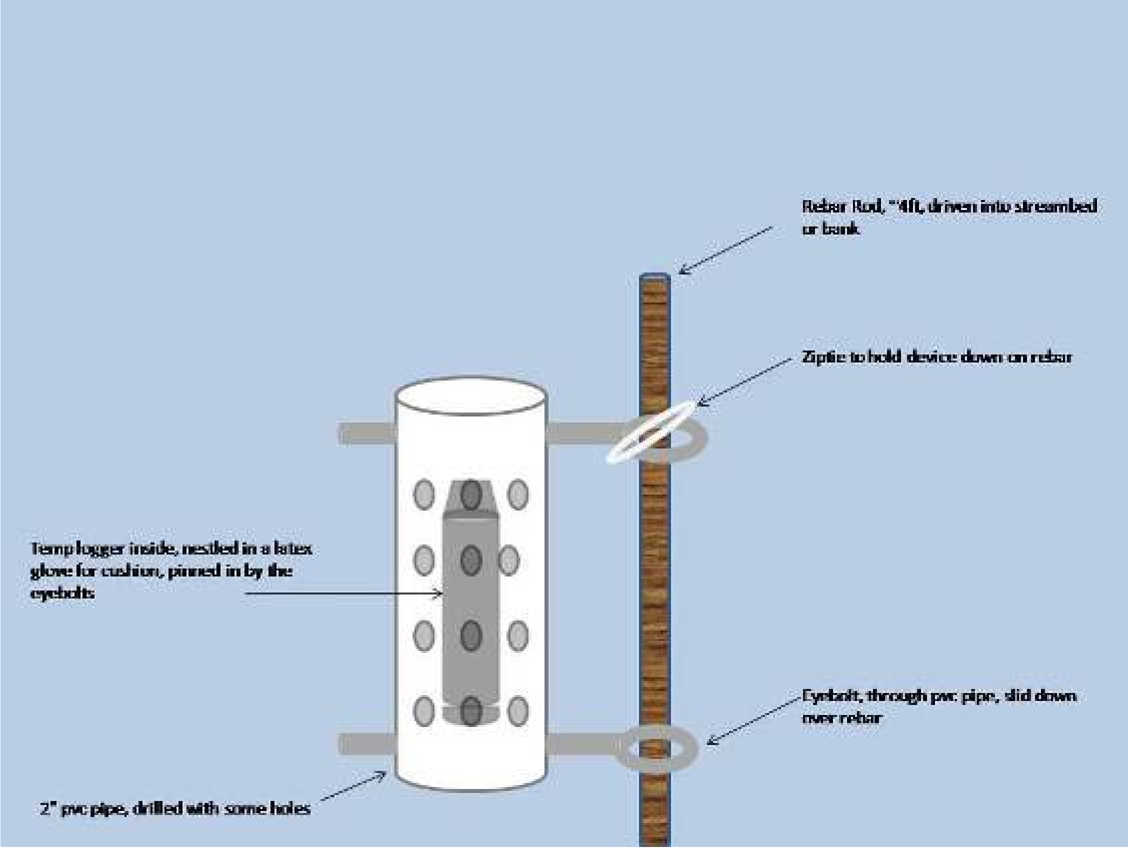


Figure 1. Data logger housing. Logger is nestled in 2 latex gloves to provide extra cushioning. PVC has a 2 inch diameter. Eyebolts bisect the PVC opening preventing the logger from falling out of the pipe.

2.6 Logger Checks

Use the temperature monitoring data sheets (Appendix 2D) when checking on the loggers throughout the year. This log will ask you to indicate the purpose of the visit (download data, visual check, removal etc.). The water temperature at the time of the check should be recorded in the log so that the accuracy of the logger can be checked after the data is downloaded. Use a handheld thermometer to record the water temperature. If you are doing a visual check you are done. If you are downloading data remove the logger from the water and download the data. Redeploy the logger in the same location and record any notes or observation in the temperature monitoring log (e.g. logger buried in sediment, logger in good condition etc.). Loggers should be monitored 1 to 4 times during the course of the year.

2.7 Retrieval

The same information that is recorded on the temperature monitoring data sheets at checks should be recorded when loggers are retrieved after a year (including date, time, and water temperature). The logger should be removed from the water and the data should be downloaded offsite. If the logger will not be redeployed in the same location make sure to remove all related materials from the site (e.g. re-bar, flagging etc.).

2.8 Data

There are several types of data of interest. Different biologist will be interested in different types of data. Each chapter is free to explore as many or as few types of data as they see fit. Data will be reported to the MI DNRE in the format they desire.

Examples of data of interest include:

<u>Daily measures</u>

- Maximum
- Minimum
- Mean
- Median
- Range
- Count

<u>Monthly measures</u>

- Maximum
- Minimum
- Mean
- Median
- Range
- Count

<u>Yearly Measures</u>

- Maximum
- Minimum
- Mean
- Median
- Consecutive hours over 70°, 72°, 74°, 76°, and 78° F
- Range
- Warmest 7 day average
- Coolest 7 day average

For MI DNRE stream classifications use **July mean water temperature**

- **Cold** = July mean water temperature **≤63.5° F (17.5°C)**
- **Cold-transitional** = July mean water temperature **>63.5° F (17.5°C) and ≤67° F (19.5°C)**
- **Cool** (or warm transitional) = July mean water temperature **>67° F (19.5°C) and ≤70° F (21°C)**
- **Warm** = July mean water temperature **>70° F (21°C)**

2.9 Logger Maintenance

MITU will keep a record of each logger. This will include logger serial number, date purchased, number and length of deployments, and battery status. MITU or each chapter will check logger accuracy each year before deployment. Accuracy will be checked as specified in the OnSet manual.

Appendix 2A – Logger Housing

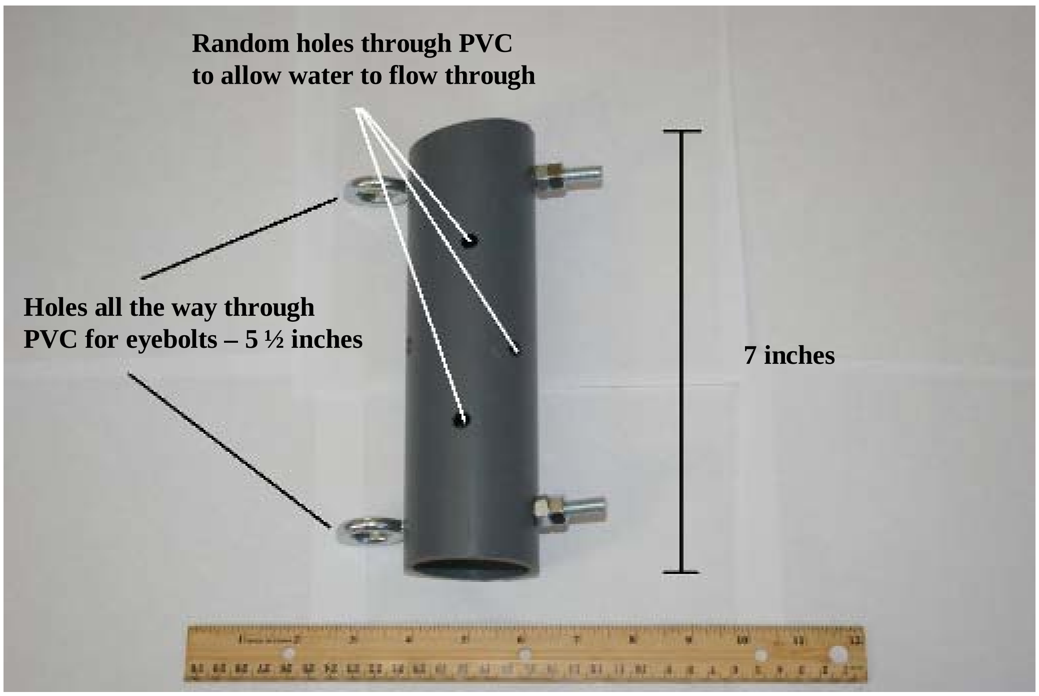
Building Temperature Logger Housing

Materials

- ¼ to ½ inch Re-bar (make sure it fits in the eye bolts you buy) –pieces about 4 feet long
- Schedule 40 gray 2 inch PVC Pipe – cut into 7 inch pieces
- 2 eyebolts per logger(5/16 x 5 inch)
- 2 regular nuts per logger
- 2 latex/rubber gloves per logger
- 4-5 Heavy duty zip ties per logger
- Several cinder blocks
- Rubber coated wire
- Several wire clamps
  - Cinder blocks, wire, and wire clamps are an alternative in case rebar will not work in some places. Rebar should work in most instances.
- Wire cutters
- Hack saw with a metal blade
- Plug in drill (cordless is not ideal)
- Drill bit slightly larger than 5/16 of an inch

Step 1

- Cut rebar into 3-4 foot pieces
  - You should be able to saw about ¼ to ½ way through with a hack saw and then break it the rest of the way
- Cut PVC into 7 inch pieces
  - A hack saw works great for this
- Drill two holes all the way through the PVC 5 1/2 inches apart
  - The gray schedule 40 PVC is very hard – a regular plug in drill works best – drilling holes with a portable, battery powered drill is pretty tough.
    - Use a drill bit that is slightly larger than the 5/16 eyebolts so they will easily slide through the holes.
  - Make sure the top and bottom holes are drilled in line with one another.
  - This is important because the eyebolts that go through these holes will hold the temp logger in place.

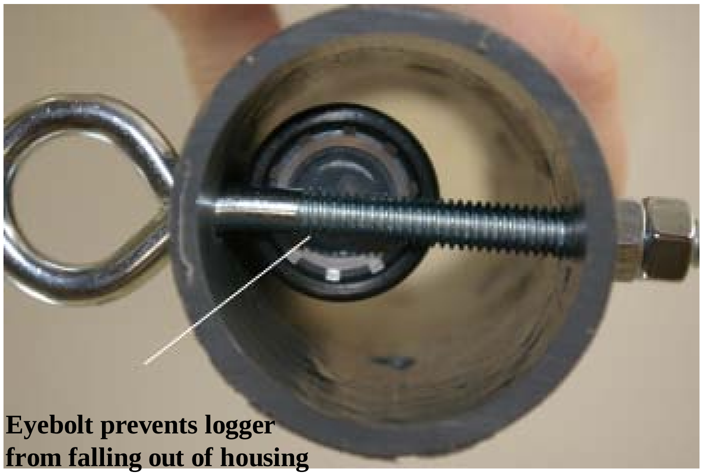


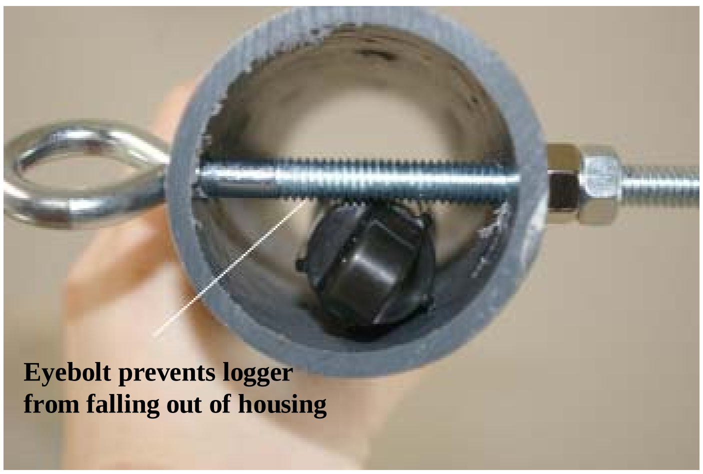
Step 2

- Drill holes randomly in PVC to allow water to flow through the pipe
- These holes do not need to go straight through the PVC pipe

Step 3

- Put in eye bolts and screw on nuts





Cinder Block Alternative Preparation

- If rebar won't work loggers will be housed in and attached to a cinder block
- The only prep for this is cutting the wire
  - If rebar won't work loggers (inside PVC housing) will be placed in a hole of a cinder block
  - Plastic coated Wire will then be strung through both eyebolts, around the cinder block, and secured with cable clamps
  - Wire ends will be secured with cable clamps tightly to make sure the logger will not be separated from the cinder block
    - Wire needs to be cut into sections long enough to be secured around a cinder block in this manner.

Appendix 2B – Logger Deployment

Temperature Logger Deployment

Materials for deployment

- Temp logger
- Logger housing and rebar
- Zip ties and latex gloves
- Permanent marker
- Cinder block (in case rebar will not work)
- Wire and wire cutters
- Wire clamps
- Heavy duty hammer/sledge hammer for pounding in rebar
- Handheld GPS (if available)
- Data sheets and pencils
- Digital camera (if available)

Deployment Procedure

- Write on PVC or attachable tag with permanent marker
    - Please Do Not Disturb
      Temperature Logger your chapter of Trout Unlimited
      Contact chapter rep (fill in email and/or phone) with questions
- **Select appropriate site for logger placement**
    - For sites with maps and photos choose a location near where photos were taken
        - The logger does not have to be in the exact location depicted use your judgment
        - Try to choose a spot in the area where the logger can be placed up against the bank
        - Make sure to document the logger location well
    - Make sure water is flowing (run or riffle)
    - Make sure logger will stay submerged all summer
    - Pound rebar into streambed
        - Place rebar out of the way; very close to the bank. We want it to be camouflaged and we don't want it to be a hazard to stream users.
            - Try to pound the rebar down far enough that it is slightly below the water surface
        - If rebar simply won't work (can't be pounded, no good spot etc.) use a cinder block instead (see directions below).
    - Make sure the number on the logger matches the logger number to be used at that site
        - Sites and corresponding logger number are written on the outside of each Ziploc bag
        - The logger number the serial number which is written in black on the blue logger label
        - There is also a label affixed to each logger with the correct site
            - Remove this label just before you deploy the logger

- **When rebar is in place**

    - Nestle logger in 1-2 latex gloves
        - Tie gloves around logger using fingers so that the sensor end (end with hole) of the logger is exposed (not covered by glove)
    - Remove top eye bolt from PVC and put the logger in the PVC pipe
    - Replace top eye bolt
    - Loosely connect the top eye bolt to the rebar with 2 to 3 zip ties
        - Leave zip ties loose enough to allow you to move the housing down the rebar
    - Lower the housing into place and tighten the zip ties
        - Place the PVC a few of inches off the bottom

- **When logger is in place in the stream**
    - Record the GPS location of the logger (if you have a GPS)
    - Write down/draw landmarks describing where the logger is located
    - Fill in information on "Temperature Logger Status Log"
    - Take LOTS of pictures of the logger, logger housing, and site (If you have a camera)
    - Record your time and mileage in your volunteer time and travel log!

