CLINTON RIVER WATERSHED COUNCIL

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Michigan Clean Water Corps (MiCorps)

Adopt-A-Stream Program: QAPP

Revision #3

_Eric Diesing________________________ __02/23/2022________________
CRWC Watershed Ecologist Date

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MiCorps Reviewer

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Signature Upon Approval Date

QAPP is approved for two years after the signature date given; afterwards it must be reapproved.

(A2) Table of Contents

Section A: Project Management

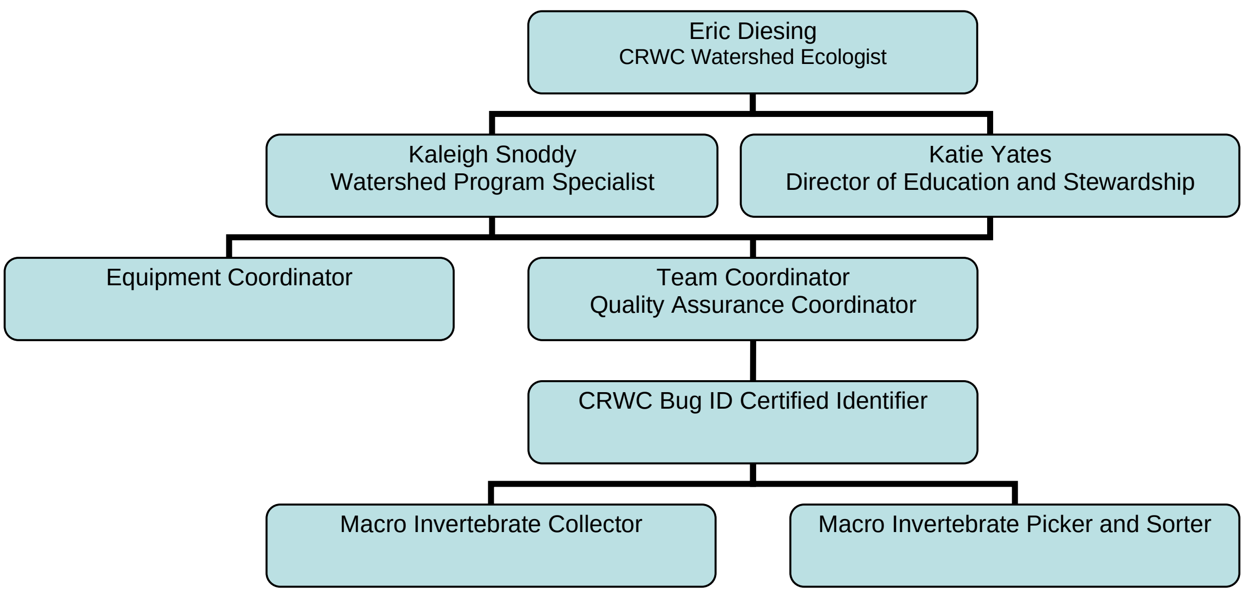
(A3) QAPP Distribution List

Eric Diesing, CRWC Watershed Ecologist
Katie Yates, CRWC Director of Education and Stewardship
Kaleigh Snoddy, CRWC Watershed Program Specialist
Tamara Lipsey, EGLE, MiCorps
Cleyo Harris, MDNR, Fisheries Biologist
Paul Steen, Huron River Watershed Council, MiCorps Stream Program Manager

(A4) Project Organization

Individual	Watershed Role	Roles/Responsibilities	Special Responsibilities
Eric Diesing 248-601-0606; eric@crwc.org	CRWC Watershed Ecologist	QA Project Manager, Program Manager, Volunteer Trainer, Macroinvertebrate Identification Verification	Management, Field, Laboratory, Corrective
Katie Yates 248-601-0606; katie@crwc.org	CRWC Director of Education and Stewardship	Volunteer Trainer, Macroinvertebrate Identification Verification	Field, Lab, Volunteer Training Support
Kaleigh Snoddy 248-601-0606; kaleigh@crwc.org	CRWC Watershed Program Specialist	Volunteer Trainer, Macroinvertebrate Identification Verification	Field, Lab, Volunteer Training Support

Adopt-A-Stream Program Organization Chart



(A5) Problem Identification and Background

Forty percent of Michigan's population lives in the three-county metropolitan Detroit area (Macomb, Oakland, and Wayne counties) in the southeast portion of the state. More than 1.5 million people in over 60 municipalities inhabit the Clinton River Watershed. The Main Branch of the Clinton River is divided into three “subwatersheds” - Upper, Main and East. The river’s four largest tributaries have their own subwatersheds—Paint Creek, Stony Creek, North Branch and Red Run. Water within each of these subwatersheds flows into the Clinton River and eventually into Lake St. Clair. Precipitation that falls within the Lake St. Clair subwatershed drains directly into Lake St. Clair via a primarily closed storm drain system.

Land use within the watershed is varied: the southern portion is urban, the middle section is made up of developing suburbs, and the northern region, while still largely rural, will soon be engulfed by developing suburbs. The condition of the river and its tributaries varies dramatically, from runoff and pollution problems in urban areas, to healthier waters with thriving trout fisheries in suburban and rural areas. Stormwater volume, sediment and bacteria continue to be the most prominent pollutants challenging water quality and habitat.

Water quality in the Clinton River has improved dramatically over the past thirty years. Industrial discharges are now regulated under the Clean Water Act. While live fish couldn't be found from Pontiac to the mouth of the Clinton in the 1960s, a large, varied fishery exists today. Many people enjoy canoeing, fishing, boating and riverfront parks throughout the watershed.

The Clinton is typical of an urban river. When it rains, urban and suburban development in the watershed result in higher river flows than we see in natural watersheds. Water that runs off of our yards and paved surfaces (including roads, sidewalks, rooftops and parking lots) discharges into our waterways, carrying with it dirt, fertilizers, pesticides, oils, metals and other pollutants. The sheer volume of water entering the river during storm events results in significant erosion and sedimentation which in turn results in the destruction of habitat.

Currently more than 40 local and county governments and numerous other public entities across the watershed that are subject to Phase II of the National Pollutant Discharge Elimination System (NPDES) under the Clean Water Act have formed 7 subwatershed planning groups—Upper Clinton, Clinton Main, Stony/Paint, North Branch, Red Run, Clinton River East, and Lake St. Clair Direct Drainage. Each group has charted a course to fulfill the requirements of their stormwater permits by working together on a subwatershed basis, sharing data and information and creating joint planning documents.

As a part of this planning and permit effort, each of these 40+ communities had to complete Public Education Plan (PEP) for educating the public on how to reduce stormwater pollution and protect our local water resources. A key component of these communities’ PEPS was the inclusion of a volunteer water quality monitoring program, the Clinton River Watershed Council’s Adopt-A-Stream program.

The CRWC will use these data to help establish a baseline for water quality at specific sites in the Clinton River and its tributaries. Our hope is that this information will be used to educate the public, making it easier to actively improve the water quality of this region. Therefore, we will submit this data to necessary State and local authorities.

(A6) Project Description

The Clinton River Watershed Councils Adopt-A-Stream volunteer water quality-monitoring program goals are to:

1. Educate citizens about water quality concepts and water quality issues in the watershed. More specifically, it is our goal to help communities in the watershed achieve the objectives of the EGLE Phase II PEP Categories, with particular emphasis on educating the public about:

   a. their responsibility and stewardship in their watersheds,
   b. the location of residential separate storm water drainage system catch basins, the waters of the state where the system discharges, and potential impacts from pollutants from the separate storm water drainage system,
   c. how to identify and report possible illicit discharges,
   d. the management of riparian lands to protect water quality.
2. Develop a long-term record of benthic macroinvertebrate communities and habitat quality that can be used by municipalities in developing and implementing their subwatershed management plans;
3. Determine whether water quality is changing over time (trends);
4. Screen for potential water quality problems throughout the watershed;
5. Use this program as a way to significantly increase involvement of citizens in watershed restoration and protection activities; and
6. Increase community awareness of, affinity for and involvement with the Clinton River Watershed Council.

Monitoring volunteers will be recruited from subwatersheds of the Clinton River. Training sessions will be held throughout the subwatersheds for the convenience of volunteers. Recruitment occurs through a variety of workshops, presentations and community displays. Recruits go through a detailed two step training process: field training and benthic certification. Volunteer recruitment, training and retraining will be conducted annually from January through April and in July through September. Specific emphasis will be on training volunteers on quality assurance so that the data collected can be used by municipalities and state agencies in making resource management decisions. Protocols and analysis strategies have been selected to ensure the greatest reliability and accuracy possible for the program.

Field Training: Volunteers are required to attend the Field Training Session. Volunteers will get a more complete understanding of water quality monitoring and the goals of the Adopt-A-Stream program. This session explains physical and biological monitoring in depth. After learning about sampling methods in the classroom, volunteers will go out to the field and test their knowledge by performing physical and biological monitoring practices. Also covered are safety protocols and an overview of volunteer tasks and monitoring timelines.

Benthic Certification: Individuals who are particularly interested in identifying benthic macroinvertebrates can take this class. Volunteers who attend this session, and successfully complete an identification quiz, are eligible to become “bug identifiers.” Each monitoring team will be assigned at least one “expert” identifier. Volunteers must receive a 96% on their quizzes to receive certification.

Recertification and Refresher Sessions: Volunteers will be invited to attend training sessions for review and any program updates on a yearly basis. Team Coordinators are required to attend refresher field training every three years. Certified Bug Identifiers are required to attend benthic certification classes if data analysis finds more than two mistakes in one monitoring season.

Sites for this program are primarily selected to <u>characterize</u> the Clinton River, its tributaries, and drains. For the original sites, a consultant was hired to map the subbasins of each watershed. Sites that were established by specific subwatersheds for watershed planning will be selected first, with additional sites added based on land use, confluence of tributaries, and recommendations by consulting firms assisting with watershed planning in the Clinton River Watershed.