If rebar won't work

- Use a cinder block.
- Place the logger in the housing as described above
- Place the housing in one of the holes in the cinder block
    - It is ok if it hangs out at one end
    - String a length of wire through both the top and bottom eyebolts and around the cinder block
    - Secure the ends of the wire around the cinder block
    - Place the cinder block in the appropriate location in the stream
    - Document the site as described above

Appendix 2C – Downloading Data

Temperature Logger Data Download Directions

Materials

- Data shuttle and appropriate coupler
- Heavy duty zip ties
- Hammer/small sledge hammer
- Knife or scissors to cut zip ties
- Temperature Logger Status Log and Volunteer Time and Travel Log sheets
- Pencils
- A soft cloth
- A watch
- A wrench if you used lock nuts

1. **Locate** the logger of interest
2. **Remove PVC and logger from stream**
    a. Cut the zip ties connecting the logger housing to the rebar
    b. If zip ties cannot be cut
        i. Remove rebar and housing together
    c. When you have the housing out of the water remove the logger from the PVC pipe by removing one of the eyebolts and sliding the logger out
3. When you have the logger out of the water remove it from the rubber gloves and **gently dry the wide (infrared) end with a soft towel**
4. Put the appropriate **coupler** on the data shuttle
5. **Slide the wide end of the temperature logger into the coupler** making sure to align the arrow on the logger and the arrow on the coupler
6. Press on the **coupler lever** (bar to right of arrow on coupler)
7. The shuttle LED light will be illuminated when a connection is made
8. The **orange LED** light blinks continuously while **download is in progress**
    a. Do not remove the logger when the orange LED is blinking
    b. This is important because after reading the logger the shuttle synchronizes the logger's clock to the shuttle's internal clock. If the logger is removed early the time will not be correct.
9. The logger is **ready to be re-deployed when the green LED light blinks**.
    a. This light will blink for 15 minutes or until you briefly press the coupler lever
10. Remove the logger from the coupler
11. Put it back in the rubber gloves
    a. Make sure the sensor end (has a hole) is not covered, tie gloves in place using glove fingers
12. If you only removed the PVC housing
    a. Slide eyebolts onto the rebar
    b. Loosely attach the top eyebolt with 2 zip ties
    c. Slide the housing into place and tighten the zip ties to secure the housing
    d. Place the PVC a couple of inches off the bottom

13. If you removed the entire housing apparatus pound the rebar back into the streambed

   a. **Do not** pound PVC with housing and logger attached
   b. Remove housing and reattach after rebar is pounded
   c. When rebar is in place slide the eyebolts onto the rebar
   d. Loosely attach the top eyebolt with 2 zip ties
   e. Slide the housing into place and tighten the zip ties to secure the housing

14. Fill in information on the "Temperature Status Log"

15. Record your **time** and **mileage** on your **volunteer time and travel log**

Troubleshooting

Red "fail" LED Blinks

The red "fail" LED blinks whenever the shuttle encounters an error. Causes of this error may be:

- **Shuttle is full**: If the red LED blinks when you try to download data from a logger, check whether all of the banks are full. The shuttle has 63 banks each of which can hold 1 logger download.
    - To check if the shuttle is full, remove the logger and press the coupler lever for at least 3 seconds. When you release the lever, the green LED blinks once for each unoccupied bank in the shuttle memory.
    - If the green light blinks clean the surfaces and try again.
    - If the green light does not blink indicating the shuttle is full put the logger back into the stream and return the shuttle to the chapter project manager so the data can be downloaded.

- **Can't communicate with logger (LED lights do not light up)**: Remove the logger and coupler. Inspect the logger and the shuttle to ensure they are free of dirt that could block the sensor. Reassemble the shuttle, coupler, and logger and shield the shuttle from strong sunlight and try again. If the shuttle still will not download the logger data put the logger back into the stream and notify the chapter project manager or a MITU staff person of the problem.

- **Shuttle batteries are low**: If you cannot download any logger data the batteries may need to be charged. The battery must be checked with a computer with HOBOware installed. Put logger back into the stream and notify the chapter project manager or a MITU staff person about the shuttle.

- **Other logger problems**: If you can download data from some loggers but not others the unreadable loggers will need to be checked in HOBOware. Put these loggers back into the stream and notify the chapter project manager or a MITU staff person on the problem.

Please note, each time you charge the shuttle batteries you must relaunch the shuttle in HOBOware. If the shuttle is not relaunched in HOBOware after the batteries are charged it will NOT download data.

If you cannot get the logger data to download put the logger back into the stream and notify Kristin Thomas (616-460-0477) kthomas@michigantu.org) or your chapter project manager.

Appendix 2D – Temperature Logger Log

Location	Date mm/dd/yy	Activity	Time	Water Temp.	Notes

Activity examples = deploy, download, visual check, etc.
Water temp - record if using Celsius or Fahrenheit
Notes examples = logger buried in debris/sediment, logger in good condition, etc.

Chapter 3 – River Habitat Mapping

Chapters across the country should be able to use the standard procedure for river habitat mapping. Consult with local agencies about additional variables they would like monitored and streams of interest to them.

3.1 Objectives

These standard protocols for river habitat mapping are intended to be used to increase the amount of habitat data available for Michigan's coldwater streams. This document is designed to provide standard protocols for mapping river habitat that can be used by trained volunteers participating in the Michigan Trout Unlimited *River Keepers Program*.

The river habitat mapping procedure is designed to address several objectives:

- Provide comprehensive habitat data for entire streams.
- Provide the best information possible to prioritize conservation, protection, and restoration of coldwater streams.
- Provide consistent methods for evaluating and quantifying in-stream habitat.

3.2 Training

All river habitat mapping program leaders must have received training from a Michigan Trout Unlimited staff member or fellow program leader. Leaders are then qualified to train volunteers to map river habitat. Leaders from chapters wishing to begin a river habitat mapping project are encourage to do "side-by-side" habitat mapping with a program leader from a chapter actively participating in river habitat mapping.

3.3 Equipment

It is recommended that several river habitat mapping "kits" be put together. These "kits" can then be passed around among volunteers which eliminates much of the hassle of sharing equipment. It is recommended kits be housed in backpacks or bags. Kits should include:

- A fiberglass or nylon tape measure (100-300 feet)
- A laser range finder
- A foldable ruler or yard stick for measuring depth
- A clipboard with a compartment
- Pencils
- Data sheets
- Laminated instruction sheets
- A handheld GPS unit (if available)
- A digital camera

- A canoe or drift boat (only necessary for streams where wading is not possible, and of course is not in the “kit” bag)

3.4 Preparation

a. Choosing a River

Several factors contribute to determining if a river is a good candidate for river habitat mapping. New habitat mapping programs should plan to start with a river that will be relatively easy to map, is of interest to the chapter, and is a priority for conservation partners (MI DNRE, RC&D’s, etc.). An easily mapped river will have easy access throughout, will be wadeable or very easy to float, and will have a large number of interested volunteers. It is recommended that more difficult rivers not be tackled until volunteers have gained experience in river habitat mapping. Chapters should consult with local fisheries biologists and other interest groups when choosing a river. MITU staff can also help with river selection.

b. Dividing a River into Sections

Rivers will be mapped in sections. These sections can vary in length depending on the size of the river. As a rule, it is probably a good idea to try not to create sections that will take more than 2-3 hours to map. Small sections of the river that frequently switch bedform (run, riffle, pool) will take much longer to map than large, monotonous sections of river. Keep this in mind when dividing a river.

It is also a good idea to try to create sections that begin and end at easy access points. This makes it easier for people to get in and out of the river and helps make it easy to find a given section. Rivers should be divided into sections by the project manager and additional volunteers before mapping begins, MITU staff can help with this task. Be specific when giving volunteers section assignments.

3.5 River Habitat Mapping

This information is included in a condensed instruction sheet in appendix 3A

a. Key Terms

Bedform Delineation

- **Run –** Moderate current, unbroken water.
- **Riffle –** Swift current, turbulent broken water.
- **Pool –** Slow or no current, unbroken water. Relatively deep.
- **Rapid –** Swift current, very turbulent, broken water. Large boulders or bedrock often breaking the surface.
- **Waterfall –** The majority of the stream flowing over a ledge or cliff.

Substrate Classification

- **Clay –** Very fine sticky texture. Easily forms ribbon when rolled in hand.

- **Silt –** Very fine texture. Smooth, silky feel when handled.
- **Sand –** Crumbles readily when handled. Single sand grains are apparent.
- **Gravel –** Rocks 1/16 to 2 ½ inches in diameter.
- **Cobble –** Rocks 2 ½ to 10 inches in diameter.
- **Boulder –** Rocks greater than 10 inches in diameter.
- **Bedrock –** Solid rock surface, not the tops of boulders.

b. Getting Started

When the river has been divided into sections, each section should be assigned to a crew. Each crew should have about 3-5 volunteers.

Make sure you know where your start and end points are! Begin by filling in the information at the top of the data sheet (river, date, crew, starting point, and surveying direction) Appendix 3B.

Habitat mapping should be done in mid to late summer through early fall, during average to low flow. Avoid mapping immediately following heavy rain. High water will make it hard to distinguish bedform, categorize substrate, and will not give an accurate percent of deep water. After rain events, wait until flow is back to normal.

c. Measuring Unit Area

A unit of the river is defined as a section of river that is made up of one consistent bedform type (i.e. each run, riffle, and pool are separate units). The first step in mapping a stretch of river is to determine the **bedform type** (run, riffle, pool, rapid, waterfall) at the starting point. Record the bedform type on the data sheet and measure the stream width at the starting point. If you are working in a downstream direction you will measure the **top width** of unit 1 and indicate the bedform type on the data sheet. You then will measure the **length** of the unit and the **bottom width**. You will also need to record a GPS coordinate at the top and bottom of each unit.

One person should remain at the beginning of the unit so you can use the range finder to measure unit length. If you are having a hard time getting the range finder to focus on an object try having a person holding up a clipboard stand at the end of the unit.

d. Substrate and In-stream Habitat

As you walk the length of each unit take note of the substrate, aquatic vegetation, woody debris, and depth. At the end of each unit all members of your group should come together to discuss bottom substrate composition, percent aquatic vegetation, and percent woody debris. You will also be asked to determine what percentage of the unit is greater than 2.5 feet deep and the value of the maximum depth within the section. When estimating percentages visualize the streambed from above and estimate what percent of the streambed is occupied by each substrate type, woody debris, aquatic vegetation, and deep water. Talk about differing opinions and come to a consensus within the group.

At the end of each unit you should also make notes of any additional pieces of information the groups feels would be useful (i.e. eroding banks, substrate embeddedness, status of the riparian corridor, culverts, drains, irrigation, etc.). Move onto the next unit when all of the necessary information has been filled in.

In the event that there is more than one bedform present in a unit (i.e. run and pool), treat each of those habitats as a unit. You will measure bottom and top width and length for the run and the pool. The run and pool within the unit will be analyzed separately.

Move on to the next bedform unit and keep mapping until you reach the end of your section.

Data Sheets – Appendix 3B

Mail completed data sheets to Michigan Trout Unlimited for analysis.
P.O. Box 442
Dewitt, MI 48820

OR

Scan and email completed data sheets to Kristin Thomas kthomas@michigantu.org

3.6 Data Analysis

Data will be analyzed and put into a database by MITU staff. MITU will quantify the area and percentage of the river represented by each bedform type and substrate. The area and percentage of aquatic vegetation, woody debris, and deep water will also be calculated. These findings will be reported to the chapter, the area DNRE biologist, and any other interested parties.

Appendix 3A – Habitat Mapping Guidelines

Guidelines and Tips

1. Make sure you know where your start and end points are.
2. Fill in site description information and survey direction
3. Begin mapping
   a. Identify the **bedform** (run, riffle, pool etc.) in your starting unit
   b. Measure the **top width** of the unit
   c. One person should remain at the start
   d. One or two additional people should walk downstream to the end of the unit you are measuring
   e. Use either a tape measure or laser range finder to measure the **length and bottom width** of that bedform unit
      i. If you are having a hard time finding something for the range finder to focus on try having a person at the bottom of unit hold up a clipboard
   f. As you walk to the bottom of the unit make sure to take note of the **substrate, aquatic vegetation, woody debris and depth** within the unit
      i. When all of the group members have walked through the unit discuss the substrate composition, percent aquatic vegetation, percent woody debris, and the percent of water over 2.5 feet.
      ii. Find the approximate location of the **deepest water in the unit** and measure the depth
   g. Record GPS coordinates at the top and bottom of each bedform unit
   h. Take photographs of each bedform unit
   i. Finally, make note of **any additional useful pieces of information** such as:
      i. Eroding banks
      ii. Substrate embeddedness
      iii. Status of the riparian corridor
      iv. Culverts
      v. Drains
      vi. Etc.
   j. When you have filled in all the necessary information for the first unit move on to the next.
4. If you are in a place in the stream where there are both a run and a pool or a run and a riffle present **treat each of those habitats as a unit**. I.e. you will measure the length, top and bottom width of the run and the pool and then treat each as an individual unit.

Appendix 3B - Datasheet

MITU Habitat Mapping Datasheet page_____ of _____

River name: ________________ County: ______________ Date:___________Crew: _______________________

Reach Name/Description: ____

Starting Point Location: - Distance from Landmark:_____________ Landmark:__________________________

- GPS Coordinates: EPE ________ Surveying Direction: Upstream or Downstream (circle one)

Bedform Types: 1=RIFFLE 2=RUN 3=POOL 4=RAPID 5=WATERFALL

Substrate Sizes: Clay, Silt, Sand, Gravel (1/16"-2 ½"), Cobble(2 ½"-10"), Boulders

Bedform Type**	Length unit__	Top width unit__	Bottom width unit__	GPS bottom	GPS top	Max Depth	% Depth > 2.5 ft	% Woody Debris	% Aquatic veg.	% Substrate Composition Clay \ Silt \ Sand \ Gravel \ Cobble \ Boulder	Other
										\ \ \ \ \	
										\ \ \ \ \	
										\ \ \ \ \	
										\ \ \ \ \	
										\ \ \ \ \	
										\ \ \ \ \	
										\ \ \ \ \	
										\ \ \ \ \	
										\ \ \ \ \	
										\ \ \ \ \	

* Examples of information to be included in other: eroding banks, riparian corridor characteristics, culverts, drains, etc.

** Pool (about 1.5 times deeper than average depth; low stream velocity); riffle (disturbed, rolling surface); run (smooth flowing section of stream); rapid (very disturbed surface, high velocity, whitewater); waterfall (the majority of the stream flowing over a ledge)

Chapter 4 – MI DNRE Adopt-A-Station Habitat Monitoring

The general methods presented in this chapter are standard protocols for habitat transect sampling. These techniques may be used around the country. However, methods for large woody debris counts and bank erosion indices are specific to the MI DNRE. Contact local agencies to determine the preferred method for quantifying wood and classifying river banks in your area.

4.1 Objectives

These standard protocols for habitat monitoring are intended to be used to increase the amount of habitat data available for Michigan's coldwater streams. This document is designed to provide standard protocols for monitoring habitat that can be used by trained volunteers participating in the MITU *River Keepers Program* in cooperation with the MI DNRE Adopt-A-Station habitat monitoring program.

This habitat monitoring procedure is designed to address several objectives:

- Increase available habitat information for Michigan's coldwater streams for use by MI DNRE staff.
- Provide procedural information for the MI DNRE Adopt-A-Station program
- Provide data that will aid in conserving, protecting, and restoring coldwater fisheries in Michigan.

<u>Use of Habitat Transects Versus Habitat Mapping</u>
For the purposes of the MITU *River Keepers Program* habitat mapping will be appropriate in most instances. However, there are some cases where habitat transect sampling is more appropriate. Habitat transects will be used in cooperation with the DNRE Adopt-A-Station Program. At the time this manual was written this program had limited availability. Habitat transects also may be appropriate in cases where a specific part of a stream needs in depth monitoring. For example, in a stream where habitat improvement has recently been conducted and in depth monitoring of a small section of stream is needed.

4.2 Training

Instruction sheets are included in each kit. A training session with a MI DNRE staff person or a MITU staff person may be available. In most cases training will consist of instruction sheets and a session with a MITU staff member.

4.3 Equipment

Equipment needed for sampling includes:

- A fiberglass or nylon tape measure
- A yard stick and/or a foldable ruler

- Clipboard
- Pencils
- Data sheets
- Hand held thermometer

4.4 Preparation

a. Site Selection

At this time watersheds are primarily chosen by MI DNRE fisheries biologists. It is a good idea to contact your local DNRE fisheries biologist to determine what coldwater systems are priorities in your area. From those options choose a watershed that is of interest to your chapter.

It is important to choose sites in a way that provides a representative sample of the watershed. For example it is good to have sites in major tributaries within a watershed and to have sites in the main river below where those major tributaries enter. It is also important to make sure the river is adequately covered from the upstream to the downstream end. Your area DNRE biologist may also be able to help with site selection.

b. Site Setup

Before sampling occurs sites should be marked with semi-permanent markers. This may include marking the beginning and end of each site with a numbered tag nailed into a tree. Always make sure to ask permission from landowners before marking trees. Flagging can also be used but should be considered a temporary marker not semi-permanent. GPS coordinates of the beginning and end of the site should also be recorded at the time the site is setup.

Each site should be 300 feet from start to finish. A marker should be placed at 0 feet and 300 feet.

4.5 Procedures

This section was prepared by the MI DNRE staff at the Baraga DNRE office for the Adopt-A-Station program in 2008.

a. Habitat Survey

You will assess water type, channel width, depth, and substrate every 60 feet throughout the section, beginning at 0 feet and ending at 300 feet (6 transects). At each transect point you should begin by determining the dominant water type (pool, riffle, run).
Dominant water type:

- Pool – 1.5 times deeper than the prevailing depth with slow current and no surface disturbance
- Riffle – shallow, disturbed rolling surface and relatively fast current

- Run – moderate depth with moderate to fast flow, little surface disturbance

Choose water type that best fits the majority of the transect.

Total channel width:

Total channel width includes islands, sand bars, exposed bedrock, shelves and all water within the stream channel.

Wetted channel width:

Only the **WET** width measured from bank to bank. If an island or dry ground is present, you would measure the water on BOTH sides of the island and add them to get your wetted width.

Depth:

Use a yard stick or folding rule to measure depth to a tenth-foot at ¼, ½, and ¾, from Left bank when facing upstream.

IN THE WATER – Set rule on "flat" bottom – avoid placing it on top of structures that would give "unusual" measurements. Do not measure the depth on dry ground/islands – only where there is water.

Bottom type:

Across transect (underneath tape measure), determine the percent composition of various substrates. Percents must add up to 100. Include islands and dry ground in your percentage ("I").

At each transect you will classify the percent of the bottom that is B-bedrock, BO-boulder (>10"), Co-cobble (3"-10"), G-gravel (1/8-3"), S-sand, O-organic (silt, detritus, muck), C-clay, or I-island/Dry. Determine the percentage of the bottom that is covered by each type of substrate and record it on the data sheet.

Embeddedness:

WHERE GRAVEL (or cobble) IS PRESENT, what percentage of the gravel or cobble is buried/embedded with fine silt and/or sand? How "buried" in sand/silt is the cobble and gravel?

You will need to determine the average percent embeddedness for all the gravel and small cobble in the transect. To determine embeddedness look where gravel and small cobble is present, in that area what percentage of gravel or cobble particles are embedded (buried) in silt/sand? If an area is 75% embedded you would only be able to see the top 25% of the rocks the rest of the rocks would be covered in sand or silt.

The rest of the observations are the entire stream Station (not just at each individual transect)

Each number corresponds to a numbered section on the Adopt-A-Station datasheet (Appendix 4A).

1. **Water Types:** Over the **entire station**, what percent of water is Pool, riffle and run? Must add up to 100 percent total. See "Visual Aids/Definitions" in survey kit for examples.
2. **Stream Observations table:** Circle ONE description for the amount of the respective characteristic.

3. **Wood Debris:** Estimate the percent of stream bottom covered by woody debris throughout the entire station.
4. **Riparian Vegetation:** Determine respective percentages of the vegetation types listed for Left and Right bank separately. Percents should add up to 100 percent for EACH BANK.
5. **Aquatic Vegetation:** Of all aquatic vegetation observed within the station, what is the percent composition of each type? (i.e. if there is simply watercress and eel-grass present, but far more eel grass, list high percentage of eel-grass (75%) and low watercress (25%). See "Visual Aids/Definitions" in survey kit for plant examples.
6. **Fish and Wildlife Observations:** Record numbers of animals and/or animal-signs, especially amphibians, reptiles, fishes, beavers, moose, etc.
7. **Water color** (circle one).
8. **Turbidity** ("low", "moderate", "high") is degree to which water loses its transparency *due to suspended particles,* the murkier the water appears, the HIGHER the turbidity**.**
9. **Level** ("low", "NORMAL", "high"): Unless you are aware of an unusual situation (drought, flooding, storm event, etc.) this will be "normal".
10. **Temp:** Take temp **6 inches under water surface in shade**.
11. **Air Temp:** Take 6 inches above water surface in shade.
12. **Time of Day**: Record when temperatures were measured.
13. **Preceding weather**: Please note recent rainfall, general temperature trends, etc. (i.e. "Past 3 days clear, 85 degrees, no rain")
14. **Days since Rain**: How long since any substantial rain (not just a "sprinkle")
15. **Stream flow:** Select a distance between two transects (they do not need to be the transects that you measured earlier, they may only be 10' or 20' apart depending on stream size) to drift a small stick down the river, unimpeded. "**Float Distance**" is the distance between transects. Avoid areas with pools, bends or logs. Measure the **wetted-width** at your two selected transects. Then, at each transect, get your **Average Depth** by measuring the depth at ¼, ½, and ¾ from left bank, add them together and **divide by 4** to (divide by "4" to account for stream shore depth of "0").
    Area: Multiply your transect Width by your transect Average Depth.
    Average Area is the area of your two transects, added together and divided by 2.
    Float time is found by timing how long it takes (in seconds) for your stick to pass between the two transects (take the average of three, unimpeded floats).
    Current Velocity is the Float Distance divided by the Float time in feet/sec multiplied by 0.9 (roughness coefficient).
    Discharge is calculated by multiplying the average Area by the velocity by **0.9.**
16. **Aquatic Invertebrates**: Collect invertebrates for about 15 minutes using small aquarium net, tweezers, eye droppers and pan (if available). I.D. if possible and return bugs to stream after recording number of each type identified. (See "Visual Aids/Definitions" in survey kit for examples.) If unable to ID bugs, place them into plastic jars WITH ALCOHOL and label with station # on outside or with paper labels for insertion into jars. (Return jars to MI DNRE.)

17. **Comments / Observations**: Record ANYTHING UNUSUAL or INTERESTING. Examples: unusual land use, observed recreational activities (fishing, swimming, ORV crossings, etc.), dead fishes, evidence of human use, springs, tributaries, fishing success, local development, etc, etc.

b. Large Woody Debris Count

Large Woody Debris is recorded **throughout the entire 300 foot station.**

1. Only count log sections that are greater than 6 inches wide AND greater than 6 feet long
2. Debris must be in 6 inches of water or more for 6 feet of length.

EXAMPLES: (assume all examples are in 6+ inches of water)

- A 15' log that is 7" wide along its entire length:

Diameter	1 (6')	2 (12 ')	3 (18')
>6"		I	
>6"			
>12"			
>12"			

- A 36' log where ½ of the log is 12-18" wide and ½ the log is 6-12" wide:

Diameter	1 (6')	2 (12 ')	3 (18')
>6"			I
>6"			
>12"			I
>12"			
>18"			

- A 19' log with 6' being less than 6", another 5' being 6-12" and the final 8' being 12-14"

Diameter	1 (6')	2 (12 ')	3 (18')
>6"	I		
>6"			
>12"	I		
>12"			
>18"			

Note: The first 6' is less than 6" wide so it is not counted at all. You are then left with 13' to take into account. That 13' is all greater than 6", with at least one section (6') being greater than 12" (put a mark in the >12" diameter/ 6' length box) . That leaves you with 7' of log that is greater than 6" wide, so you put a mark in the upper-left hand box.

Natural log jams, beaver dams, and brush deposits

Record the areal dimensions of each jam to the nearest 3 feet. A log jam is defined as 3 or more large diameter (>6”) intermingled logs in water at least 6 inches deep. Record the type of log jam – log jam, beaver dam or brush deposit and the length and width of the structure on the data sheet.

Artificial Structures
Record the areal dimensions of each structure and the type of structure. Record linear feel for wing deflectors. Record the type of structure, width, and length.

c. Bank Erosion Hazard Index

BEHI- (Bank Erosion Hazard Index): Observe the AVERAGE values 30 feet upstream and downstream of **each transect** on **BOTH banks** (see *left Bank* and *Right Bank* on the data sheets. There should be several data sheets to account for both banks at each of the 6 transects.)

BANK - from water’s edge to where the water would flow over bank at High water events (usually where bank angle changes dramatically or vegetation begins).

Root DEPTH (% of Bank Height): If bare soil on bank is present, then the roots can be seen and a percent can be determined by *direct* observation. If not readily visible, you must use some intuition to determine how deep the roots probably go. If, vegetation extends from the top of the bank to the water’s edge, then the percent will be high as there are roots from the top of the bank all the way deep down to the water’s edge. Example: on a grassy bank with no soil exposed, the root depth percent is going to be “90-100%”

Root Density*:* *Where there are roots present*, what percent of the area is occupied with the roots vs. soil? (i.e. very few roots within lots of dirt is low % -5-14%. Densely packed roots with a little soil between, such as grass, will be high %.)
Example – If tag-alder covers the bank but you can still see exposed soil in between the “trunks”, then the density will be moderate or sparse (30-79%).

Surface Protection: The percent of streambank that is covered and therefore protected by vegetation, large woody debris, sod mats, plant roots, branches, boulders and / or rocks. **BEDROCK IS TO BE COUNTED AS HIGHLY PROTECTED – 100%**

Bank Angle (degrees): This is the average bank angle from the water’s edge to where the river would overflow its banks during high water events. The angle is measured from shore as opposed to the center of the stream. (Example: A nearly flat bank will have an very acute angle, i.e. 5 – 20 degrees. Banks with an undercut or overhang will have a value greater than 90 degrees….**The more vertical the bank, the greater the angle value**.)
Examples of Different Bank Conditions;

<u>Root Depth/Bank Height</u> ≈ 90-100%

<u>Root Density</u> ≈ 55-79%

<u>Bank Angle</u> ≈ 21-60 degrees

<u>Surface Protection</u> ≈ 55-79% at least.

<u>Root Depth/Bank Height</u> ≈ 90-100%

<u>Root Density</u> ≈ 80-100%

<u>Bank Angle</u> ≈ 0-20º

<u>Surface Protection</u> ≈ 80-100%

<u>Root Depth/Bank Height</u> ≈ 90-100%

<u>Root Density</u> ≈ 30-54%, not counting sod slump

<u>Bank Angle</u> ≈ 81-90º

<u>Surface Protection</u> ≈ 30-54%

Note sod slumping into channel – a sure indication of an unstable bank, presumably because streamside vegetation = mowed grass, not woody vegetation. Otherwise the channel is in pretty good shape.