Sites will be reaches primarily upstream of key road crossings due to their easy access, prior collection of data at these sites and the limited amount of sizable buffered streams/river areas within the watershed.

Additional monitoring sites will be selected based on the following criteria:

a) site conducive to adopted protocols
b) safe access
c) site has been selected by the CRWC as a location for baseline data collection
d) site is upstream or directly downstream of conversion of two water bodies
e) site location within subwatershed sub-basins has been considered (land use, location of other sites)
f) data from site would be helpful to subwatershed planning or BMP implementation
g) site is within similar data has been collected from site in recent years
h) sites are in reasonable proximity to volunteers homes

Consideration is also given to the size of the subwatershed, with more sites, ideally occurring in larger watersheds. Additional sites will be added as more volunteers are recruited and trained.

If requested, the Project Manager will also add impact assessment sites. This will be done by picking one site upstream of the potential pollution source (the reference or control site) and one or several sites (impact and recovery sites) downstream.

Teams will generally consist of 3-5 members. All teams must consist of at least three trained adults at least two trained adults must be available for any monitoring event. At least one team member needs to be “Benthic Certified.”

Macroinvertebrate and habitat assessments will be conducted in May and October. These times have been selected due to reliable water flow (there is often low flow into September) and presence of a diversity of species. In order to meet program goals, each of these evaluations is a critical component of the overall study.

Macroinvertebrate samples will be collected from all available habitats with a 1mm mesh D-net starting downstream and moving upstream for approximately 35 - 45 minutes with an area of no more than 300 feet maximum. If two collectors are in the stream at the same time, samples will be collected for 20 minutes by each person. All organisms found will be identified and placed in a sample vial to be returned to the watershed. This identification protocol allows data to be used in a total stream quality score MiCorps monitoring protocols.

For habitat evaluation, volunteers will note the relative proportions of substrate, riparian vegetation, and the extent of sedimentation. Observations concerning land use and potential sources/causes of stress also will be recorded. For informational and educational purposes, volunteers will also record characteristics such as water odor and color.

Macroinvertebrate taxonomy will take place in June and November. Following each assessment, all data received from the volunteers will be entered into a computer spreadsheet and analyzed. Results will be provided in summary format, at minimum, on an annual basis to interested volunteers, CRWC members, the general public, municipalities and other parties participating in the Clinton River Watershed Subwatershed Advisory Groups and EGLE. Data will be evaluated against any baseline data already established.

It is our goal to post data and results summaries to our Web site. Results will be used by the Clinton River Watershed Council to educate watershed residents, students, government officials and businesses/organizations on water quality trends within the watershed. Results will also be used by municipalities within the watershed to help guide the development and implementation of their subwatershed management plans. Trends in water quality and identification of sites that are experiencing significant impact will be particularly useful to the subwatershed planning and stormwater BMP implementation processes. Additionally, results will be uploaded to the MiCorp data exchange on an annual basis.

Primary constraints are supplies and manpower. As in any project cost of supplies are at the utmost concern. One monitoring kit is approximately $225. A lack of volunteers could pose a potential constraint on this project. Since we have a large area to cover, and limited staff and volunteer time, this is a realistic concern. Promotion and recruitment will focus on overcoming noted challenges.

Task Timetable												
Task	J	F	M	A	M	J	J	A	S	O	N	D
Conduct New Volunteer Trainings			**X**	**X**			**X**	**X**	**X**			
Conduct Refresher Volunteer Trainings	**X**	**X**	**X**					**X**	**X**			
Inventory Monitoring Equipment Kits/Calibrate Equipment			**X**	**X**					**X**			
Purchase and Re-stock Monitoring Equipment Kits as Needed	**X**							**X**				**X**
Confirm Team Coordinators Status, Re-assign Team Coordinators as Needed, Confirm volunteer participation/Re-assign as needed, Assign New Volunteers to Monitoring Sites				**X**					**X**			
Conduct Adopt-a-Stream Monitoring					**X**					**X**		
QA-Conduct side-by-side Monitoring (20% sites); Observe team at site and correct protocols as needed- QA Level II					**X**					**X**		
QA-Verify Macroinvertebrate Identification; Note Problems; Take Corrective Actions as Needed					**X**	**X**				**X**	**X**	
Analyze Data and Complete Annual Report	**X**					**X**	**X**				**X**	**X**

(A7) Data Quality Objectives

Stream Crossing Watershed Survey procedures and GLEAS Procedures # 51 are commonly used by consultants and volunteer monitoring groups across Michigan. To increase comparability of results from this program to data collected by other groups or at previous times, protocols used in this program reflect the above listed EGLE procedures to the fullest extent possible. Any changes in protocols have been made to increase the quality of data collected by volunteers and to ensure the sustainability of the program.

Data collected at an individual site will be comparable to data collected at other sites and representative of conditions within each subwatershed because: 1) all data collection occurs within a 100-300 ft reach (most sites do not allow access to a longer reach than 300 ft) and 2) the same data entry form is used by each team for data acquisition.

Primary monitoring sites will be located directly upstream of road crossings. Additional reference sites will be located in “pristine” areas of the watershed and/or adjacent to areas that implement best management practices (BMP) in an effort to monitor water quality under “the best possible conditions” within the watershed. Reference sites will be noted as such during analysis and reporting. As waterways in the Clinton River Watershed are very flashy, in the event of high water or other unsafe monitoring conditions at the time of planned monitoring, volunteers are asked to complete the entire monitoring process at a later time during the identified monitoring month when water levels are below 3ft and/or closer to typical seasonal levels.

CRWC's Watershed Ecologist and Programs Coordinator will perform quality assurance review of all data forms. Data from the current season will be compared with prior seasons as needed as part of the quality assurance review. Watershed Ecologist will contact Team Coordinators for clarification and/or retraining whenever any questions of completeness, accuracy or precision are in question. CRWC will also make a "good faith" effort to complete comparison assessments of at least 25% of the monitoring sites each year. This effort will also allow CRWC to establish higher level quality assurance.

Representativeness

For road/stream crossings, volunteers are instructed to monitor pre-selected sites approximately 25 feet upstream of road crossings to avoid direct impact from roads. For all sites, as much as the local area allows, sites are established to represent the full variety of stream habitat types available locally, emphasizing the inclusion of riffle habitat. Site locations have been pre-established by the Project Manager and recommendations are provided to Team Coordinators on where to monitor. Team Coordinators are directed to take photos and/or make a drawing to show the reach and surrounding environment.

Comparability

CRWC's primary goal is to establish comparability of data collected within the Clinton River Watershed by CRWC, EGLE and various consulting firms and/or municipal efforts to gather baseline data for watershed management purposes. By using standardized sampling methods and units of reporting, and documenting them in CRWC's QAPP, comparability can be achieved in future monitoring efforts by following the QAPP. Procedures used are based on the revised GLEAS Procedure #51 (2002), Stream Crossing Watershed Survey Procedure (April 27, 2000) and MiCorps training procedures, increasing comparability with monitoring completed across Michigan.

Monitoring will take place the first Saturday in May and October. CRWC anticipates that monitoring during this season will reflect state-wide efforts to gather data during stable, normal flow conditions. Since macroinvertebrate identification occurs at the order level for the MiCorps program, and because a wide variety of macroinvertebrates can be found during both September and October, CRWC doesn't anticipate significant discrepancies in comparability of data based on seasonality. Because the Clinton River Watershed is highly urbanized, CRWC does anticipate significant differences in macroinvertebrate populations and habitat conditions found within its watershed versus those found less urbanized watersheds.

Completeness

Following a QA review of all collected and analyzed data, data completeness will be assessed by dividing the number of measurements judged valid by the number of total measurements performed. The data quality objective for completeness for each parameter for each sampling event is 90%. If the program does not meet this standard, the Watershed Ecologist will consult with external agencies who are considered leaders in stream monitoring (ex. MiCorps) to determine the main causes of data invalidation and develop a course of action to improve the completeness of future sampling events. The equation used: $\%C = V / T \times 100$

Precision

Since there is inherent variability in accessing the less common taxa in any stream site and program resources do not allow program managers to perform independent (duplicate) collections of the sampling sites, our goal for quality assurance is conservative.

Teams will use replicate field sampling methods. All volunteers will be trained to follow the same SOP's with emphasis on:

1. collecting style (must be thorough and vigorous)
2. habitat diversity (must include all habitats present and be thorough in each one)
3. the transfer of collected macroinvertebrates from the net to the sample jars (thoroughness is critical)

Team Leaders are in charge of quality control on site. They will read SOP's out loud to volunteers during each monitoring session. Data entry forms include sections on:

1. all names of team members that are monitoring that day
2. sampled habitats-collectors are required to check off all habitats sampled that day
3. site drawings- include all riparian information, aquatic habitat information

Accuracy and Bias

To address accuracy the CRWC will maintain a voucher collection. After each monitoring event all collected samples will be checked for accurate identification. This will be done by a qualified bug ID expert and the program quality assurance manager. CRWC maintains a collection of laboratories received benthics for identification reference. %A= # of valid samples / T x 100

(A8) Training Requirements and Certification

All volunteers will be trained in a consistent manner (by CRWC staff or approved, trained Adopt-a-Stream Volunteers) to ensure that the protocols are conducted properly and in a standardized fashion. At least one investigator for each site will be a skilled in field aquatic sampling methods and organism identification (Team Coordinator). CRWC staff will complete MiCorps workshop and side-by-side training. Whenever possible, Adopt-A-Stream Volunteers selected to provide training to other volunteers will also complete MICORPs workshop training and will be trained and observed by CRWC staff prior to training volunteers on their own.