Root Depth/Bank Height ≈ 5-30% at best

Root Density ≈ 5-14%

Bank Angle ≈ 81-90º

Surface Protection ≈ 5-14%

Appendix 4A – Habitat Datasheet

Adopt-A-Station
Stream Station Description - Field Form

Station # ________ Date ________ Surveyors ____________________

Upstream GPS ____________________ Downstream GPS ____________________

1	Transcept No.	Distance from Origin (ft.)	Dominant Water Type *	Total Channel Width (ft)	Wetted Channel Width (ft)	Depth (to the tenth of foot.) ** 1/4	1/2	3/4	Bottom Type % ‡ B	BO	Co	G	S	O	C	I	***Emb. %
downstream	1	0															
	2	60															
	3	120															
	4	180															
	5	240															
upstream	6	300															
	Total	300	------														
	Average	60	------														

2. Water Types: Estimated % for entire Station - % pool________ %riffle___________ %run____________
3. Stream Observations:

Foam	Abundant	Moderate	Sparse	Absent	Undercut Banks	Abundant	Moderate	Sparse	Absent
Oil Sheen	Abundant	Moderate	Sparse	Absent	Overhang. Veg.	Abundant	Moderate	Sparse	Absent
Filamentous algae	Abundant	Moderate	Sparse	Absent	Deep Pools	Abundant	Moderate	Sparse	Absent
Trash	Abundant	Moderate	Sparse	Absent	Boulders (>10")	Abundant	Moderate	Sparse	Absent

4. Woody debris estimate % for entire station - _____ %
5. Riparian vegetation (type, %) _Left Bank:____________________
Right Bank: ____________________

Riparian vegetation classes

YD - yard/lawn | **TA** -Tag alder types | **LD** - Large deciduous trees (> 6 inch diameter)
AP - Agriculture, pasture | **SC** - Small coniferous trees (up to 6 inch diameter)
AR - Agriculture, row crops | **LC** - Large coniferous trees (> 6 inch diameter)
GF - Grassland/Forb | **SD** - Small deciduous trees (up to 6 inch diameter)

6. Aquatic vegetation:
Watercress _____% Lilly pads / duckweed _____% Cattails _____%
pondweed _____% eelgrass / aquatic grass _____% Other: ______________ _____%
7. Fish and Wildlife Observations / Evidence:____________________
____
8. Water color (green, black, brown, clear) 9. Turbidity (low, moderate, high) 10. Level (low, normal, high)
11. Water temperature(degrees F)____________ 12. Air temperature (degrees F)_____________ 13. Time of day______________
14. Preceeding weather:____________________ 15. Days since rain ______
16. Streamflow

Transect	Wet. Width	Ave. Depth	Area (WxD)
1			
2			

Float distance = _______________ ft.
Float time =_______________sec. (Ave. of 3 floats)
Current velocity = ft./sec. X 0.9 = _____________ ft./sec.

Average Area = ______________________________ sq. ft.
Discharge = Average Area x Current velocity Discharge= __________cfs

17. Aquatic invertebrates (# observed and returned to stream: Were insects collected? Yes / No.
mayfly___ stonefly___ blackfly___ scuds___ dragonfly___ damselfly___
midges___ worms___ caddisfly___ crayfish___ leeches___ hellgrammites___
Other:____________________
18. Comments and observations:

----
* pool (1.5 times deeper than prevailing depth); riffle (distrubed, roiling surface), run
**Channel Depths are measured from the LEFT BANK while FACING UPSTREAM…i.e. first depth is taken 2.5 feet from left shore if the wetted width is 10ft.
*** Embeddedness for gravel: Where gravel is present, what percentage of gravel or small cobble particles is embedded (buried) in silt/sand?
‡ B-Bedrock, BO-Boulder (>10"), Co-Cobble (3"-10"), G-Gravel (1/8-3"), S-Sand, O-Organic (silt, detritus, muck), C- Clay, I- Island / Dry
3. Deep pool is 1.6x the prevailing depth of station.
4. Observe vegetation within 30' of bank for whole Station length.
16. Record # of each type of insect you found and ID'd. **ONLY use jars for unidentified bugs!** Label your preservation jar with Station #.
17. Please record "unusual" sightings. Examples: Eroded banks, buffer area infringement, ORV crossings, etc.
All measurements occur starting at downstream origin, and banks (left, right) are determined while facing UPSTREAM
Depth measurements taken in English units to the tenth of a foot.

Appendix 4B – Large Woody Debris Datasheet

Adopt-A-Station
Large Woody Debris Count Data

Station #: ____________________________ Date: _________________________

Crew: ____

Individual logs at least 6 feet long in contact with water at least 6 inches deep.
Measure portion of log in water 6+" deep.

Length Classes (# of full 6' stick lengths) -- One mark per observation

Diameter	1 (6')	2 (12 ')	3 (18')	4 (24')	5 (30')	6 (36')	7 (42')	8 (48')
>6"								
>6"								
>12"								
>12"								
>18"								
>24"								

Natural log jams (NLJ) and beaver dams (Dam) & brush deposits (BD)
Record areal dimensions of each jam to the nearest 3'
Log jam definition: 3 or more large diameter (>6") intermingled logs in water at least 6 inches deep

Individual Log Jam dimensions (length x width in ft.)

Type	Length (ft)	Width (ft)

Type	Length (ft)	Width (ft)

Artificial structures- record areal dimensions of each structure (lineal feet for wing deflectors)
Type codes- Log Jam (LJ), Lunker Structure (LS), Raft (R), RipRap (RR), Stump clumps (S),
Wing deflectors (W),
- Individual log (Log)

Only record area of structure in water > 6" deep

Type	Length (ft)	Width (ft)

Type	Length (ft)	Width (ft)

Appendix 4C – Bank Erosion Datasheet

Modified Bank Erosion Hazard Index (BEHI) Field Form

Date:______ Station #:________

Distance of Transect from Origin*: **0'**

****LEFT** Bank (Circle one in each column)

Root Depth (% of BH)	Root Density (%)	Surface Protection (Avg. %)	Bank Angle (degrees)
90-100	80-100	80-100	0-20
50-89	55-79	55-79	21-60
30-49	30-54	30-54	61-80
15-29	15-29	15-29	81-90
5-14	5-14	5-14	91-119
< 5	< 5	< 10	> 119

Comments:

****RIGHT** Bank (Circle one in each column)

Root Depth (% of BH)	Root Density (%)	Surface Protection (Avg. %)	Bank Angle (degrees)
90-100	80-100	80-100	0-20
50-89	55-79	55-79	21-60
30-49	30-54	30-54	61-80
15-29	15-29	15-29	81-90
5-14	5-14	5-14	91-119
< 5	< 5	< 10	> 119

Comments:

Distance of Transect from Origin: **60'**

LEFT Bank (Circle one in each column)

Root Depth (% of BH)	Root Density (%)	Surface Protection (Avg. %)	Bank Angle (degrees)
90-100	80-100	80-100	0-20
50-89	55-79	55-79	21-60
30-49	30-54	30-54	61-80
15-29	15-29	15-29	81-90
5-14	5-14	5-14	91-119
< 5	< 5	< 10	> 119

Comments:

Distance of Transect from Origin: **60'**

RIGHT Bank (Circle one in each column)

Root Depth (% of BH)	Root Density (%)	Surface Protection (Avg. %)	Bank Angle (degrees)
90-100	**80-100**	**80-100**	**0-20**
50-89	**55-79**	**55-79**	**21-60**
30-49	**30-54**	**30-54**	**61-80**
15-29	**15-29**	**15-29**	**81-90**
5-14	**5-14**	**5-14**	**91-119**
< 5	**< 5**	**< 10**	**> 119**

Comments: ______________________________

Distance of Transect from Origin: **120'**

LEFT Bank (Circle one in each column)

Root Depth (% of BH)	Root Density (%)	Surface Protection (Avg. %)	Bank Angle (degrees)
90-100	**80-100**	**80-100**	**0-20**
50-89	**55-79**	**55-79**	**21-60**
30-49	**30-54**	**30-54**	**61-80**
15-29	**15-29**	**15-29**	**81-90**
5-14	**5-14**	**5-14**	**91-119**
< 5	**< 5**	**< 10**	**> 119**

Comments: ______________________________

RIGHT Bank (Circle one in each column)

Root Depth (% of BH)	Root Density (%)	Surface Protection (Avg. %)	Bank Angle (degrees)
90-100	**80-100**	**80-100**	**0-20**
50-89	**55-79**	**55-79**	**21-60**
30-49	**30-54**	**30-54**	**61-80**
15-29	**15-29**	**15-29**	**81-90**
5-14	**5-14**	**5-14**	**91-119**
< 5	**< 5**	**< 10**	**> 119**

Comments: ______________________________

Distance of Transect from Origin: **180'**

LEFT Bank (Circle one in each column)

Root Depth (% of BH)	Root Density (%)	Surface Protection (Avg. %)	Bank Angle (degrees)
90-100	80-100	80-100	0-20
50-89	55-79	55-79	21-60
30-49	30-54	30-54	61-80
15-29	15-29	15-29	81-90
5-14	5-14	5-14	91-119
< 5	< 5	< 10	> 119

Comments: ____________________

RIGHT Bank (Circle one in each column)

Root Depth (% of BH)	Root Density (%)	Surface Protection (Avg. %)	Bank Angle (degrees)
90-100	80-100	80-100	0-20
50-89	55-79	55-79	21-60
30-49	30-54	30-54	61-80
15-29	15-29	15-29	81-90
5-14	5-14	5-14	91-119
< 5	< 5	< 10	> 119

Comments: ____________________

Distance of Transect from Origin: **240'**

LEFT Bank (Circle one in each column)

Root Depth (% of BH)	Root Density (%)	Surface Protection (Avg. %)	Bank Angle (degrees)
90-100	80-100	80-100	0-20
50-89	55-79	55-79	21-60
30-49	30-54	30-54	61-80
15-29	15-29	15-29	81-90
5-14	5-14	5-14	91-119
< 5	< 5	< 10	> 119

Comments: ____________________

Distance of Transect from Origin: **240'**

RIGHT Bank (Circle one in each column)

Root Depth (% of BH)	Root Density (%)	Surface Protection (Avg. %)	Bank Angle (degrees)
90-100	80-100	80-100	0-20
50-89	55-79	55-79	21-60
30-49	30-54	30-54	61-80
15-29	15-29	15-29	81-90
5-14	5-14	5-14	91-119
< 5	< 5	< 10	> 119

Comments: ______________________________

Distance of Transect from Origin: **300'**

LEFT Bank (Circle one in each column)

Root Depth (% of BH)	Root Density (%)	Surface Protection (Avg. %)	Bank Angle (degrees)
90-100	80-100	80-100	0-20
50-89	55-79	55-79	21-60
30-49	30-54	30-54	61-80
15-29	15-29	15-29	81-90
5-14	5-14	5-14	91-119
< 5	< 5	< 10	> 119

Comments: ______________________________

RIGHT Bank (Circle one in each column)

Root Depth (% of BH)	Root Density (%)	Surface Protection (Avg. %)	Bank Angle (degrees)
90-100	80-100	80-100	0-20
50-89	55-79	55-79	21-60
30-49	30-54	30-54	61-80
15-29	15-29	15-29	81-90
5-14	5-14	5-14	91-119
< 5	< 5	< 10	> 119

Comments: ______________________________

* Origin is Downstream Endpoint
** Bank side determined while facing UPSTREAM.

Chapter 5 – Macroinvertebrates

The methods outlined in this chapter are standard for qualitative analysis of stream macroinvertebrates, and will work in most areas. Chapters around the country wishing to begin a macroinvertebrate monitoring program should contact local agencies to determine what methods are best for that area.

Any chapter wishing to begin a MiCorps program must coordinate through the Huron River Watershed Council and MiCorps. Michigan Trout Unlimited can help with this coordination process.

This chapter was prepared by Jo Latimore, Huron River Watershed Council, in 2006.

MiCorps Volunteer Stream Monitoring Procedures

5.1 Objectives

This set of stream monitoring forms is intended to be used as a quick screening tool to increase the amount of information available on the ecological quality of Michigan's streams and rivers, and the sources of degradation to the rivers. This document is designed to provide standardized assessment and data recording procedures that can be used by trained volunteers participating in the Michigan Clean Water Corps (MiCorps) Volunteer Stream Monitoring Program.

This stream monitoring procedure is designed to address several general objectives:

- Increase the information available on the ecological quality of Michigan rivers and the sources of pollutants, for use by DNRE staff, local communities and monitoring groups.
- Provide consistent data collection and management statewide.
- Serve as a screening tool to identify issues and the need for more thorough investigations.

5.2 Training

All MiCorps Volunteer Stream Monitoring Program leaders must have received basic training in the stream assessment methods described below from MiCorps staff. Trained program leaders are then qualified to train their program volunteers in these procedures.

5.3 General Concepts

The procedures and data forms provided below include two types of assessment: Stream Habitat Assessment and Macroinvertebrate Sampling.

The Stream Habitat Assessment is a visual assessment of stream conditions and watershed characteristics. The assessment should include approximately 300 feet of stream length. Only observations that are actually seen are to be recorded. No "educated guesses" are to be made about what should be there or is probably there. If something cannot be seen, it should not be recorded. The one exception is if a significant pollutant source or stream impact is known to be upstream of a particular site, a comment about its presence can be made in the comment section of the form.

The Macroinvertebrate Sampling procedure should be used in conjunction with the Stream Habitat Assessment because each approach provides a different piece of the stream condition puzzle. Because of their varying tolerances to physical and chemical conditions, macroinvertebrates indicate the ecological condition of the stream, while the macroinvertebrate data is used to calculate the MiCorps Stream Quality Index, which provides a straightforward summary of stream conditions and can be used to compare conditions between study sites.

5.4 Survey Design

1. Selecting Monitoring Sites

One of the basic questions in planning stream monitoring is the location of study sites: how many stream sites should be surveyed within a watershed to adequately characterize it, and where should they be located? That depends on a variety of factors including the heterogeneity of land use, soils, topography, hydrology, and other characteristics within the watershed. Consequently, this question can only be answered on a watershed-by-watershed basis.

A general DNRE guideline is to try to survey a minimum of 30% of the stream road crossing sites within a watershed, with the sites distributed such that each sub watershed (and in turn their sub watersheds) 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, it should contain a diverse range of the available in-stream cover, and it should contain some gravel/cobble bottom substrates if possible. Remember that each study site should allow for the assessment of 300 feet of stream length.

2. Time of Year

The time of year in which monitoring is conducted is important. For comparison of monitoring data from year to year, data should be collected during the same season(s) each year. Ideally, macroinvertebrate sampling should take place in spring and again in early fall. Different macroinvertebrate communities are likely to be encountered during these different seasons, and sampling twice a year will provide a more complete picture of the total stream community. Surveys conducted during or shortly after storm runoff events may help to identify sources of pollutants, but high water obscures bank conditions and increased stream turbidity which may make assessment of in-stream conditions difficult. Furthermore, all sites within a single watershed should be surveyed as closely together in time as possible to facilitate relative data comparisons among stations surveyed under similar stream flow and seasonal conditions.

5.5 Instructions for Completing Data Sheet

1. Stream Habitat Assessment

a. Photographs

Taking Pictures

Always take photos. Photographs are useful for interpretation of Stream Habitat Assessment data and for later comparisons among different sites. Site photos should show the bank conditions and some of the riparian corridor. Additional photos may be taken to highlight a particular item of concern in the stream or upland landscape. Be sure to document photos as they are taken, to simplify identification later.

b. Stream, Team, Location Information

MiCorps Site ID#: A site ID# for each of your study sites will be assigned to you by MiCorps. If you do not know the MiCorps Site ID#, leave this space blank.