Training includes a background presentation on the monitoring program and how the tasks that the volunteers are being trained to carry out fit into the overall program, demonstration by the trainer of the tasks, practice by the volunteers, closely watched by the trainer, feedback on volunteer performance at the training session, and a formal acknowledgement of successful completion of the training which is achieved by sending certificates to trained volunteers.

Field Training: Volunteers are required to attend the Field Training Session. Volunteers will get a more complete understanding of water quality monitoring and the goals of the Adopt-A-Stream program. This session explains physical and biological monitoring in depth. After learning about sampling methods in the classroom, volunteers will go out to the field and test their knowledge by performing physical and biological monitoring practices. Also covered are safety protocols and an overview of volunteer tasks and monitoring timelines. Special emphasis is placed on:

1. collecting style (must be thorough and vigorous)
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Benthic Certification: Individuals who are particularly interested in identifying benthic macroinvertebrates can take this class. Volunteers who attend this session, and successfully complete an identification quiz, are eligible to become "bug identifiers." Each monitoring team will be assigned one "expert" identifier. Volunteers must receive a 96% on their quizzes to receive certification.

Recertification and Refresher Sessions: Volunteers will be invited to attend training sessions for review and any program updates on a yearly basis. Team Coordinators are required to attend refresher field training every three years. Certified Bug Identifiers are required to attend benthic certification classes if data analysis finds more than two mistakes in one monitoring season.

Training records will be kept as part of CRWC's volunteer database.

Data entry will be completed or reviewed by Watershed Ecologist for accuracy.

Section B: Project Design and Procedures

(B1) Study Design and Methods

The CRWC views Adopt-A-Stream as being essential to evaluating the baseline data of flowing water in the Clinton River watershed. By tracking trends, we hope to provide information for communities that will influence planning, watershed management, resource protection, etc. Critical information includes the baseline data for streams in the Clinton River watershed including changes in benthic populations and physical habitat. Therefore, each element is important to the relative context of each stream sample. That is, each site provides a micro-sample of a stream system.

Safety

Volunteers are asked to wait at least three days after heavy precipitation before sampling. There is a place on the field data sheet to note the extent of precipitation in the previous days. It is recognized that during extremely wet periods, sampling may have to be delayed.

Volunteers are asked to work in groups of three or more and asked not to monitor alone. Safety procedures are discussed during the training sessions (see "Safety Guidelines" in the Appendices). Written copies are provided to each volunteer and placed in the site monitoring kits. Site teams are asked to monitor on the first Saturday of May and the first Saturday of October. However, if conditions do not permit monitoring on that day, we ask them to complete it no later than the second Sunday of the month. If a volunteer cannot make a scheduled sampling visit for any reason, they must notify the Team Coordinator. If only one volunteer is available for monitoring, the Team Coordinator will contact CRWC and the Project Manager will attempt to find a replacement. If a replacement cannot be found, then the site visit may have to be rescheduled or canceled. Final decisions on monitoring visit dates will be made by each site's Team Coordinator.

If site access requires crossing private property, then Team Coordinators must seek permission from the owner. This shouldn't be a problem because most sites will be located at road crossings or prior arrangements will have been made by either CRWC or the municipality where the site is located. All volunteers will be provided with CRWC Adopt-a-Stream monitoring signs to place in their vehicles when monitoring to identify themselves.

Frequency

The choice of sampling frequency is based on the rate at which change is likely to occur in the measurements. Due to the rapid development that is occurring in much of the Clinton River Watershed, CRWC has elected to monitor macroinvertebrates and habitat parameters twice a year. It is anticipated that some sites may very well experience change in conditions in less than one year. While certain areas of the watershed and waterways are stable or in above average condition, repeated sampling will allow CRWC to build a larger set of baseline data.

Concern over non-point source pollutants from stormwater is a major reason this program has been established, however, the program is currently designed to assess general conditions based on cumulative pollutant loads and extreme conditions. Therefore monitoring during wet weather conditions is not currently a part of the program.

Sampling Period

Frequency of monitoring is twice a year, on the first Saturday of the May and October. However if conditions do not permit monitoring on these days, monitoring will be completed no later than the second Sunday of the month.

Time of Day Sampled

Restrictions are not currently placed on the time of day when volunteers can monitor (other than when daylight is available). Time of day will not affect habitat assessments or macroinvertebrate sampling.

Sample Site Selection

Sites for this program are primarily selected to characterize the Clinton River, its tributaries, and drains. Originally, a consultant was hired to map the subbasins of each watershed. Sites that were established by specific subwatersheds for watershed planning will be selected first, with additional sites added based on land use, confluence of tributaries, and recommendations by consulting firms assisting with watershed planning in the Clinton River Watershed.

Sites will be reaches primarily upstream of key road crossings due to their easy access, prior collection of data at these sites and the limited amount of sizable buffered streams/river areas within the watershed.

Monitoring sites will be selected based on the following criteria:

i) site conducive to adopted protocols
j) safe access
k) site has been selected by the CRWC as a location for baseline data collection
l) site is upstream or directly downstream of conversion of two water bodies
m) site location within subwatershed sub-basins has been considered (land use, location of other sites)
n) data from site would be helpful to subwatershed planning or BMP implementation
o) site is within similar data has been collected from site in recent years

p) sites are in reasonable proximity to volunteers homes

Consideration is also given to the size of the subwatershed, with more sites, ideally occurring in larger watersheds. Additional sites will be added as more volunteers are recruited and trained.

If requested, the Project Manager will also add impact assessment sites. This will be done by picking one site upstream of the potential pollution source (the reference or control site) and one or several sites (impact and recovery sites) downstream.

The CRWC site list is given in Appendix B.

Equipment Selection/Storage

D-nets with 1 mm mesh are the current standard for most macroinvertebrate monitoring programs and are therefore, the nets used by this program. All nets have CRWC AAS marked on them and 1ft, 2ft, and 3ft markings on the handle. Tweezers, droppers, spoons, squirt/rinse bottles, first aid kit supplies and various other small items.

Microscopes, thermometers and field guides are stored at CRWC's office along with extra hand lenses. Items are stored in dry basement.

Equipment will be used at one site only. Therefore, cross contamination or the spread of invasive species or organisms should not be a problem. However, in the event that any sampling equipment will be used at multiple sites, any item that comes in contact with water (waders, nets, tubs, buckets, ice cube trays, bulbs and tweezers) will be cleaned appropriately (either washed in a bleach solution or hot, soapy water and rinsed thoroughly) by the Watershed Field Assistant and/or a trained volunteer using indoor sinks leading to city sewage treatment facilities (not septic fields). In the event that equipment is not washed, it will dry completely for at least 3 days before use.

Methods Reference

MiCorps Volunteer Stream Monitoring Program: Monitoring Procedures. December 2020. https://micorps.net/wp-content/uploads/2021/01/VSMP-MonitoringProcedures.pdf

Benthic Macroinvertebrate Monitoring

Sampling will take place during the first weekends of May and October. These months have been selected due to reliable water flow and presence of a diversity of species. Sites will be primarily upstream of key road crossings due to their easy access, prior collection of data at these sites and the limited amount of sizable buffered streams/river areas within the watershed.

Macroinvertebrate samples will be collected from all available habitats (riffles-downstream and upstream, pools, leaf packs, tree roots, snags, submerged logs, undercut banks, overhanging vegetation, aquatic plants and sediments) with a 1 mm mesh D-net starting downstream and moving upstream for approximately 30 minutes. All collected organisms will be placed into one composite sample before identification begins. The composite sample will be separated into ice cube trays by visually similar animals. The certified identifier will then identify all animals from the ice cube trays to the level noted below.

Common Name	Scientific Taxa
Hellgramite (Dobsonfly)	Megaloptera, Corydalidae
Clubtail Dragonfly	Odonata, Gomphidae
Sensitive True Flies (water snipe fly,net winged midge, dixid midge)	Athericidae, Blephariceridae, Dixidae,
Stonefly	Plecoptera
Caddisfly	Trichoptera
Mayfly	Ephemeroptera
Alderfly	Megaloptera, Sialidae
Scud	Amphipoda
Dragonfly	Odonata
Beetle	Coleoptera
Somewhat Sesitive True Flies	Dipterans (those not listed elsewhere)
Crayfish	Decapoda
Bivalves/Snails	Pelecypoda, Gastropoda
True Bug	Hemiptera
Damselfly	Odonata
Sowbug	Isopoda
Tolerant True Fly (mosquito, rat-tailed maggot, solider fly)	Culicidae, Syrphidae, Stratiomyidae
Leech	Hirudinae
Aquatic Worm	Oligochaeta

This identification protocol allows data to be used in a total stream quality score (excellent, very good, good, fair, fairly poor, poor, very poor) as directed MiCorp order level identification procedures. Results compiled from these indices when monitoring is conducted by volunteers proved to agree most closely with those results obtained by professional biologists following the same monitoring protocols. Indices used when individual specimens are identified include:

- Total Number of Taxa
- Total Number of Ephemeroptera
- Total Number of Trichoptera
- Total Number of Plecoptera
- Percent Ephemeroptera
- Percent Trichoptera
- Percent Contribution of Dominant Taxon
- Percent Isopoda, Gastropoda, Hirudinae
- Percent Surface Dependent

Results for each of the indices provide potentially useful information that can't be gleaned from the Stream Crossing Watershed Survey monitoring procedures alone. For example, high numbers of lunged snails (Pulmonata) can be an indicator of low oxygen levels, which often occurs due to organic wastes or nutrients. Most non-insects are found in areas with more significant pollution problems. See Appendix C for Standard Operating Procedures. Following field identification by the teams certified identifier, CRWC staff will further identify macroinvertebrate samples to the family level for internal data usage. This taxonomic resolution allows Adopt-A-Stream data to be closely aligned with Michigan Department of Environment, Great Lakes and Energy (EGLE) Procedure 51 data.