Stream Name: Use the stream or river name found on the U.S. Geological Survey (USGS) topographic map for the area and also note the local name if it is different. For tributary streams to major rivers, record the tributary stream name here, ***not*** the major river name. If the tributary is an unnamed tributary, record as “Unnamed Tributary to” followed by the name of the next named stream downstream. For example, a station on an unnamed tributary of Hogg Creek would be recorded as “Unnamed Tributary to Hogg Creek”.

Location: This is often the name of the road from which you access the study site. It is very important to indicate whether the site is upstream or downstream of the road. If the same road crosses a single stream two or more times, it is sometimes desirable to record the road name relative to the nearest crossroads (e.g. “Green Road between Brown Road and Hill Road”).

Date: Record the month, day and year.

Time: Record the time when the monitoring activity began. Use 24-hr time (e.g. 1:00 PM should be recorded as 1300).

Names: Record the name and the phone number of the person completing the datasheet, as well as the names of other team members participating in the assessment.

c. Stream and Riparian Habitat

Average Stream Width (ft): Circle the range that represents the average stream width in feet. Take width measurements of the stream at several points along the 300-foot assessment area, and indicate the average width here. These measurements are also useful in creating the Stream Site Sketch.

Average Stream Depth (ft): Circle the appropriate depth range in feet. Take depth measurements at several points within the 300-foot assessment area, and indicate the average depth here. This observation is for the average depth of the stream that is consistently observed. For example, if the stream is generally shallow (<1ft), but has a pool that is 3ft deep, circle the <1ft category since a pool is not representative of the average depth of <1ft observed over most of the stream.

Stream Flow Type: Circle the category that best represents general flow volume in the stream. Describe the flow during the assessment in relation to the annual average flow. If river flow is reduced in the summer, due to dry and hot conditions, circle "L" because it is below average, even though low flow may be typical for that stream in the summer.

Dry	=	No standing or flowing water, sediments may be wet.
Stagnant	=	Water present but not flowing, can be shallow or deep.
L (low)	=	Flowing water present, but flow volume would be considered to be below average for the stream.
M (medium)	=	Water flow is in average range for the stream.
H (high)	=	Water flow is above average for the stream.

Highest Water Mark: The highest water mark is the maximum height to which the stream water level rises at the site, as determined by the visible evidence present. This level is typically reached during floods or high flow conditions. The highest water mark is determined as the distance in feet **above the present water level** at the site. If the surveyor cannot visibly determine how far the stream rises at the site, circle the "?" on the form. The highest water mark may be visible as discoloration on bridge pilings or abutments, stream debris (trash, leaves, weeds) left along the stream banks or in tree/shrub branches, ice scour marks on trees or streambanks, or muddy residues left in floodplains or on streamside vegetation.

Turbidity: Circle the appropriate description of turbidity. Turbidity is caused by suspended particulates such as silt, sand, algae, or fine organic matter. Turbid water is opaque to varying degrees, preventing the observer from seeing very far into it. Note that water can have a color to it that is not turbidity, such as the brown transparent water often associated with swampy areas.

Oil Sheen: An oily appearing sheen on the water surface caused by petroleum products. A thin sheen will often have a rainbow of hues visible. The sheen can be distinguished from bacterial sheens by remaining viscous when poked with a stick or otherwise physically disturbed, whereas bacterial sheens break into distinct platelets.

Bacterial Sheen: Bacterial sheens occur as oily appearing sheens on the water surface, often with a silverish cast to them. The sheens are produced from bacterial decomposition activity, and occur most often in still water areas of lake edges and coves, as well as wetland areas. The sheen can be distinguished from petroleum products by breaking into distinct platelets when poked with a stick or otherwise physically disturbed, whereas petroleum products remain viscous.

Foam: Naturally occurring foam often looks like soap suds on the water surface and can be white, grayish or brownish. Foam is produced when water with dissolved organic material is aerated and can range in extent from individual bubbles to mats several feet high. Foam is typically produced in streams when water flows through rapids or past surface obstructions such as logs, sticks and rocks. Simple wave action can produce foam in lakes. This naturally occurring foam is quite common. Natural foam can be distinguished from soap suds by rubbing it between the fingers. If the suds disintegrate and leave only wet fingers or a gritty residue, the foam is natural. If the suds feel slippery and soapy, or smell perfumed, it is not natural foam.

Water Temp: This is an optional data item. The person coordinating a particular watershed survey will determine if temperature measurements will be made. If measured, record the water temperature to the nearest degree Fahrenheit or centigrade, making sure to include the scale units.

Water D.O.: This is an optional data item. The person coordinating a particular watershed survey will determine if dissolved oxygen (DO) measurements will be made. If measured, record the DO level in the river. If DO is measured, it is important that the water temperature be measured also.

Water pH: This is an optional data item. The person coordinating a particular watershed survey will determine if pH measurements will be made. If measured, record the pH of the stream to the nearest tenth.

Water Velocity (ft/sec): This is an optional data item. The person coordinating a particular watershed survey will determine if water velocity measurements will be made. If measured, record the approximate surface water velocity in feet per second, observed at the surface <u>in the area of fastest river flow</u> that is <u>not impacted by a road crossing</u>. One method is to observe how far downstream a floating object travels in one second (observe for 10 seconds and divide the distance by 10).

<u>Substrate:</u> Substrate is the material that makes up the bottom of the stream. In general, good quality substrates (from an aquatic habitat perspective) contain a large amount of course aggregate material—such as gravels and cobbles—with a minimal amount of fine particles surrounding or covering the interstitial pore spaces. These stable materials provide the solid surfaces necessary for the colonization of attached algae and the development of diverse macroinvertebrate communities.

Using the particle size and composition guidance provided below, identify the percent areal extent of each substrate type present. The composition estimate should include the entire area of the stream bottom in the study site (typically, 300 feet of stream). Sometimes it is not possible to determine the substrate type all the way across a river because it is too deep or the water is turbid. In these cases, assign the appropriate percentage amount to the "unknown" category.

Substrate Type		Composition and Size
Boulder	-	Rocks 10" diameter or larger
Cobble	-	Rocks 2.5 – 10" diameter
Gravel	-	Rocks 0.1 – 2.5" diameter
Sand	-	Coarse grain
Silt-Muck-Detritus	-	Fine grain/organic matter
Hardpan-Bedrock	-	Solid clay/rock surface
Artificial	-	Human made
Unknown	-	The portion of the stream bottom for which a substrate type determination cannot be made because the bottom cannot be seen due to water depth or turbidity.

<u>Plant Community</u>: The following categories should be observed throughout the 300-foot assessment reach. If a category type (e.g. aquatic plants) is not present in the stream, mark 0 for absent. If a category type can be seen only in a very small amount, mark 1 for rare. If a category is present in most areas, mark 2 for common. If a category type is present in a large portion of the stream, mark 3 for abundant. If a category occupies nearly the entire site, mark 4 for dominant.

<u>Aquatic Plants</u>: This category refers to aquatic macrophytes only, not terrestrial species. By definition, macrophytes are any plant species that can be readily seen without the use of optical magnification. However, the usage here is directed primarily toward <u>aquatic vascular plants</u>—plants with a vascular system that typically includes roots, stems and/or leaves. This includes duckweed, as it is a floating vascular plant. Certain large algae species that superficially look like vascular plants, such as chara, can be recorded here as well. If the person conducting the survey is knowledgeable about aquatic plants, the particular type or species of plant(s) can be noted in the comment section at the end of the

form. Floating, suspended, or filamentous algae species should be recorded in one of the algae categories and not here.

Filamentous Algae: Algae that appear in stringy or ropy strands, such as Cladophora. The strands may or may not be attached to other objects in the water body.

Adjacent Land Uses: Circle the appropriate left or right streambank (facing downstream) designation for all of the following land uses that are adjacent to the stream. Land use along the entire length of stream that can be seen from the road stream crossing should be evaluated. This might include land that is beyond the riparian corridor. “Adjacent” requires the use of some judgment on the part of the surveyor, but generally refers to any land that can be seen from the crossing and is reasonably close to the stream such that pollutants could run off it into the stream. For example, if a 20-acre corn field is near a stream but separated from it by a 10’ grass/shrub buffer strip, the “row crop” category should be circled. If the same field were 100’ from the stream and the intervening distance was wooded, the “forest” category should be circled.

Riparian Vegetative Width: The riparian vegetative width is the width of the streamside natural vegetation zone along the stream banks. The width is measured from the edge of the stream to the end of the contiguous block of natural vegetation. Natural vegetation is defined as including trees, shrubs, old fields, wetlands, or planted vegetative buffer strips (often used in agricultural areas and storm water runoff control). Agricultural crop land and lawns are **not** considered natural vegetation for the purposes of this question. Circle the appropriate distance (in feet) that represents the **average, or most representative** (>50% of the lineal bank distance) width of the vegetation zone for each side of the river. Left and right banks are determined from the perspective of facing downstream.

Sources of Degradation: The intent of this section is to evaluate the relative importance of potential sources in terms of pollutant contribution to the water body at a given site in the watershed. The evaluation assesses the potential for pollutant inputs at the site, **NOT pollutant impacts**, or the potential for pollutant impacts. Pollutant impacts, as indicated by visual manifestations, were evaluated previously on the first page of the data sheet. Evaluating potential sources of pollutants to a water body is a three step process: identification of potential sources, evaluation of pathways for pollutants to get to the water body, and finally evaluation of the severity (magnitude) of this pollutant input or loading. The three steps of this process will result in scoring identified sources on the survey sheet as Slight, Moderate, or High Priority in terms of the severity or amount of their pollutant contribution to the water body at the site being surveyed.

(1) Source Identification

Visually evaluate the various land use/land change activities at the site for potential sources of pollution. Note all potential sources for the area that can be seen (choosing from among the list of sources on the data sheet). For example, is there evidence of soil disturbance at the site, or land uses such as residential lawns, agricultural fields, parking lots, urban areas, etc., near the water body? Use the source definitions provided to help identify what potential sources may exist. If it is known that a significant source exists upstream of the study site, such as a wastewater treatment plant, it may be important to note the presence of that source, but it should be recorded in the comments section since it was not visible at the site.

(2) Pollutant Pathway

Next, for each potential source that has been identified, evaluate how pollutants could get from the source to the water. An evaluation of likely pathways for pollutants to enter the water body provides information regarding the potential for the identified sources to contribute pollutants. The following provides a quick outline of some visual observations to consider in evaluating pollutant pathways. Pay particular attention to likely water runoff patterns at the site that may occur during rainfall or snowmelt events.

- Gully/rill erosion provides a direct pathway for pollutants to enter the stream in a concentrated flow when the land slopes toward the stream. Pollutants associated with eroding soils will vary depending on the type of land use activity.
- Tile/pipe discharges are potential direct pathways for pollutants.
- Bare soils near the edge of a water body provide a likely pathway for sediment to get to the water body.
- Maintained lawns to the edge of a water body provide a likely pathway for nutrients and pesticides to the water body.
- Land disturbance/use activities to the edge of a water body provide a likely pathway for various pollutants to the water body.
- Open areas of disturbed soils and/or bare soils devoid of vegetation provide a potential pathway for pollutants via wind erosion.
- Steep streambanks (steeper than a 2:1 slope) devoid of vegetation are likely pathways for sediment.
- No canopy over the water body is a pathway for dramatic thermal increase in water temperature during the day.
- Impervious surfaces (parking lots, roads, roof tops, etc.) provide a likely pathway for various pollutants, and may increase flows in the watershed causing flashiness.
- Culverts/bridges may not be aligned with the stream, or may be undersized, and could provide a likely pathway for flow to create streambank erosion both upstream and downstream of the culvert or bridge.

(3) Severity Ranking

Finally, for each source for which a pathway has been identified, evaluate how severe the pollutant loading is. Rank each source identified as Slight, Moderate or High severity for the contribution of pollutants, based on the magnitude or quantity of pollutants likely to be delivered to the stream. The surveyor must use their judgment on assigning a slight, moderate or high rating.

The severity ranking is based only on *pollutant inputs* from the specific source *at the site*, not on visible stream impacts or impacts the pollutant may cause downstream. The pollutant loads from the identified source(s) may or may not have an impact at the site.

Evaluation of the source, location and pathways can provide a reasonable assessment of the severity of the pollutant loading. The following provides a quick outline of some visual observations to consider in evaluating the severity of pollutant loading.

- Proximity to water body – generally the closer the use, or land disturbance activity, is to the water body, the greater the likelihood for pollutant delivery.
- Slope to water body – generally the steeper the slope/topography to the water body, the greater the likelihood of overland pollutant delivery.
- Conveyance to water body (ditch, pipe, etc.) – generally a conveyance from the use, or land disturbance activity, increases the likelihood of pollutant delivery.
- Imperviousness – impermeable surfaces reduce the amount of land area available for water infiltration and increase the potential for overland runoff. Additionally, if a watershed is greater than 10% impervious, it will start to show some systemic problems due to impacts from flow. If a watershed is greater than 25% impervious, the natural hydrology is generally heavily impaired.
- Intensity and type of use, or land disturbance activity – generally the more intensive the activity the greater the likelihood for the generation of pollutants. Certain activities may have specific types of pollutants associated with them.
- Size of erosion area – generally the larger the erosion area the greater the likelihood for sediment delivery.
- Soil type – clay is less permeable than sand, and therefore would create a greater potential for overland runoff of pollutants.
- Presence and type of vegetation – the greater the vegetative buffer around a water body, the better the filtration of pollutants from nearby land disturbance and use activities. Certain types of vegetative buffers work better than others and should be evaluated on a case-by-case basis.

2. Stream Macroinvertebrate Monitoring

a. Streamside Procedures

Stream Location Information:

MiCorps Site ID#: A site ID# for each of your study sites will be assigned to you by MiCorps. If you do not know the MiCorps Site ID#, leave this space blank.

Stream Name: Use the stream or river name found on the U.S. Geological Survey (USGS) topographic map for the area. For tributary streams to major rivers, record the tributary stream name here, ***not*** the major river name. If the tributary is an unnamed tributary, record as “Unnamed Tributary to” followed by the name of the next named stream downstream. For example, a station on an unnamed tributary of Hogg Creek would be recorded as “Unnamed Tributary to Hogg Creek”.

Location: This is often the name of the road from which you access the study site. It is very important to indicate whether the site is upstream or downstream of the road. If the same road crosses a single stream two or more times, it is sometimes desirable to record the road name relative to the nearest crossroads (e.g. “Green Road between Brown Road and Hill Road”).

Date: Record the month, day and year.