All macroinvertebrates are identified, and placed in 70% isopropanol filled specimen jars (2-3 available in each kit), correctly labeled (ie. Site code, date). All sample vials from a single site are placed in a single labeled gallon freezer bag. Freezer bags are returned to CRWC in the monitoring kits within 5 days of monitoring. All bags from one season are placed in a cardboard storage box with a lid and placed in the CRWC dry storage facility.

<u>Habitat Assessment</u>

Volunteers also will evaluate habitat and physical conditions at each site as part of the May and October monitoring. They will note the relative proportions of substrate, riparian vegetation, and the extent of sedimentation. Observations concerning land use and potential sources/causes of stress also will be recorded. These physical observations are necessary as a complement to the benthic data in order to fully evaluate site conditions.

The primary habitat assessment process will follow the Single Site Watershed Survey protocols established by the Stream Crossing Watershed Survey Procedure and MICorps. Additional habitat assessment information will be gathered using the GLEAS Procedure #51 protocols. However, only those metrics which apply to both riffle/run and glide/pool streams and are deemed the most significant will be assessed. The remaining items are significantly more complex therefore there is a concern that data collected for those metrics will not be accurate when assessed by the average volunteer and that frustration over collecting accurate data for these items may reduce volunteer interest in the program. See Appendix D for Standard Operating Procedures.

<u>Invasive Species Decontamination Procedures</u>

It has been seen that invasive species can have significant detrimental impacts on Michigan's ecosystems, native flora and fauna. To address this issue, all Adopt-A-Stream teams will be provided with basic invasive species decontamination equipment (lint roller, diluted bleach solution in spray bottle, tap water in spray bottle, bristled scrub brush, hoof pick, disinfectant wipes) and instructions for the use of this equipment in each kit. CRWC Adopt-A-Stream training will include common invasive species identification information and instruction for equipment decontamination procedures. Additionally, all equipment will be decontaminated according to MiCorp protocols upon return to CRWC facilities. This decontamination will take place after each monitoring event (first weekend in May and first weekend in October, yearly).

<u>Sample Handling and Custody</u>

The following documentation will occur through this program:

1. **Field data sheets**
2. **Sample identification**
3. **Quality Assurance notes**
4. **Equipment maintenance/calibration log**
5. **Sample archives and/or voucher collections**
6. **Sample Disposal**

1. **<u>Field data sheets</u>** are completed on-site at the time of sampling. These sheets are provided in the monitoring equipment kits and on CRWC's website. Team Coordinators will complete these data sheets for their sites each monitoring season. (See Appendices for copies of forms.) All data sheets will be returned to the Adopt-a-Stream Program Coordinator after completion in the monitoring kit clipboard no later than 5 days after monitoring. Field data sheets will be stored at the CRWC office for 5 years.

Any time a volunteer records a reading outside of the expected range or that is suspect for any other reason (e.g. one site is much higher than the rest), the volunteer will:

• Do what's possible to verify/fix before leaving the site: e.g. take another reading, check equipment, etc.
• Report to Project Manager immediately. The supervisor should discuss the situation with the sampler and decide whether to make a site visit to resample.

All records from the field data sheets will be maintained in the Adopt-a-Stream database to ensure that historical data are not lost. CRWC staff and/or trained volunteers will enter data into the database and complete necessary analysis. To ensure data is being correctly transferred from paper data sheets to the electronic system, 10% of the data sheets will be selected and cross-referenced between the paper and electronic data forms. If errors are identified, a CRWC staff member or trained volunteer will correct the errors. If there are greater than 10% errors in the database, all data entered for the season will be checked by the Project Manager. Any volunteers responsible for errors in data entry will be contacted and additional training will be provided if necessary.

The Team Coordinator is responsible for labeling and securely closing the sample jars, placing jars into the Adopt-A-Stream kit, returning the kit and sample to the CRWC office. Upon return to CRWC, the collections are checked for labels, the data sheets are checked for completeness and for correct information on the number of jars containing the collection from the site. Collections are kept in a labeled cardboard box in the CRWC office until identifications are verified by the Project Manager. The data sheets are used on the identification day, after which they remain on file indefinitely. When verification is complete, alcohol in the jars is changed as needed, and all sample collections are placed back in a cardboard box and placed in storage at the CRWC office for future reference.

As transfers only happen between Team Coordinators and the Project Manager, custody transfer forms are not used.

3. Quality Assurance notes are made as the Project Manager verifies macroinvertebrate identification and reviews field data sheets. These sheets are kept with the data forms for the season along with notes on any actions taken. QA documentation generated from this project will be maintained by CRWC for the duration of the program.

Identification resources include:

- *A Guide to Common Freshwater Invertebrates of North America*. Voshell, J. Reese Jr. 2002
- *Aquatic Entomology; The Fishermen's and Ecologists' Illustrated Guide to Insects and Their Relatives*, McCafferty, W. Patrick. 1998
- *Freshwater Macroinvertebrates of Northeastern North America*. Pecarsky, Barbara L. et al. 1990.
- *Guide to Aquatic Insects and Crustaceans. Izaak Walton League of America. 2006.*
- *Introduction to the Aquatic Insects of North America*. Third Edition. Merritt, R.W. and K.W. Cummins.1996.
- *How to Know the Aquatic Insects*. Lehmkuhl, Dennis M. 1979.

4. The Equipment Maintenance/Calibration Log will be updated during April and September of each year in preparation for monitoring seasons or as issues arises. Each season an equipment inventory is done for each monitoring kit using a master checklist. Dispensable items are replaced and items are inspected for damage. Anything needed is replaced. Thermometers are calibrated and discarded if an error there is a discrepancy of one-degree Celsius.

4. **Sample archives and/or voucher collections:** Specimens collected by volunteers will be stored indefinitely by CRWC for future training/verification purposes.
5. **Sample disposal:** All specimens that will not be preserved will be returned to the water. Invasive species will be placed in trash.

(B2) Equipment Testing, Inspection, and Maintenance Requirements

All equipment will be inspected by site Team Coordinators after each use. If any repairs/replacements need to be made, the Team Coordinator will inform the CRWC staff and corrections will be made prior to additional use. Team Coordinators are asked to rinse all equipment used at the monitoring site and again, at home using a fresh water source (preferably on the lawn) to prevent transfer of any species or contaminants. In addition, CRWC staff or trained volunteers will inspect all equipment at the end of each monitoring season and prior to subsequent monitoring seasons or if damage reported.

Thermometer Instrument Calibration and Frequency

The only instruments requiring calibration are the thermometers. This will be done by placing thermometers into a jar of water which has been allowed to attain room temperature and taking readings from each. If the reading of a thermometer deviates from the average temperature by more than 1 degree Celsius, it will be properly discarded and replaced. These calibrations will be done prior to each monitoring season. To calibrate thermometers, the CRWC will use a range of temperatures typical to those found during the months in which monitoring takes place

Equipment Type (Quantity per Kit)	Type of Inspection	Available Parts	Maintenance, Corrective Action
Storage Tub with lid (1 large)	Not broken, CRWC label, clean	None	Replace label as needed, clean, purchase replacement as needed
Storage Tub with lid (1 small)- placed inside large tub with most supplies	Not broken, CRWC label, clean	None	Replace label as needed, clean, tape small cracks as needed, purchase replacement as needed
D Net (1)	free of holes and canvas net firmly attached, depth markings clear-1, 2, 3ft, CRWC AAS clearly labeled	Several replacement nets on hand in storage room, pliers to adjust net rings in office	Adjust canvas net as needed so it is firmly attached with metal rings, re-label depth and CRWC markings as needed, replace net if it has holes
Five Gallon Bucket (1)	Free of cracks, CRWC label, clean	None	Replace label as needed, clean, purchase replacement as needed
Waders (2) 1 pr 13 or 12 & 1 pr 10 or 11 (NOTE SIZES) (waders placed inside bottom of large tub)	Look for visible tears, put on and wet to test for leaks before and after repair if damage suspected	Neoprene strips and glue for mending	Follow instructions on repair kit-generally glue neoprene strip to inside of wader or glue along seams
Storage Clipboard (1)	No cracks in lid, inner storage lid not broken, closes properly, reminder labels on lid in good condition	Keep 1 extra clipboard on hand, blank labels, originals in AAS binder	Replace clipboard and labels as needed
Car Signs (10)	In good condition	Original in AAS binder	Restock as needed
Collectors Permit (1)	MDNR permit has current calendar year on it	Original in office	Replace as needed
Blank Liability Waivers (10)	In good condition	Original in AAS binder	Restock as needed
Laminated Equipment Kit List (1)	In good condition	Original in AAS binder	Restock as needed
Laminated SOPs (1)	In good condition	Original in AAS binder	Restock as needed
Laminated ID Keys (1)	In good condition	Original in AAS binder	Restock as needed

Return Envelopes for forms (postage pd) (5)	Make sure envelope flaps aren't stuck together	Envelopes, CRWC stamp, and stamps in office	Restock as needed
Waterproof Data Forms (5 sets)	In good condition	Original in AAS binder, stock of waterproof paper in office	Restock as needed
Invasive Species ID Cards (1 set) (Bag labeled: "Invasive Species ID Cards & ID Labels"	In good condition inside undamaged quart Ziploc bag	Extras cards in top drawer of resource bin by door, extra bags	Restock as needed, replace zip loc bag as needed
ID labels for Macro Collection Vials (5 sets)	5 complete sets in paper clips in quart Ziploc bag	Original in AAS binder	Restock as needed
Dropper (4)	No holes in them	Extras in AAS cabinet	Replace as needed
Tweezers (4)	Tips come together, colored string/ribbon on them	Extras in AAS cabinet	Attempt to straighten if bent (cost $5 each), replace if they can't be straightened
Hand lenses (2)	Lenses are clean and reasonably free of scratches; ribbon/string on each to help locate if dropped	Extras in AAS cabinet	Use dish soap and water to clean lenses as needed; replace if broken
Ruler (1)	Check for damage	None	Replace as needed
Pencils (several)	Make sure mechanical pencils have lead or standard are sharpened	Extras in office	Sharpen or replace as needed
Thermometer (2)-1 standard, 1 digital	Place all in a water sample at once; readings should all be within .5 degrees of each other, check for separation of blue liquid in standard ones, make sure battery works on digital, make sure no water damage in "waterproof" digital thermometers	Extras in AAS cabinet, purchase replacement batteries as needed	If liquid separated, attempt to shake it down-if successful, take temperature reading again to confirm accuracy; replace battery in digital as needed; replace digital if water damage (clear tape can be placed over reading window to help keep water out)
Pollution Hotline Numbers Label (1)	Check inside lid to make sure label is intact	Original in AAS binder	Replace as needed
Counter (1)	Reset to zero, make sure advances properly, check for CRWC label	Extras in AAS cabinet	Re-label as needed, Replace as needed
Field Scope (1)	Make sure eyepiece and other lenses are clean, fiber optic isn't broken or loose, storage container is intact	Extra fiber optics in AAS cabinet	Wash lenses with soap and water if needed, replace fiber optic if needed, replace storage container if damaged
Guide to Freshwater Invertebrates of N. America-Voshell, J. Reese Jr. 2002 (1)	Make sure pages aren't falling out, check for water damage	Extras kept in office	Assess damage-minor water damage okay, major water damage=replace, if pages missing replace, tape pages back in or replace if pages are falling out
Guide to Aquatic Insects and Crustaceans- Izaak Walton League of America. 2006. (1)	Make sure pages aren't falling out, check for water damage	Extras kept in office	Assess damage-minor water damage okay, major water damage=replace, if pages missing replace, tape pages back in or replace if pages are falling out
Ice Cube Trays (4)	Check for cracks, clean	Extras in storage room	Replace as needed
Disposable Cameras in Plastic Bag (2)	Make sure plastic bag is sealed and intact, replace if used or water damage is apparent	None	Purchase additional cameras as needed and replace
Petri Dishes (4)	Check for cracks, clean	Extras in AAS cabinet	Clean as needed, replace if cracked
Safety Goggles (2)	Clean as needed, make sure strap works properly	Extras kept in AAS cabinet	Clean as needed, replace if damaged
Spoons (4)	Check to see if broken	Extras in AAS cabinet	Replace if damaged
Squirt Bottle (1)	Make sure lid works	Extras in AAS cabinet	
Tarp (1)	Clean, minimal tears	None	Purchase as needed
Sorting Trays/White Tubs (4)	Clean, no cracks	Extras in storage room	Replace as needed
Bags (w/label) of Macro Vials (5 bags of 20)	Site Info Label on gallon zip lock bag, 20 vials ½ full of 90% alcohol in each bag, make sure lids are tight	Extra vials and alcohol in AAS cabinet	Restock as needed
Hand Cleaner (1)	At least ½ full, not broken	Extras in AAS cabinet	Refill or replace as needed
Trash Bags (12)	Appx. 12 rubber-banded together	Extras in storage room	Restock as needed

Paper Towels	Paper napkins/towels in zip lock bag- bag intact, no water damage	Extras in office	Restock as needed
First Aid Kit (1)	Kit isn't damaged; stocked	Extra Band-Aids and alcohol wipes in AAS cabinet; purchase other items as needed	Restock as needed
Gloves (non-latex) (50 pr)	Check # available	Extras in AAS cabinet	Restock as needed

(B3) Inspection/Acceptance for Supplies and Consumables

Purchasing Supplies

The Program Manager makes purchases of supplies; other supply purchases are made based on price. An electronic list of monitoring equipment sources which is shared by several CRWC programs is maintained by CRWC on the CRWC's shared computer drive. This list is updated at least once per year to reflect current prices. Extra sampling equipment and basic consumables (i.e. First aid kit supplies) are maintained by CRWC in small quantities.

Acceptance of Supplies and Consumables

Upon receipt of new supplies, either the Program Manager or a trained volunteer opens all packages, verifies the correct orders have been received, supplies are intact/functional, and that expiration dates are at least 1 year from date of receipt. Any damage/expiration concerns are immediately addressed by contacting suppliers for replacements. At this time, the Program Manager or trained volunteer properly labels the supplies (by writing CRWC-AAS on the items with a permanent marker and/or placing a CRWC sticker on the items).

(B4)- N/A

(B5) Data Management

Data forms are collected by the Program Manager, hole-punched, and placed into annual Adopt-a-Stream Data Form binders (the year is listed on the spine of each binder) which are kept in or near the Program Manager's office space. Data forms are kept for at least five years. The data forms are initialed and checked for completeness, first by the Team Coordinator, then by the Program Manager who serves as the Quality Assurance Manager. Field data sheets will also be reviewed by the Project Manager for unusual measurements and accuracy of calculations. In addition, the Project Manager will verify macroinvertebrate identifications as previously noted to verify data accuracy. Team Coordinators are contacted if problems are suspected. See Appendix F to review the program's data form.

Data will be entered from data forms directly into CRWC's Adopt-a-Stream Microsoft Office Excel database by the Watershed Programs Specialist for storage. This database is automatically backed up by CRWC's server each night. The server system uses three different backup tapes, one of which is kept off site. A backup copy of the database file will updated after each season's data entry is complete and stored on CRWC's shared computer system in the same location as the standard file: AAS and Stream Leaders/AAS/Data.

Once a year, all new data will be exported to a MICORPS compatible format and entered into the MICORPS data exchange system. Once a year all new macroinvertebrate data will also be provided to MDNR and EGLE.

Section C: Assessment, Correction and Reporting

This section describes the system used to assess the capability and performance of CRWC's Adopt-a-Stream program.

The first step in determining quality of the program is the completion and acceptance of a Quality Assurance Project Plan (QAPP). MICORPS will review and approve the QAPP.

Assessments are most accurate and most informative when completed by both internal staff and external experts. CRWC's primary external review process will be led by MICORP staff. Informal assessment of the program will take place on an ongoing basis. This process will be led by the Program Manager. The Program Manager's key responsibility is the success of the program. With this in mind, the Program Manager will always be evaluating the amount of time needed to manage various aspects of the program, volunteer participation and interest, opportunities for strengthening training or adding/modifying parameters, quality of tools available, etc.

This report will summarize the status of the program and include topics such as volunteer participation (i.e. retention, new volunteers, QA Levels, involvement in other stewardship activities, watershed knowledge/behavior evaluations, etc), number of sites monitored, and quality assurance levels achieved/challenges for the year, and a review of the most recent annual report and other reporting mechanisms.

Based on the QA procedures included in the program QAPP (as summarized below), an assessment of the current year's monitoring program will be included in the written report.

Performance Assessment

- Volunteer Retention Rate

- Number of volunteers who participated on an existing mentor team for their first season of monitoring.

- Percentage of comparison assessments (side-by-side assessments) conducted by CRWC and the results. CRWC will make a "good faith" effort to complete comparison assessments of at least 25% of the active monitoring sites each year. When possible these assessments will take place while a team is monitoring. If not, the assessment will take place within the same week as when the team monitored the site.

Data Quality Assessment Process

- Data completeness will be assessed for each form submitted by dividing the number of measurements judged valid by the number of total measurements performed. The data quality objective for overall completeness is 90%. The Project Manager will contact any Team Coordinator that doesn't provide 100% complete macroinvertebrate sampling data or 100% habitat assessment data.

- The total diversity reported for each site must equal at least 70% of the diversity of the previous two years. Sites with results less than 70% will be "flagged" and re-sampled by experts as time permits to verify or discard the unusual results. Data forms will be checked for any unusual changes in habitat assessment (specifically land use at or adjacent to the site) to further analyze data changes.

- Total habitat assessment score reported for each site must be within 30% of the score of the previous two seasons. Sites with a score greater than 30% will be “flagged” and assessed by experts as time permits to verify or discard the unusual results. Data forms will be checked for any unusual changes in habitat assessment (specifically land use at or adjacent to the site) to further analyze data changes.

- Database entry accuracy will be assessed each season. (Based on a check of 10% of data forms, the accuracy rate will be reported. (If there is greater than 10% inaccuracy, the Program Manager automatically verifies all data entry for the season.)

Corrective Actions

If deviation from the QAPP is noted at any point in the sampling or data management process, the affected samples/data may be deleted from the data set. Re-sampling/re-assessing will be conducted if possible, given that the deviation is noted soon after the occurrence and volunteers or experts are available. Otherwise, a gap may be left in the monitoring record. All corrective actions, such as above will be documented and communicated to MICORPS.

All data collected during this project will be reviewed by the Project Manager to determine whether the QA objectives are met. The Project Manager will decide whether data are accepted, rejected, or qualified.

Any problems in these areas will be corrected through personal contact with Team Coordinators, re-fresher trainings and if necessary, changes in Team Coordinators.

As part of the Adopt-a-Stream assessment, the following topics will also be investigated.

- Is monitoring occurring as planned?
- Are the goals of the program being met?
- What, if any changes have been made over the last year to improve the program?
- Are the corrective actions being used improving the program?
- Are the monitoring procedures/data collected meeting the needs of stakeholders?
- How useful/effective was the current year’s annual report?
- Are additional types of analysis needed? If so, how will the work be accomplished, what resources are needed, and what is the timeline for integrating the analysis into the program?

The chart shown below is a reference that will be used by CRWC to make decisions about acceptance of data.