Collection Start Time: Record the time when macroinvertebrate sampling begins. Use 24-hr time (e.g. 1:00 PM should be recorded as 1300).

- *Major Watershed*: Record the name of the major watershed where the study site is located (e.g., Grand River Watershed, St. Mary's River Watershed), and the corresponding HUC Code, if known.
- *Latitude and Longitude:* Record the latitude and longitude coordinates of the study site. Ideally, these coordinates will correspond to the midpoint of the stream study reach. Sources for these coordinates include a GPS unit, a topographic map, or digital maps, such as www.topozone.com.

Monitoring Team: Record the name of the person completing the datasheet, the person doing the actual in-stream macroinvertebrate collecting, as well as other team members participating in the assessment.

Stream Conditions:
Average Water Depth : This value can be taken from the Stream Habitat Assessment datasheet, if completed at the same time. Otherwise, to measure average water depth (ft), three measurements should be made at random points along the representative reach length being surveyed, and these values averaged for a mean depth.

Siltation: Some siltation along stream margins is normal. However, silt that settles on gravel, cobble, and woody debris in the main stream channel can have a negative impact on the benthic invertebrates that colonize these substrates and also can affect fish reproduction. Note on the data form whether there is obvious siltation on the dominant substrate types in the main stream channel.

Embeddedness: Embeddedness refers to the extent to which gravel, cobble, or boulders are surrounded or covered by fine material (such as silt or sand). The more the substrate is embedded, the less its surface area is exposed to the water and available for colonization by invertebrates. Record the appropriate level of embeddedness observed in the stream reach. This is measured as the percentage of an **individual** substrate piece, such as a rock, that is covered on average.

Fish or Wildlife: During the macroinvertebrate survey, volunteers should take note of any fish or wildlife (frogs, turtles, ducks, etc.) that may be visible in or near the stream and document any observations on the survey form.

Note if any crayfish or large clams that would not fit in the sample jar were found at the site but not collected. Many freshwater clams are rare or endangered, and should not be disturbed. Remember; however, to include these organisms in the Stream Quality Score on the second page of the data sheet.

Macroinvertebrate Collection:
The sampling effort expended to collect benthic macroinvertebrates at each site should be sufficient to ensure that all types of benthic invertebrate habitats are sampled in the

stream reach. This generally will be about 30 minutes of total sampling time per station. Macroinvertebrate samples should be collected from all available habitats within the stream reach using a dip net with one millimeter (mm) mesh, a kick screen made from doweling and window screening, or by hand picking. Habitat types can include riffles, pools, cobbles, aquatic plants, runs, stream margins, leaf packs, undercut banks, overhanging vegetation, and submerged wood. Habitat and substrate types from which macroinvertebrates were collected (or collections were attempted) should be recorded on the form; include as many as possible.

Collecting should begin at the downstream end of the stream reach and work upstream.

All organisms collected should be placed into a bucket or tray. The composite sample should be rinsed and all large pieces of debris removed. The remaining sample contents should be emptied into enamel or plastic pan(s) with a light-colored bottom.
The team of volunteers should then sort through the collection and place the macroinvertebrates into jar(s) of 70% ethanol preservative for later identification. Volunteers should be shown how to pick through the tray, and to inspect rocks and other debris, emphasizing hidden locations under bark and in caddisfly cases. Be sure that every jar has a label written in pencil and placed inside the jar. It is recommended that all individuals collected be placed in the sample jar. However, in cases where there are VERY large numbers of clearly identical organisms, no more than approximately 15 individuals need to be included in the collection.

*** While macroinvertebrates collected from the stream can be identified to order in the field by experienced collectors, the collected organisms must still be preserved in labeled sample jars and retained by the volunteer monitoring program for verification purposes. See "Macroinvertebrate Monitoring: Is It Good for the Stream?" in the MiCorps Monitor, Issue 2 (April 2006) for more information (www.micorps.net/newsletter.html) ***

b. Macroinvertebrate Identification and Stream Quality Assessment

The organisms in the collection should be identified to order or sub-order, as indicated, using taxonomic keys. The abundance of each taxon in the stream study site should be estimated and recorded on the survey form (R=Rare [1-10 organisms], C=Common [11 or more organisms]).

The total stream quality score should be calculated as indicated on the survey form. This score is then used to rank the site as excellent, good, fair, or poor.

<u>Identification Confidence</u>: The name(s) of those determining the identification of organisms in the sample should be recorded, as well as a numerical rating of confidence in the identifications.

For more information, or to view the latest version of this procedure and MiCorps data sheets, visit the MiCorps website at www.micorps.net.

Appendix 5A – Stream Macroinvertebrate Datasheet

MiCorps Site ID#:________________

Michigan Clean Water Corps

Stream Macroinvertebrate Datasheet

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

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)

Datasheet checked for completeness by:____ Datasheet version 10/08/05
Data entered into MiCorps database by:____ Date:______________

MiCorps Site ID#:_______________

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

Datasheet checked for completeness by:_______________________________ Datasheet version 10/08/05
Data entered into MiCorps database by:_______________________________ Date:____________

Appendix 5B – Stream Habitat Assessment

STREAM HABITAT ASSESSMENT

I. Stream, Team, Location Information

Site ID:___________________ Date:____________________ Time:______________________

Location:____

Name(s):____

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	Deep 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 when 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	Is yes to #10, does the foam feel gritty or soapy?	Gritty (foam is most likely natural)		Soapy (foam could be artifical)			
	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.
If group will take transects and pebble counts (in Section IV), check this box and record the measured percentages. ☐

Substrate type	*Size*	*Percentage*
Boulder	>10" diameter	
Cobble	2.5 - 10" diameter	
Gravel	0.1 - 2.5" diameter	
Sand	coarse grain	
Fines: Silt/Detritus/Muck	fine grain/organic matter	
Hardpan/Bedrock	solid clay/rock surface	
Artificial	man-made	
Other (specify)		

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

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

Comments:

MiCorps Site ID#:___________ Date:_________________

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II. Stream and Riparian Habitat (continued)

D. Plant Community

Estimate the percentage of the stream covered by overhanging vegetation ________%

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	Filamentous Algae (Streamers)	Shrubs	Trees
Macrophytes (Standing, Floating Plants)	**0= Absent 1= Rare 2= Common 3= Abundant 4= Dominant**	Grasses	**0= Absent 1= Rare 2= Common 3= Abundant 4= Dominant**
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 Residential Lawn Park Shrub, Old 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 Residential Lawn Park Shrub, Old 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:_________________

Michigan Clean Water Corps

III. Sources of Degradation

1. In what ways is this stream degraded, if any?

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

3. Based on what you can see from this location, what are the potential causes and level of severity of this degradation? Only judge what you can see from the site.

(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:

Appendix 5C – Optional Quantitative Measurements

MiCorps Site ID#:___________ Date:_________________

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IV. Optional quantitative measurements

A. Transects and Pebble Counts

To take quantitative stream habitat measurements, conduct 5-10 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 (can be arbitrary).
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 the 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.

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

Chapter 6 – In-stream Flow

The techniques found in the in-stream flow chapter are standard protocols for measuring stream flow using a flow meter or current velocity meter (Gordon et al. 2004; Bain and Stevenson 1999). However, some aspects of the standard protocols presented are specific to Michigan. In Michigan, volunteers wishing to operate the flow meter must be certified in measuring stream flow by the Michigan Department of Natural Resources and Environment and the United States Geological Survey (MI DNRE/USGS). This certification is specific to Michigan. In other parts of the country program coordinators should contact pertinent local agencies about criteria required for those agencies to utilize volunteer collected flow data.

6.1 Justification

Stream flow can be a good indicator of stream degradation due to water withdrawal. In most coldwater streams groundwater input is a very important factor in keeping water levels up and keeping water temperature low. Therefore, changes in stream flow can indicate negative impacts due to groundwater or surface water withdrawal.

The Great Lakes compact requires that Great Lakes states develop a framework for preventing adverse resource impacts to streams due to large quantity water withdrawal. Michigan currently has a tool to predict the impact of groundwater withdrawals on stream flow, and the subsequent impact on fish. If stream flow is reduced enough to have a negative impact on the resident fish community the proposed withdrawal cannot be approved. The predictive tool relies on limited stream flow data to predict flow in Michigan streams. Gaps in data are currently filled with modeling of stream flow. There are currently many stream sections and even entire stream systems where all index flows are estimated through modeling. There is a great need for more flow data for Michigan streams; however, state agencies are unable to expand in-stream flow sampling at this time.

The MI DNRE/USGS have begun developing criteria and tools for using volunteer collected flow data to help improve flow predictions that determine policy. MITU volunteers can help collect this much needed data for coldwater streams in Michigan.

6.2 Objectives

The standard protocols for in-stream flow monitoring are intended to be used to increase the amount of stream flow data available for coldwater streams. This document is designed to provide standard protocols for monitoring in-stream flow that can be used by trained volunteers participating in the *River Keepers Program*.

This in-stream flow monitoring procedure is designed to address several objectives:

- Increase available in-stream flow data for Michigan's coldwater streams for use by the MI DNRE, the USGS, MITU, and other stakeholders.

- Provide consistent in-stream flow monitoring methods that follow the guidelines set forth by the MI DNRE/USGS.
- Improve upon the data used in the "Water Withdrawal Assessment Tool".

6.3 Training

MI DNRE/USGS Stream Flow Monitoring Certification
The MI DNRE/USGS require anyone who will be directly measuring in-stream flow to attend USGS approved training. This training should be available beginning in the summer of 2010. At the time this document was created the specifics of this training were not yet available. Please contact a MITU staff person for further information.

MITU Training
Until MI DNRE/USGS in-stream flow monitoring training is available, MITU staff will provide interested chapters with training on how to sample in-stream flow. Please note, this is a temporary situation. As soon as certification is available through the MI DNRE/USGS, any chapter wishing to participate in flow monitoring will be required to send at least on representative to be certified. This is necessary because data will only be accepted by the DNRE if a certified volunteer collects the data.

Stream flow assistants can be trained by a person who has been certified as a volunteer stream flow monitor or by a MITU staff person.

The methods outlined below are generally accepted methods and can be found in Aquatic Habitat Assessment (Bain M.B. and Stevenson N.J. 1999. American Fisheries Society, Bethesda, Maryland) and Stream Hydrology: An introduction for ecologists 2nd Ed. (Gordon N.D., McMahon T.A., Finlayson B.L., Gippel C.J., and Nathan R.J. 2004. Jon Wiley and Sons, Ltd. West Sussex, England.).

6.4 Equipment

- Tape measure
- Stakes or rebar to anchor tape measure in stream banks
- Flow meter (specifics to be determined)
- Calculator
- Clipboard
- Data sheets
- Pencils
- Waders

6.5 Preparation

a. When to Sample
The goal is to sample streams at low flow. In general, this will occur in July and August during dry hot periods. Scheduling flow monitoring can be challenging because we do want to sample at low flow. Therefore, flow should not be measured just after a large

rain event or during a very wet time period. Wait until flow has receded after rain. If you are unsure about the water level in a particular stream you can check the USGS flow data for that stream, if available, or another stream in the watershed or area. This should give a good idea of the water level in the stream of interest. USGS real time flow data can be found at http://waterdata.usgs.gov/nwis/rt.

b. Site Selection

Stream flow data from any coldwater stream is of value. However, streams in which water level is a concern are especially good candidates for in-stream flow monitoring. For example, watersheds with large amounts of irrigation or industrial withdrawal and marginal coldwater (cold-transitional) streams are good candidates. MITU staff can help determine which steams in your area may be good candidates for stream flow monitoring.

6.6 Monitoring In-stream Flow

(Appendix 6A)

a. Site Selection

Choose a fairly straight section of stream for monitoring flow. Look for fairly uniform flow, depth, width, velocity, and slope. Avoid sites with extreme turbulence, upstream obstructions, divided channels, or dead water zones.

b. Site Preparation

Can be done by stream flow assistants

After selecting a site, string a measuring tape across the stream perpendicular to flow. Anchor the tape, so it is taught, at both ends. Do NOT cinch knots in the tape it will break.

Record the distance to the water's edge from the left bank (when looking upstream). This will be the "zero" value. Try to anchor the tape so that the water's edge is at an even foot – this will make things easier.

Divide the stream in at least 20 subsections from water's edge on one bank to water's edge on the opposite bank. You will measure flow in the middle of each section. Record the width of the sections on the data sheet.

Record points where flow readings will be taken on the data sheet. For example, if you have a 20 foot wide stream you will have 20 1 foot sections and will measure flow in the middle on each section, thus if the water's edge is at 0 on the tape measure, your points for recording flow will be 0.5, 1.5, 2.5, 3.5 etc.

Record the depth at each of these points on the data sheet.

Record the depth at which flow measurements will be taken at each point on the data sheet. You will measure flow at 60% depth from the surface in water that is less than 2.5

feet (29 ½ inches, 0.75 m), this number should be rounded to the nearest 0.1 inch. Flow will be measured at 20% and 80% depth from the surface in water that is greater than 2.5 feet (29 ½ inches, 0.75 m), this value should be rounded to the nearest 0.01 inch.

See example data sheet in Appendix 6B

c. Measuring Flow

An individual certified to collect flow data by the MI DEQ/USGS must operate the flow meter at all times.

Use a flow meter to measure stream flow at the pre-determined locations and depths. The recorder will tell the individual measuring flow at what distance across the stream and what depth to measure flow.

When using a Global Flow FP101 Flow Probe:

When the flow meter is in the water at the correct depth, hold the top button on the computer to reset the meter. Wait until the AVG. VELCOITY reading (bottom number) has stabilized to record flow. The top number is the instantaneous velocity and will continue to fluctuate. Remove the meter from the water and move on to the next point, and repeat each step.

Make sure to hold the flow meter away from your body. Do not stand in front of, behind, or very close to the flow meter, this can cause a disruption in normal stream flow.

For each subsection record:

- Distance from the left bank (facing upstream) along tape measure
- Water depth
- Water velocity

d. Calculating Discharge

The data sheet provides an easy format to calculate discharge. A chapter member can do this step OR can send the completed data sheet (without discharge calculated) to the MITU staff.

Measure depth and width in feet and water velocity in feet/second. This will yield a discharge in cubic feet per second (CFS).

References

Bain M.B. and Stevenson N.J. 1999. *Aquatic Habitat Assessment*. American Fisheries Society, Bethesda, Maryland.