Data Review, Verification and Validation

Verifying Entity	When	Activity	Possible Corrective Measures and Notification
Team Coordinator	Sampling day - when team turn in data sheets	Collect, review data forms for: 1. outliers 2. illegible data entries 3. missing data (compare vs. sampling plan)	1, 2. Discuss with team. Correct simple problems (e.g. illegible entries). Re-sample/re-assess, if needed and possible. Flag problems that are not correctable. 3. Discuss with team, locate any missing data forms. If possible, re-sample/re-assess where volunteers missed data. Flag any problems that are not correctable.
Project Manager or QA officer	When all data forms are turned in to CRWC for the season	1. Compare number of samples/ tests performed vs. number promised in QAPP for chemical tests. 2. Compare data collected with targets or expected values for chemical and habitat assessments. 3. Spot check calculations. 4. Verify macroinvertebrate identification.	1. Check to see if any data form sheets are missing. 2. Confirm equipment kit used and check equipment if needed. Re-run calculations. 1-3. If possible, re-run samples/tests/assessment. For habitat assessments, mark data form as "independent" (can't be used to establish a habitat score) if less than 100% complete or there are concerns about data quality for more than 10% of items. For chemical tests, mark data form as "No replicates" if two or more data sets are not recorded for each test. Flag any problems that are not correctable. 4. Flag any problems that are not correctable. Mark macroinvertebrate data form as "unacceptable" if less than 90% accurate.
Program Manager or QA Manager	When all data have been entered into the computer and/or when graphs and charts are generated.	Spot check for any changes in values from data forms to computer database (10% of forms). Spot check for any changes in values from data to graphs and charts when completing analysis. Check for outliers.	Correct any errors found, flag uncorrectable problems.

Reconciliation with Data Quality Objectives

The Program Manager (who is also the QA Manager) will evaluate the actual data against data quality goals. This will be done seasonally-within 90 days receipt of all monitoring data.

CRWC's Adopt-a-Stream data quality objectives and sampling design as listed in the program's QAPP will be reviewed. An initial check will be made to decide which data must be thrown out. If questions arise about the quality of any data for a specific site, records of the sampling site details, time of sampling, weather conditions, sampling equipment and team experience will be made. A decision based on this information and previous records for the site will be made as to whether the data is unsuitable for comparison. Analysis for accuracy and completeness will be made based on procedures listed earlier in this QAPP. Assumptions about the data/limitations will be recorded. A paper copy will be filed with the data forms and the electronic file will be stored in the AAS/Data folder.

Data will be analyzed following procedures referenced earlier in this QAPP as well as other methods recommended by CRWC staff. Possible methods include charts, graphs, use of simplified water quality indicators, comparisons to baseline data collected by subwatershed groups, water quality standards, and site specific as well as subwatershed-based trends. Macroinvertebrate data will receive a Total Stream Quality Score (Excellent, Good, Fair, Poor) as directed by the MiCorp procedures.

Habitat assessment data will receive a Habitat Quality Score following procedures established by Environmental Consulting Technologies Inc. for analysis of watershed planning baseline monitoring data for the Stony/Paint and Clinton Main Subwatersheds.

Individual chemical parameters will receive a score (Excellent, Good, Fair, Poor) based on existing state standards, recommendations listed in watershed plans within the Clinton River Watershed, and as needed, standards typically used by other Midwest volunteer stream monitoring programs. CRWC will explore the use of adopting Q values for each parameter and calculating a Chemical Water Quality Index.

With a water quality index in place for each type of monitoring, CRWC will be able to establish a total score and ranking for each site monitored.

Reporting

The CRWC will complete an annual report for volunteers. Further, we hope collected information will be useful for local municipalities and citizens of the Clinton River watershed. The CRWC will analyze data for quality before it is submitted to other parties.

The Project Manager will coordinate the production of the annual report summarizing the CRWC's monitoring results from the previous year (spring and fall sampling). This report will be distributed to all volunteers, project participants, and municipalities participating in subwatershed planning advisory committees, CRWC members and any others who request it. In addition to the monitoring results, the report will describe any problems that occurred, any QA concerns, notable achievements, how the data were used, a list of monitored sites, and the names of volunteers and future project sponsors. As time and resources allow, CRWC will also create web pages and online databases that can be accessed by the public to review data for sites monitored as part of the Adopt-A-Stream program.

Results will be provided in summary format, at minimum, on an annual basis to interested volunteers, CRWC members, the general public, municipalities and other parties participating in the Clinton River Watershed Subwatershed Advisory Groups and EGLE. Data will be evaluated against any baseline data already established. Where applicable, EPA standards for “fishable” and “swimmable” waters and state standards for parameters will be used in analysis. Each subwatershed has its own characteristics and water quality problems. While most are connected to stormwater, and many overlap, data collected will be analyzed in light of the water quality problems presented in each of the subwatershed watershed management plans.

It is our goal to post data and results summaries to our Web site. Results will be used by the Clinton River Watershed Council to educate watershed residents, students, government officials and businesses/organizations on water quality trends within the watershed. Results will also be used by municipalities within the watershed to help guide the development and implementation of their subwatershed management plans. Trends in water quality and identification of sites that are experiencing significant impact will be particularly useful to the subwatershed planning and stormwater BMP implementation processes.

Appendix A- Safety in the River

General Safety

1. Do not monitor alone. A minimum of three team members is recommended per monitoring session. There is safety in numbers.

2. Do not monitor if there has been <u>significant rainfall</u> during the three days prior to your scheduled monitoring day. Water levels and speed of flow are often unpredictable and unsafe after rainfalls due to stormwater. **Never attempt to monitor in water that is deeper than three feet or water that is too deep or swift to allow a volunteer to comfortably stand in it and follow monitoring procedures.** If you are unsure whether water levels are safe or not, contact CRWC (248-601-0606) prior to monitoring.

3. If the water appears to be severely polluted (a strong smell of sewage or chemicals, unusual colors, lots of dead fish, oil sheen), **do not monitor chemical or macroinvertebrates**. Report any spills to the Department of Environmental Quality at 800-292-4706 or the county pollution hotline for your site:
    a. Macomb County - (586) 772-3425
    b. Oakland County - (248)-858-0931
    c. Wayne County- (888)-223-2363

4. <u>Always</u> keep your hands away from your eyes and mouth when monitoring. Always wash your hands (and any other body parts that come in contact with the water) thoroughly with soap and water after monitoring. Never eat after monitoring without first washing your hands. **WEAR GLOVES WHEN CONDUCTING DISSOLVED OXYGEN AND PHOSPHORUS TESTS. THE CHEMICAL REAGENTS USED CAN CAUSE SKIN IRRITATION (PHOSPHORUS MONITORING REAGENTS ARE DISPOSED OF AS HAZARDOUS WASTES.). DON'T HOLD THE CHEMICALS NEAR YOUR FACE. IF YOU GET THESE CHEMICALS ON YOUR SKIN OR HAVE OTHER CONCERNS REGARDING THE REAGENTS, READ THE ENCLOSED MATERIAL SAFETY DATA SHEETS FOR INSTRUCTIONS ON WASHING YOUR SKIN.**

5. Glass may be hidden in the bottom of the stream or along the stream banks. Watch out for it!

6. Before monitoring, ask if any of your monitoring team members are allergic to any type of insects or spiders. If so, make sure you know where they keep any antidotes or medicines that will subdue or stop an allergic reaction. If a volunteer gets an insect/spider bite and has a history of allergic reactions or the bite swells up to unusual size, has severe redness, or the volunteer is having trouble breathing, seek medical attention immediately. <u>In the event of an emergency, CRWC has asked volunteers to provide CRWC with allergy/medication information and emergency contact phone numbers. Call CRWC for this information once you have sought medical attention.</u>

7. Ticks are prevalent in grassy and wooded areas. It is recommended that volunteers wear light colored clothing and long pants that can be tucked into socks. It is important that volunteers check their bodies for ticks. If you do find an embedded tick, do not pull it out. Seek advice from a medical professional on proper tick removal.

8. CRWC recommends that volunteers entering the water at a monitoring site wear waders. Waders will help keep your body warm while in cool or cold water and can help reduce contact with waters that may or may not contain unknown pathogens.

Wader Safety

(Excerpt from "Gone Fishin'" by L. Gordon Stetser, Jr.; Michigan Out of Doors, June 1992)

1. Plan your route. Look ahead for exits, should you have difficulty, and "read" the water for spots to avoid, such as drop-offs, sunken logs, and tricky currents. Backtracking is often dangerous or impossible once you've committed to a tough situation.

2. Cross currents at right angles or slightly downstream. Move slowly, keeping the foot on the upstream side in the lead and pointed forward. Your rear, or anchor, foot should point downstream and be at right angles to your lead foot. Move the lead foot forward about half a step, feeling for a solid hold. Next, move the anchor foot forward the same distance – you should shuffle across so that your anchor foot never passes the lead. This way, both feet are always able to lend support. If you must turn around, do so toward upstream.

3. If, despite your precautions, you take a spill, don't panic. Your waders, even full of water, weigh less than on land and the water inside the waders doesn't add a single ounce as long as you're in the water! Further, the common fear that air trapped in your waders will raise your feet higher than your head and force your face underwater is simply unfounded.

Waders do make kicking useless. If the current is gentle, bend your knees and use the side or breast stroke to safety. In a swifter current, lie on your back, bend your knees, and point your feet downstream so your feet, not your head, will bounce off the rocks. Sculling with your hands will help direct you to the nearest shallow area, which, of course, you had noted before. *Don't* waste precious energy in the vertical position going for the bottom. Without the ability to read, this position is virtually impossible to maintain and leads quickly to exhaustion – the major cause of many drownings. And remember, concentrate on getting out of the water and *don't worry about* saving your gear!

If you chose, you may wear a lifejacket when in or near the water.