Gordon N.D., McMahon T.A., Finlayson B.L., Gippel C.J., and Nathan R.J. 2004. *Stream Hydrology: An introduction for ecologists.* 2nd Ed. Jon Wiley and Sons, Ltd. West Sussex, England.

Appendix 6A – Sampling Protocol

Stream Flow Sampling Protocol

When to Sample

- We want to sample at low flow
- During hot dry periods
    - Likely in July and August
- Do not measure flow just after a large rain event
    - Wait until flow has receded – this could be a few days or a week or more
    - Check real time USGS flow data to get an idea of water level at the site you will be sampling
        - http://waterdata.usgs.gov/nwis/rt
        - For example if you are interested in Prairie Creek you can check water levels in the Grand River to get an idea about the level of Prairie Creek

Site Selection

- Choose a fairly straight reach
- Look for fairly uniform flow, depth, width, velocity, and slope
- Avoid sites with extreme turbulence, upstream obstructions, divided channels, or dead water zones

Site Preparation

- After selecting a site string a measuring tape across the section perpendicular to flow, anchor tape at both ends with stakes.
    - Do not cinch knots in the tape it will break
- Record the distance to the water's edge from the left bank (looking upstream) along the tape measure. This will be our "zero" value
        - Try to anchor tape so that the water's edge is at an even foot – this will make things easier
- Divide the stream into 20 subsections from water's edge on one bank to water's edge on the opposite bank.
    - You will measure flow in the middle of each section
    - Record the width of the sections on the data sheet
- Record points where flow readings will be taken on the data sheet
    - i.e. if you have a 20 foot wide stream you will have 20 1 foot sections and will measure flow in the middle of each section, thus if the water's edge is at 1 foot on the tape measure, your points for recording flow will be 1.5, 2.5, 3.5 etc. – see example data sheet
- Record the depth at each of these points on the data sheet
- Record the depth at which flow will be measured at each point.
    - 60% depth from the surface in water that is less than 2.5 ft (29 ½ inches, 0.75 m)
    - 20% and 80% depth from the surface in water that is greater than 2.5 ft (29 ½ inches, 0.75 m)

- See example data sheet

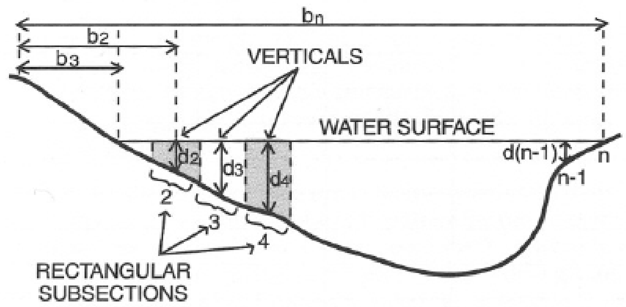

Figure 14.1 Cross section of a stream showing sampling locations for water depth (*d*) and velocity. Note that the interval represented is half the distance between adjacent measurement points except the first, and last interval, to the water edge.

Measuring Flow

- Use the current velocity meter to measure stream flow at pre-determined locations and depths
- The recorder will tell the individual measuring flow at what point and depth to measure flow
- When the flow meter is in the water at the correct depth hold the top button on the computer to reset the meter
- Wait until the AVG. VELOCITY reading (bottom number) has stabilized to record flow
    - The top number is the instantaneous velocity and will continue to fluctuate
    - Make sure to hold the flow meter away from your body, do not stand in front of, behind, or very close to the meter this can cause a disruption in normal stream flow.
- Remove meter from water, move on to next point, place meter in water at depth, and then hold the top button on the computer to reset the meter and begin measuring again
- For each subsection record
    - Distance from left bank (looking upstream) along tape measure
    - Water depth
    - Water velocity

Appendix 6B – Flow Datasheet

Flow Measurement Data Sheet

Assessment Site:	
Recorders:	Date and Time:
Streamflow Condition:	

Distance from left bank endpoint (ft;m)	Cell width (ft;m)	Water depth (ft;m)	Depth at which velocity is measaured	Water velocity (ft/s; m/s)	Cell area (ft^2;m^2) (water depth x cell width)	Cell discharge (ft^3/s;m^3/s) (cell area x water velocity)	Notes
1	-	0	-	0	-	-	Water edge
	0				0	0.00	
	Sum is the stream width				Sum is the cross section area	Sum is the stream discharge	

Appendix 6C – Example Datasheet

Flow Measurement Data Sheet - EXAMPLE

Assessment Site:	
Recorders:	Date and Time:
Streamflow Condition: High Average Low	

Distance from left bank endpoint (ft;m)	Cell width (ft;m)	Water depth (ft;m)	Depth at which velocity is measaured	Water velocity (ft/s; m/s)	Cell area (ft^2;m^2) (water depth x cell width)	Cell discharge (ft^3/s;m^3/s) (cell area x water velocity)	Notes
1	-	0	-	0	-	-	Water edge
1.5	1	0.8	0.48				
2.5	1	0.75	0.45				
3.5	1	0.9	0.54				
4.5	1	0.8	0.48				
5.5	1	1.1	0.66				
6.5	1	1.1	0.66				
7.5	1	0.9	0.54				
8.5	1	1	0.6				
9.5	1	1.3	0.78				
10.5	1	1.5	0.9				
11.5	1	1.7	1.02				
12.5	1	1.4	0.84				
13.5	1	1.6	0.96				
14.5	1	2	1.2				
15.5	1	2.6	0.52, 2				
16.5	1	2	1.2				
17.5	1	1.4	0.84				
18.5	1	1	0.6				
19.5	1	0.8	0.48				
20.5	1	0.6	0.36				
	-	0	-	0	-	-	Water Edge
	20						
	Sum is the stream width				Sum is the cross section area	Sum is the stream discharge	

Chapter 7 – Fish Sampling

The methods for sampling fish populations presented in this chapter are specific to the Michigan Department of Natural Resources and Environment Stream Status and Trends Program. Chapters beginning a fish sampling program outside of Michigan should contact pertinent local agencies for guidance on specific techniques. It is important to make sure you are collecting data in a way that will allow local agencies to utilize it. For example, the MI DNRE wants fish length data presented to them based on the number of fish per inch group. Therefore, we will present the data in this way; however, we plan to record fish length to the nearest 0.1 inch. This is an example of a way in which protocols may need to be modified to meet the needs of local agencies.

7.1 Justification

Harvest regulations on coldwater fishers are one of the primary tools managers' posses to help enhance these fisheries. Basic information (density, density variability, growth rate, and age-specific mortality schedule) about the fish population in a stream is required to ensure appropriate regulations are in place. Generally, this would require that a fish population survey be done in a given stream at least once, but preferably 2-3 years in a row. The MI DNRE conducts this type of survey; however, they conduct surveys on a randomized basis to ensure statewide coverage. Therefore, due to the large number of coldwater fisheries in Michigan, an individual stream likely only gets sampled about once a decade. The result is that we lack information to assess whether regulations are appropriate or effective for a large percentage of coldwater fisheries in MI. With a shrinking state budget the MI DNRE lacks the ability to increase its overall effort in sampling fish population. Volunteers can help to fill the gap by conducting population estimates and species surveys in coldwater streams.

7.2 Objectives

These standard protocols for fish sampling are intended to be used to increase the amount of fisheries data available for Michigan's coldwater streams. This document is designed to provide standard protocols for conducting fish population surveys and surveys of fish species, size, and age that can be used by trained volunteers participating in the *River Keepers Program*.

These fish sampling standard protocols are designed to address several objectives:

- Increase the amount of available fisheries population data for coldwater streams in MI.
- Increase the amount of available species, age, and size distribution data for coldwater streams in MI, especially in streams that have not been sampled in 30 plus years.
- Provide consistent, rigorous, and safe methods for the sampling of fish in coldwater streams in MI by MITU volunteers. All procedures follow MI DNRE Stream Status and Trends Program Sampling Protocols.

7.3 Training

Any chapter that would like to sample fish must have at least one member who has been through fish sampling training with a MITU staff person. This includes training on identifying non-game fish, how to photograph an unknown species for later identification, and electrofishing safety. Please contact a MITU staff person for further information.

If a chapter would like to sample fish but does not own a backpack electrofisher, they may use the MITU backpack electrofisher. However, a MITU staff member must be present when sampling is being conducted with the MITU backpack electrofisher. Sampling should be scheduled through the MITU Aquatic Ecologist.

Safety is of the utmost concern when using electricity to sample fish populations. At least one CPR/First Aid certified individual must be present at EVERY sampling event.

7.4 Equipment

- Backpack electrofisher
- Nets with non-conducting handles
- Gloves specifically designed for electrofishing
- Measuring board
  - Measuring board that can be worn around the waist
- Buckets
- Coolers
- Polarized sunglasses
- Fish identification guide
- Digital camera
- Waders
  - If you are using breathable waders make sure to wear long pants underneath to help prevent shocks.
  - Non-breathable or neoprene waders will work well.
- Data sheets
- Pencils
- Handheld GPS
- Handheld thermometer
- Yard stick

7.5 Preparation

<u>a. Communicate with area Fisheries Biologist</u>

It is very important that you, or a MITU staff person, talk with your area fisheries biologist before making plans to begin a fish monitoring program. We are trying to collect data that will be useful to DNRE biologists; therefore, communication is essential.

We need to determine what type of survey the biologist would like the chapter to do (population estimate or one-pass) and what streams in their area are priorities.

b. Site Selection

After we have talked with the area fish biologist about priority sites we can choose which priority sites we would like to sample and where in those stream sampling will take place. It is important to determine where sampling will take place early on so MITU staff can apply for a collectors permit. MITU staff will help with site selection.

c. Collectors Permit

A chapter representative or a MITU staff person can apply for a collectors permit for your chapter. If a MITU staff person applies, but will not be present for all shocking events, it is necessary for a chapter representative who will be present to also be on the application. A person listed on the collectors permit must ALWAYS be present when sampling is being conducted. You must know where you will be sampling before you can apply for a permit. Permit applications can be submitted online or printed, filled out, and mailed in. Permit applications are available at: http://www.michigan.gov/dnr/0,1607,7-153-10364-35079--,00.html .

In order for MITU to maintain a good working relationship with the MI DNRE, it is very important we NEVER sample without a permit, that we ALWAYS have a copy of the permit with us when sampling, and that an individual listed on the permit is ALWAYS present during sampling. It is also very important that you contact your area Conservation Officer about a week before each sampling event to let them know where, when, and how you will be sampling. This can prevent unnecessary travel by Conservation Officers and an inconvenience to you while sampling. If a Conservation Officer does stop and inquire about what you are doing let them know what you are up to and show them your permit. A list of Conservation Officers can be found at: http://www.michigan.gov/dnr/0,1607,7-153-42199-24666--,00.html.

7.6 Fish Sampling Methods

There are two different types of fish surveys outlined in this document. There are methods for a fisheries population estimate and methods for a survey that does not estimate population, but looks at species, age, and size distribution. Each chapter should consult with their area Fisheries Biologist when deciding which type of survey will work best in their area.

7.7 Population Estimates

Sampling should be conducted between August 1 and October 15, but preferably between August 15 and September 15.

a. Data Sheets

On SURVEY INFORMATION form:

- Stream Survey Details - Record GPS coordinates of station boundaries and the half-way point, in decimal degrees to five places past the decimal point. Check the box that says "Fixed site marking and recapture run" as the purpose.
- Effort Details – Record the type of electrofisher used and the number of probes.
- We will not be using blocknets at this time.

b. Sampling Methods

Day 1 will be the marking run, Day 2 will be the recapture run. Mark all trout species.

Before you begin shocking:

- Make sure you know where the starting and ending points are.
- Fill 3-4 cooler about half-way with stream water if you do not have a measuring board that can be worn around the waist (belly board)
  - If you have a belly board you will not need coolers
- Assign tasks to volunteers
  - One person to run the electrofisher
  - Two to three people to net fish
  - One to two people to collect netted fish in buckets
  - One person to transport fish from buckets to cooler
  - If there are sufficient volunteers – two to three people to identify, count, measure, and mark fish

Measuring, identifying, and marking fish
Begin shocking in an upstream direction, so shocked fish flow into your nets. Make sure to shock the entire stream bottom and areas that look like prime habitat. As you collect fish place them in the cooler for storage until they can be processed.

If you have a "Belly Board" – The volunteer who will be measuring and marking the fish should put on the "Belly Board". All fish that are shocked should be transferred to buckets containing fresh stream water. Fish should go straight from the buckets onto the "Belly Board" to be identified, measured, and marked. You may have more than one volunteer working on identification.

It is important that the individual wearing the "Belly Board" follow at least 50 feet behind the shocking team so that released fish are not recaptured.

If you do not have a "Belly Board" - Coolers should be filled with stream water. Make sure to keep the lids closed to keep the water as cool as possible. If you do not have bubblers in your coolers, make sure to put fresh stream water into the coolers ever 10-15 minutes. If trout begin to rise to the top it is a sign they are running out of air. If this happens change the water in the cooler and measure, mark, and release the fish. Trout should not be left in the coolers for more than about 30-40 minutes.

Put all of the fish you shock into the coolers as you go. If you have enough volunteers, two to three can begin processing fish as they are caught. If you do not have sufficient volunteers to have two people work on identifying and marking fish, place fish in the coolers until they are full or 30 minutes has passed. At that point mark your place in the stream and stop to process the fish. Non-trout should be released below the downstream end of the study section. Marked trout should be released in the lower half the stream section, but not right at the bottom.

If you have to stop in the middle to process fish, make sure to mark your place in the stream so you know where to continue shocking.

Identifying and Marking Fish

Identify every fish you can. If you are unsure about the identify of a fish take several digital images of the fish and count it as “unknown 1”, count all fish of the same species as “unknown 1”. Count subsequent new species of unknown fish as unknown 2, unknown 3, etc. and be sure to take several digital photographs.

Mark all trout. The easiest method for marking is a fin clip. Consistently mark all trout with a fin clip. Snip the fin perpendicular to the fin rays so it is clear the fish has been marked. Clip off a small, but noticeable, piece of the **top** of the tail fin during the marking run (day one) and a small, but noticeable, piece of the **bottom** of the tail during the recapture run (day two). Clipping a different part of the tail each day allows recaptured fish to be identified on day one and day two. If a fish is recaptured within the same day do not count the fish the second time it is captured, we do not want to double count fish, this will cause inaccuracy in the population estimate.

Record the species and length of all fishes. Note the appearance of new species on the recapture run, but do not include them with quantitative data collected from the first pass.