Appendix B- Getting Started

1. Make sure there is a copy of the *CRWC Adopt-a-Stream Volunteer Monitoring In Progress sign* on the front dash of each volunteer's vehicle.

2. Select a representative reach (300 ft. maximum) of the river/stream/drain for monitoring. If the monitoring site is next to a road (road crossing), then the monitoring should be made upstream from the road crossing (Monitor the water body before it flows under a road/bridge). If the access point to your site is not a road crossing, then monitoring can take place in either direction. If possible, do not monitor directly adjacent to the road/bridge; move upstream as much as 25 ft if possible (not possible at all sites).

   If you do not have access to a 100 ft. reach at your site, monitor the longest reach possible and note the approximate length of your reach in the **Additional Comments** section of your data form.

3. Set up your team's "work station" (i.e. chairs, tarp, table, etc. for identifying macros) in a location that is safe from oncoming traffic, and far enough from the water's edge that volunteers and equipment won't accidentally fall into the water.

4. Assign team roles *(Individuals may fill more than one role (suggested roles are listed below).*

   a. Team Coordinator: The person in this role has been pre-selected by the volunteer and CRWC. This individual has responsibility for the safety of the monitoring team, assignment of team roles, proper completion of monitoring protocols and data forms and identification of macroinvertebrates. This includes coaching of team members as necessary on how to complete monitoring tasks/roles. It is recommended that the Team Coordinator complete all data forms.

   b. Equipment Coordinator: This person will inventory equipment upon arrival, keep track of equipment while monitoring, ensure equipment is clean upon storage, and complete a second inventory prior to departure to make sure all equipment is present and functional. This person will report any missing or damaged items to the Team Coordinator prior to departure from the monitoring site.

   c. Quality Assurance Coordinator: This person will help ensure data quality by helping the team follow proper protocols. This person will read the step-by-step monitoring instructions (and refer to informational sheets as needed) out loud, while other team members perform the monitoring tasks/assessments.

   d. Identifier: This should be the "Macro ID" certified Team Coordinator or a volunteer designated by the Team Coordinator who is also "Macro ID" certified for the current year (will be noted on the team coordinator's team list for the current season). This individual will identify and count organisms found at the site, complete the macroinvertebrate data sheet and collect and preserve specimens of each of the groups identified in labeled vials (1^{st} two monitoring seasons per Identifier). If the Team Coordinator has another "Macro ID" certified team member to identify and count the organisms, he/she should verify that forms are being completed properly and "spot check" identification for team members that are serving as "Identifiers".

   e. Collector: This is a trained team member who will collect samples with the net from all of the different habitats in the stream/river/drain.

f. <u>Collecting Assistant</u>: This person will help the collector by kicking the stream bottom (and scrubbing rocks as needed/able) at various habitats in the water body. This person will also help by passing equipment on shore as needed.

g. <u>Field Techs</u>: These volunteers will complete chemical tests and work together to complete physical/habitat assessment. Only those who have completed Adopt-a-Stream volunteer training should conduct chemical monitoring and provide input on physical/habitat assessment.

h. <u>Pickers</u>: These individuals are responsible for picking out macroinvertebrates from the samples collected and placing them in ice cube trays for the Identifier to count and identify. To be successful a Picker needs to look very carefully through the debris for small creatures clinging to leaves and rocks and to be as unbiased as possible in selecting creatures of different types and sizes from the sample.

5. Inventory your equipment. A *Kit Equipment List* is provided in the Monitoring Equipment Kit (inside clipboard).

   Note: Each kit will likely have more materials that you will use. Each kit is set up at the beginning of the monitoring season with enough supplies for six different site teams (i.e. 6 sets of macro collection vials). If you wish, you may choose to take only the materials you need "streamside", leaving the extra materials in a team member's vehicle.

6. Complete the **Team and Site Location** sections of your data form. CRWC will provide your team coordinator with the **Site Location** information in advance of the monitoring season.

7. Complete the **Weather** section of your data form.

   a. Check the box that best represents the current weather (sunny, partly cloudy, etc.).
   b. Measure air temperature. To do this, hang the thermometer from a tree branch (if your site is mostly shady) or hold it in the air in a representative location along the banks of your site for at least 3 three minutes, then read and record the temperature.
   c. Write down the number of days since the last rainfall (or snowfall).
   d. Write down the estimated amount of rain/snow (in inches). If you are unsure of the amount of precipitation, check your local tv station, newspaper or weather.com.

8. Have team members planning to enter the water put on waders. Team members are encouraged to share the waders with each other so that everyone who wishes to enter the water will have a chance to complete part of the "in stream" procedures. Only those collecting data, water samples or macroinvertebrates should be in the water.

9. Complete the <u>**physical/habitat**</u> protocols first, then <u>**macroinvertebrate identification**</u>. This order will minimize the impact that your team might have on results by limiting your access to the water during the monitoring process.

10. Once your team has <u>completed the data forms, the team coordinator should take them home with him/her along with the used coliform vial, a copy of the coliform instructions and BOD vial/instructions (BOD is optional).</u> He/she should also take one of the self-addressed, stamped envelopes provided in the kit. The team coordinator should use the completed paper data form to enter the data into an Access database file (provided by CRWC via email or CD). <u>**The team coordinator should return the completed paper data form to CRWC within one week of monitoring**</u>**.**

11. After monitoring, examine kit contents and make sure everything is accounted for and nothing has been damaged. If anything is missing or damaged, report this to CRWC ASAP.

12. The monitoring kit should be returned to its location as soon as possible (ideally the next day). Please rinse waders and other equipment thoroughly (this is important to prevent transfer of invasive species), and if possible, allow them to dry overnight before returning them to the storage bin. Equipment will be used at one site only. Therefore, cross contamination or the spread of invasive species or organisms should not be a problem. However, in the event that any sampling equipment will be used at multiple sites, any item that comes in contact with water (nets, tubs, buckets, icecube trays, bulbs and tweezers) must be cleaned appropriately (either washed in a bleach solution or hot, soapy water and rinsed thoroughly) by the Adopt-A-Stream Coordinator and/or a trained volunteer using indoor sinks leading to city sewage treatment facilities (not septic fields). In the event that equipment is not washed, it will dry completely for at least 3 days before use.

Appendix C- Aquatic Macroinvertebrates

1) Survey a max. 300-foot (if possible) stream stretch. If it is at a road crossing, sample upstream of the road.

2) Because macroinvertebrates have adapted to survive in a variety of stream conditions, all habitats need to be sampled. Macroinvertebrate samples should be collected using a dip net with a 1 mm mesh and by hand picking as needed. Habitats to be sampled include:

Most Diverse Habitat	Riffles
	Leaf packs
⇳	Tree roots, snags, and submerged logs
	Undercut banks, overhanging vegetation
	Submerged and Emergent Vegetation (aquatic plants)
Least Diverse Habitat	Sediments

3) The sampling effort should be sufficient to ensure that all types of benthic macroinvertebrate habitats are sampled in the site reach. **<u>This should take about 35-45 minutes of total sampling time. If you have multiple types of habitat, spend equal amounts of time collecting from each habitat type.</u>**

4) Determine a plan of attack for collection sites based upon the above habitat chart.

5) **<u>Start at the downstream-most point, and work upstream</u>** so you always work into undisturbed water.

6) **<u>All organisms collected from each habitat should be emptied into the same bucket to form one combined sample. Do not begin formal counting/identification until all samples have been collected and combined.</u>**

7) To make collection easier, the samples from multiple habitats may be collected in the same net load. For example, a sample from an undercut bank can be held in the net while overhanging vegetation is sampled, then organisms collected from both habitats can be dumped into a collection bucket at the same time. **Do what is easiest for you but be very careful not to loose your samples.**

8) The composite sample (all samples five-gallon bucket) should be divided into several sub-samples (by pouring into various white pans) to make location of macros easier and quicker. The “pickers” will place “like groups” in plastic sorting trays, and then identify all organisms from the white pans. Simply identify the organisms you find and note on your data form that you sampled twice.

Keys to easier “picking”:

- **Patience!**
- **Look for movement**

9) Once organisms have been placed in sorting trays, the team's "identifier" will use the identification keys provided to identify the organisms found, record information on data forms and place labeled samples in sample jars. **THE IDENTIFIER MUST BE A TRAINED AAS MEMBER WHO IS "MACRO CERTIFIED".**

STEPS TO IDENTIFYING MACROS

a) Obtain one of the macroinvertebrate vials from the monitoring kit. Complete the label on the outside of the sample vial/jar.
b) Obtain one set of macro identification labels from the kit. (Note: Do not return "extra" labels from the set to the kit. Recycle them/throw them away.)
c) Take the first macro from the sort trays.
d) Identify the organism and record on the order level datasheet.
e) Place the macro in a sample vial.
f) Repeat until you run out of macros.

10) Once macroinvertebrate identification is complete and the samples have been placed in vials with identification labels, return the vials to the monitoring kit. CRWC will "visit" the kit and "pick up" the set of vials or get the samples at the end of the season.

11) Once the identifier has all organisms identified (or the "end" of his/her macros, he/she should write the total "count" of each organism type in the correct column.

12) The abundance of each group of organisms found at the site should also be recorded on the data form.

Note: The preservative in the sample collection jars is rubbing alcohol (Rubbing alcohol is flammable).

Crayfish, **<u>live</u>** clams, and **<u>live</u>** snails should be **<u>counted and released</u>**. **Empty shells should not be counted. DO NOT COLLECT FISH**. **Take photos for CRWC verification.**

3. For each macroinvertebrate group the number of individuals should be tallied. *The total stream quality score will be calculated along with other metrics once data has been entered into the monitoring database*.

4. During the macroinvertebrate survey, volunteers should take note of any fish or wildlife (frogs, turtles, ducks, etc.) that may be visible in/near the stream and document these observations on the "Additional comments" section of the data form.