Measure and take scale samples from 10 trout in each inch class for trout 4 inches or larger. Record the length of the scale sampled fish to the nearest tenth of an inch.

When you have finished shocking the study reach process fish as described above. Avoid releasing marked fish in the upper one-half of the survey area to minimize the numbers of fish migrating out of the station prior to the recapture run.

Record the amount of time spent shocking (this can be found in seconds on the electrofishing unit).

Recapture

On day two electrofish the same stream reach as day one. Collect all fish making note of any species you did not see on day one, you do not have to count or measure these fish, just note their presence. Place captured trout and new species into coolers, filled with stream water, or into buckets to be measured immediately on a “Belly Board”. Put fresh stream water into coolers every 10 to 15 minutes.

Each trout needs to be measured and examined for a mark. Record the length and if the fish has a mark or not on the RECAPTURE RUN data sheet. Also, mark each trout captured on the recapture run by clipping off a small piece from the bottom of the tail fin. Release trout at the bottom of the study reach or as they are worked up if a “Belly Board” is being used (make sure the individual wearing the “Belly Board” is following at least 50 feet behind the shocking team).

Keep track of the number of trout collected with and without marks on the RECAPTURE RUN data sheet. You only need to pay attention to trout and new species on day two.

Do not include new species collected during the recapture run on the data sheet from day one. Simply note their presence on the RECAPTURE RUN data sheet.

Record the amount of time spent shocking (this can be found in seconds on the electrofishing unit).

7.8 Random Site Protocols

<u>a. Determining Sampling Location</u>

A chapter member or a MITU staff member should contact the area Fisheries Biologist to obtain a list of priority streams. Based on this list we will identify road-stream crossing or other access points for sampling on the priority streams. If road-stream crossings and public access points are not available chapter representative should contact land owners to obtain permission to access and survey the stream.

<u>b. Sampling Protocols</u>

Try to schedule fisheries surveys between June 15 and September 15, but preferably between July 15 and August 30.

On the SURVEY INFORMATION form:

- Stream survey details – check the box for “Random site one-pass” as the purpose.
- Effort details – Record the type of electrofisher used and the number of probes.

<u>c. Fish Survey Protocols</u>

Always sample in an upstream direction. The recommended lengths of stream to be surveyed based on stream size are as follows:

- Small streams <15 feet wide – 500 feet
- Small streams >15 feet wide – 800 feet
- Medium streams – 1200 feet

Before you begin shocking:

- Make sure you know where your starting and ending points are.
- Fill 3-4 coolers about half-way with stream water and close the lids
- Assign tasks to volunteers
  - One person to run electrofisher
  - Two to three people to net fish
  - One to two people to collect netted fish in buckets
  - One person to transport fish from buckets to coolers
  - If you have enough volunteers – two to three people to identify and measure fish

Begin shocking in an upstream direction, so shocked fish flow into your nets. Make sure to shock areas that look like "prime habitat" well. As you collect fish place them in the coolers for storage until they can be processed. Fish less than 1 inch long can be ignored.

Coolers should be filled with stream water. Make sure to keep the lids closed to keep the water as cool as possible. If you do not have bubblers in your coolers, make sure to put fresh stream water into the coolers ever 10-15 minutes. If trout begin to rise to the top it is a sign they are running out of air. If this happens change the water in the cooler and measure and release the fish. Trout should not be left in the coolers for more than about 30-40 minutes.

Put all of the fish you shock into the coolers as you go. If you have enough volunteers, two to three can begin processing fish as they are caught. If you do not have sufficient volunteers to have two people work on identifying and counting fish, place fish in the coolers until they are full or 30 minutes has passed. At that point mark your place and stop to process the fish. Release the fish at the bottom of the stream section to minimize the chance of recapturing individuals.

If you have to stop in the middle to process fish, make sure to mark your place in the stream so you know where to continue shocking.

Identifying and Measuring Fish

Measure and count all fishes.

Identify every fish you can. If you have unsure about the identify of a fish take several digital images of the fish and count it as "unknown 1", count all fish of the same species as "unknown 1". Count subsequent new species of unknown fish as unknown 2, unknown 3, etc. and be sure to take several digital photographs.

Collect scale samples for 10 fish per inch group for salmonid species.

Record the amount of time spent shocking (this can be found in seconds on the electrofishing unit).

7.9 Habitat Data

When you are finished sampling fish fill in the "Stream Habitat Observations" datasheet. Fill in as much of the sheet as you can with the equipment available. Variables to be recorded on this data sheet include: air and water temperature, average stream width, average and maximum depth, substrate composition, channel morphology, and amount and type of fish cover. Describe water level as low, normal, or high. Water clarity should be described with poor, average, good. A description of color and turbidity can also be included here. Estimate substrate composition and channel morphology for the entire stream section. Electrofishing efficiency should be described as poor, average, good.

This datasheet should be completed after each fish sampling event.

7.10 Data

Completed data sheets should be given to MITU staff. If a MITU staff person is present at the sampling event that person will take the data sheets when sampling is completed. If no MITU staff person is present, mail data sheets to MITU:

Michigan Trout Unlimited
P.O. Box 442
Dewitt, MI 48820

MITU will put the data into the format desired by the MI DNRE and send it in. MITU will also prepare a report for the chapter summarizing the findings.

Appendix 7A - Electrofishing Tips and Techniques

Electrofishing Tips and Techniques

- It is a good idea to test the electrofisher before sampling begins.
  - Ideally this should be done a day or two before the sampling event occurs.
  - Two or more people should take the electrofisher to a stream and make sure fish are being stunned when the electricity is turned on.
  - If fish are not being stunned the power needs to be adjusted, refer to your electrofisher handbook for recommendations of settings.

- All crew members must wear polarized sunglasses to help them see stunned fish and to help improve visibility of the stream bottom to reduce tripping

- Begin at the downstream end of the site and work in an upstream

- Every fish is important
  - Everyone is biased towards netting large fish. Your eye naturally goes to the bigger fish. It is important to consciously try to look for small fish. Seeking out small fish can help minimize bias towards catching big fish that catch your eye.

- Make sure to sample all habitat features and the entire stream bottom
  - Think of it like you are vacuuming the streambed and must pass over the entire streambed – moving from one shoreline to the other in a zigzag pattern works well.

- When sampling undercut banks and complex habitat structures (log jams etc.) it often works well to put the probe all the way under the bank or into the structure before turning on the electricity, the pull the probe out in a sweeping motion so the fish follow.

- In riffles and fast moving water, it works well to have the netters positioned downstream of the person operating the shocker with their nets in the water to allow fish to flow into the net.

- It is a good idea to leave the net in the water in fast moving water even if you don’t see any fish as they can be hard to see when they are quickly floating downstream, especially sculpin, and other benthic fish, which travel near the bottom.

Appendix 7B – MITU Fish Sampling Data Sheets

Mark Recapture Fish Survey - Marking Run

Location____

Date:________________ **Gear Type:** __________________ **Weather**: ____________________

Site: ________________ **Site average width (ft):** _____________ **Distance (ft):** _____________

Shocking time marking run: _______________ **Shocking time recapture run**: ______________
Total shocking time: ____________________ **Page** ________ **of** __________

Collectors: ____

Species	Total Length (in.)	Mark (?)	Scale #	Comments

Species	Total Length (in.)	Mark (?)	Scale #	Comments

Page _______ of _________

Mark Recapture Fish Survey - Recapture Run

Location____

Date:________________ **Gear Type:** __________________ **Weather**: ____________________

Site: ________________ **Site average width (ft):** _____________ **Distance (ft):** _____________

Shocking time marking run: _______________ **Shocking time recapture run**: ______________
Total shocking time: ____________________ **Page** ________ **of** __________

Collectors: ____

Species	Total Length (in.)	Recapture (?)	Scale #	Comments

Species	Total Length (in.)	Recapture (?)	Scale #	Comments

Page _______ of _________

One-Pass Fish Survey

Location____

Date:_________________ **Gear Type:** ___________________ **Weather**: _____________________

Site: _________________ **Site average width (ft):** ______________ **Distance (ft):** ______________

Total shocking time: _____________________ **Page** ________ **of** __________

Collectors: ____

Species	TL	TL	TL	TL	TL	TL	TL	TL

Page _____ **of** ______

* TL - total length
** Include scale sample number in TL box for fish from which scales are taken

Species	TL	TL	TL	TL	TL	TL	TL	TL

Page _____ of ______

* TL - total length
** Include scale sample number in TL box for fish from which scales were taken

Appendix 7C – MI DNRE Fish Collection Datasheets

FISH COLLECTION: SURVEY INFORMATION (reduced to fit on this page).

DNR

Stream Status and Trends Program
Fish collection

Survey information
Page 1
Revised 3/22/04

Stream survey details:

Begin date: ________ End date: ________ GPS[1]: Upstream Middle Downstream

Water body: ________ Lat: ________ ________ ________

Station: ________ Long: ________ ________ ________

VSEC I.D. ________ County: ________ T. ________ R. ________ Sec. ________

Station description[2] (describe or map on back of sheet): ________

Purpose: Fixed site marking and recapture run ☐ Random site one pass ☐ Other (explain): ________

Check if station is inaccessible: ☐ Check if station is intermittent/dry: ☐ Check if station has Great Lakes access: ☐

Has station been stocked w/in last 5 years? Yes ☐ No ☐ If yes, indicate species: ________

Crew (first initial, last name): ________

Effort details:

Effort number: ________ Beginning date: ________ Time: ________ Ending date: ________ Time: ________

Effort number: ________ Beginning date: ________ Time: ________ Ending date: ________ Time: ________

Gear: Boomshocker ☐ Backpack ☐ Barge ☐ EF Unit I.D. no. ________

Station length[3] (ft): ________ Station width (ft): ________ Acres: ________ Check if block nets were used[4]: ☐

Gear notes:

No. of anodes: ________ Volts: ________ Duty cycle: ________ Pulse: ________

Notes: ________

Sampling conditions:

Water temp (^oF): ________ Air temp (^oF): ________ Time of temperature recording: ________ AM ☐ PM ☐

Conductivity (µs/cm): ________ Notes: ________

Electrofishing efficiency: Low ☐ Med. ☐ High ☐ Water level: Very high ☐ High ☐ Avg. ☐ Low ☐ Very Low ☐

Weather: Clear ☐ P. Cloudy ☐ Overcast ☐ Rain ☐ Water color: Clear ☐ Gry ☐ Brn ☐ Blk ☐ Green ☐

[1] Record GPS coordinates in decimal degrees to 5 decimal places.
[2] Include access point with reference to nearest road or highway.
[3] **Fixed sites**: Use lengths of pre-existing long-term pop'n estimate stations if they exist. Otherwise, station lengths are 1000'.
Random sites: Sm. stream <15' wide=500', >15' wide=800'; med. stream=1200'; lg. stream=1500', very lg. stream=boomshock for 1 mile.
[4] Fixed sites: Block nets are optional, but should be used consistently.

FISH COLLECTION: SURVEY INFORMATION, page 2 (reduced to fit on this page).

DNR

Stream Status and Trends Program
Fish collection

Survey information
Page 2
Revised 3/22/04

Water body and station: ______________________ Begin date: __________ End date: __________

Site assessment data: *The purpose of this section is to provide a* ***rapid*** *assessment of on-site conditions…devote time accordingly.*

Physical appearance:	Upstream of section midpoint (Check all that apply)				Downstream of section midpoint (Check all that apply)			
Invertebrates[5]	Abundant ☐	Moderate ☐	Sparse ☐	Absent ☐	Abundant ☐	Moderate ☐	Sparse ☐	Absent ☐
Floating algae	Abundant ☐	Moderate ☐	Sparse ☐	Absent ☐	Abundant ☐	Moderate ☐	Sparse ☐	Absent ☐
Filamentous algae	Abundant ☐	Moderate ☐	Sparse ☐	Absent ☐	Abundant ☐	Moderate ☐	Sparse ☐	Absent ☐
Turbidity	Abundant ☐	Moderate ☐	Sparse ☐	Absent ☐	Abundant ☐	Moderate ☐	Sparse ☐	Absent ☐
Oil sheen	Abundant ☐	Moderate ☐	Sparse ☐	Absent ☐	Abundant ☐	Moderate ☐	Sparse ☐	Absent ☐
Foam	Abundant ☐	Moderate ☐	Sparse ☐	Absent ☐	Abundant ☐	Moderate ☐	Sparse ☐	Absent ☐
Trash	Abundant ☐	Moderate ☐	Sparse ☐	Absent ☐	Abundant ☐	Moderate ☐	Sparse ☐	Absent ☐
Comments (presence of crayfish, minnows):								

Instream cover:	Upstream of section midpoint (Check all that apply)				Downstream of section midpoint (Check all that apply)			
Undercut banks	Abundant ☐	Moderate ☐	Sparse ☐	Absent ☐	Abundant ☐	Moderate ☐	Sparse ☐	Absent ☐
Overhanging vegetation	Abundant ☐	Moderate ☐	Sparse ☐	Absent ☐	Abundant ☐	Moderate ☐	Sparse ☐	Absent ☐
Deep pools	Abundant ☐	Moderate ☐	Sparse ☐	Absent ☐	Abundant ☐	Moderate ☐	Sparse ☐	Absent ☐
Boulders	Abundant ☐	Moderate ☐	Sparse ☐	Absent ☐	Abundant ☐	Moderate ☐	Sparse ☐	Absent ☐
Aquatic plants	Abundant ☐	Moderate ☐	Sparse ☐	Absent ☐	Abundant ☐	Moderate ☐	Sparse ☐	Absent ☐
Logs/woody debris	Abundant ☐	Moderate ☐	Sparse ☐	Absent ☐	Abundant ☐	Moderate ☐	Sparse ☐	Absent ☐
Comments:								

Notes, maps, or additional comments:

[5]Note invertebrate abundance on hard surface (such as rock or wood).

Stream Habitat Observation for CLMMU Small-Stream Surveys

Water body: ________________________ Station: ________________________ Date: ________________

Crew: ____

Current Weather: ________________________ Preceding Weather: ______________________________

Air Temperature: ___________@______am/pm Water Temperature: _________@______am/pm

Length of station: __________________________ Average stream width: __________________________

Depth range: _________________________ Maximum depth: _______________________

Water level: ________________________

Water clarity: _______________________

Substrate composition:
_______% silt
_______% sand
_______% gravel
_______% cobble
_______% boulder

Stream channel morphology:
_______% pool
_______% run
_______% riffle

Electrofishing efficiency: ____

Presence and type of fish cover: ____

Other comments