Specific sampling procedures for each habitat type are listed below.

<u>Riffles</u>

1. When selecting a riffle, s<u>elect the fastest (white water present, larger rocks) and slowest (no white water, smaller gravel sized rocks) moving areas of the riffle</u> to take your samples in an

attempt to find different types of organisms. Organisms collected from both these sites will constitute one riffle sample.

2. With the net opening facing upstream, place the bottom of the net flush on the stream bottom immediately downstream from the riffle. Position the handle perpendicular to the stream flow.

3. While the first volunteer ("collector") holds the net, the second ("collecting assistant") picks up large rocks (2 inch or greater diameter) within a 1 foot by 1 foot area directly in front of the net opening and gently rubs them in the net opening to remove any clinging organisms. Be sure to hold the rocks under water in front of the net. Gently place the cleaned rocks outside the sampling area. (Usually takes less than one minute.)

If the water level is too deep or sharp objects don't allow the "collecting assistant" to safely/easily pick up rocks from the stream/river/drain bottom, then the "collecting assistant" should spend 1-2 minutes kicking the 1ft square area directly in front of the net. Use a kicking/shuffling motion with your feet to dislodge rocks. You're trying to shake organisms off rocks and kick up organisms that are hiding under the rocks. Kick down approximately two inches while moving toward the net.

4. When all the stones (or as many as possible) are removed from the sample area, the "collecting assistant" stands approximately one foot upstream of the net opening and kicks the stream bed vigorously to dislodge any remaining organisms into the net.

5. Kick down approximately 2 inches (approximately 30 seconds) while moving toward the net.

6. When done kicking, the "collector" sweeps the net in an upward fashion to collect the organisms. Return all the rocks to their 1^{st} square area.

Note: If the net is relatively empty after sampling at the first station, steps 8 - 13 may be skipped and the net emptied (according to steps 8 - 13) only as necessary.

7. Carry the net to the shoreline. Have team members on the shore assist with rinsing/dumping.

8. Before emptying the collected material into the sample bucket/pan, have the "collection assistant" pour stream water through the net and its contents until the water runs clear. This is particularly important in streams with sediment problems and in pools. This should help reduce the murkiness of the water which can make finding and sorting macros difficult.

9. One volunteer should hold the sampling bucket/pan, while a second volunteer empties the net's contents into the tray. Using the squirt bottle filled with stream water, rinse the inside of the net into the bucket/pan to collect all the organisms.

10. Remove any clinging organisms and place them directly into the sampling bucket/pan.

11. Turn the net inside out and rinse it with water, letting the water run through the net into the sample bucket/pan to dislodge any aquatic macroinvertebrates that are still attached to the net. Remove any remaining macros using forceps and place them in the sample bucket/pan.

12. **Collect a total of three riffle samples by repeating steps 1 - 13.**

13. **If using a smaller pan, dump the sample into the five-gallon bucket.**

Leaf Pack

1. Look for leaves that are about four to six months old. These old leaf packs are dark brown and slightly decomposed. Slimy leaves are an indication that they are decaying. Only a handful of leaves is necessary for sampling.

2. With the net opening facing upstream, place the bottom of the net flush on the stream bottom immediately downstream from the leaf pack. Position the handle perpendicular to the stream flow.

3. Have the "collection assistant" gently shake the leaf pack in the water to release some of the organisms, then quickly scoop up the net, capturing both organisms and the leaf pack in the net.

> **Note:** If the net is relatively empty after sampling at the first station, steps 5 - 8 may be skipped and the net emptied (according to steps 5 - 10) only as necessary.

4. Before emptying the collected material into the sample bucket/pan, have the "collection assistant" pour water through the net and it contents until the water runs clear. This is particularly important in streams with sediment problems and in pools. This should help reduce the murkiness of the water which can make finding and sorting macros difficult.

5. Carry the net to the shoreline.

6. One volunteer should hold the sampling bucket/pan, while a second volunteer empties the net's contents into the tray.

7. Using the squirt bottle filled with stream water, rinse the inside of the net into the bucket/pan to collect all the organisms.

8. Remove any clinging organisms and place them directly into the sampling bucket/pan.

9. Turn the net inside out and rinse it with stream water, letting the water run through th net into the sample bucket/pan to dislodge any aquatic macroinvertebrates that are still attached to the net. Remove any remaining macros using forceps and place them in the sample bucket/pan.

10. Collect a total of three leaf pack samples by repeating steps 1 - 10.

11. If using a smaller pan, dump the sample into the five-gallon bucket.

Tree Roots, Snags, and Submerged Logs

Snags are accumulations of debris caught or "snagged" by logs or boulders lodged in the stream current. Caddisflies, stoneflies, riffle beetles, and midges commonly inhabit these areas.

1. Select an area on the tree roots, snag, or submerged logs which is approximately 3 feet by 3 feet in size.

2. Scrape the surface of the tree roots, logs, or other debris with the net while on the downstream side of the snag. You can also disturb such surfaces by scraping them with your foot or large

stick, or by pulling off some of the bark to get at the organisms hiding underneath. In all cases, be sure that the net is positioned downstream from the snag, so that dislodged material floats into the net.

3. You may remove a log from the water to better sample from it, but be sure to replace it when you are done.

> **Note:** If the net is relatively empty after sampling at the first station, steps 5 - 8 may be skipped and the net emptied (according to steps 5 - 10) only as necessary.

4. Before emptying the collected material into the sample bucket/pan, have the “collection assistant” pour water through the net and it contents until the water runs clear. This is particularly important in streams with sediment problems and in pools. This should help reduce the murkiness of the water which can make finding and sorting macros difficult.

5. Carry the net to the shoreline.

6. One volunteer should hold the sampling bucket/pan, while a second volunteer empties the net’s contents into the tray.

7. Using the squirt bottle filled with stream water, rinse the inside of the net into the bucket/pan to collect all the organisms.

8. Remove any clinging organisms and place them directly into the sampling bucket/pan.

9. Turn the net inside out and rinse it with stream water, letting the water run through th net into the sample bucket/pan to dislodge any aquatic macroinvertebrates that are still attached to the net. Remove any remaining macros using forceps and place them in the sample bucket/pan.

10. Collect a total of three tree root samples by repeating steps 1 - 10.

11. If using a smaller pan, dump the sample into the five-gallon bucket.

Undercut Bank and Overhanging Vegetation

Undercut banks are areas where moving water has cut out vertical or nearly vertical banks, just below the surface of the water. In such areas you will find overhanging vegetation and submerged root mats that harbor dragonflies, damselflies, and crayfish.

1. Place the net below the surface under the overhanging vegetation.

2. Move the net in a bottom - up motion, jabbing at the bank five times in a row to loosen organisms. For overhanging vegetation, put the net under the bank edge at the base of the plants and shake the vegetation using your yet, trying to shake off the animals clinging to the plants.

> **Note:** If the net is relatively empty after sampling at the first station, steps 3 - 6 may be skipped and the net emptied (according to steps 3 - 8) only as necessary.

3. Before emptying the collected material into the sample bucket/pan, have the “collection assistant” pour water through the net and it contents until the water runs clear. This is particularly important in streams with sediment problems and in pools. This should help reduce the murkiness of the water which can make finding and sorting macros difficult.

4. Carry the net to the shoreline.

5. One volunteer should hold the sampling bucket/pan, while a second volunteer empties the net’s contents into the tray.

6. Using the squirt bottle filled with stream water, rinse the inside of the net into the bucket/pan to collect all the organisms.

7. Remove any clinging organisms and place them directly into the sampling bucket/pan.

8. Turn the net inside out and rinse it with stream water, letting the water run through th net into the sample bucket/pan to dislodge any aquatic macroinvertebrates that are still attached to the net. Remove any remaining macros using forceps and place them in the sample bucket/pan.

9. Collect a total of three undercut bank samples by repeating steps 1 - 8.

10. If using a smaller pan, dump the sample into the five-gallon bucket.

Submerged and Emergent Vegetation (Aquatic Plants)

1. Keep the net opening pointed upstream and move the net through the vegetation trying to shake the plants and catch any animals.

> **Note:** If the net is relatively empty after sampling at the first station, steps 3 - 6 may be skipped and the net emptied (according to steps 3 - 8) only as necessary.

2. Use your hands to agitate the vegetation and dislodge the animals into the net.

3. Before emptying the collected material into the sample bucket/pan, have the “collection assistant” pour water through the net and it contents until the water runs clear. This is particularly important in streams with sediment problems and in pools. This should help reduce the murkiness of the water which can make finding and sorting macros difficult.

4. Carry the net to the shoreline.

5. One volunteer should hold the sampling bucket/pan, while a second volunteer empties the net’s contents into the tray.

6. Using the squirt bottle filled with stream water, rinse the inside of the net into the bucket/pan to collect all the organisms.

7. Remove any clinging organisms and place them directly into the sampling bucket/pan.

8. Turn the net inside out and rinse it with stream water, letting the water run through th net into the sample bucket/pan to dislodge any aquatic macroinvertebrates that are still attached to the net. Remove any remaining macros using forceps and place them in the sample bucket/pan.

9. Collect a total of three submergent or emergent vegetation samples by repeating steps 1 - 8.

10. If using a smaller pan, dump the sample into the five-gallon bucket.

Sediments

Areas of mostly sand and / or mud can usually be found on the edges of the stream, where water flows more slowly.

1. A collector stands downstream of the sediment area with the dip net resting on the bottom. A collection assistant disturbs the sediment to a depth of about two inches as he or she approaches the net.

2. The collector sweeps the net upward to collect the organisms as the collection assistant approaches.

3. **Keeping the opening of the net at least an inch or two above the surface of the water, wash out the sediment from the net by gently moving the net back and forth in the water of the stream. THIS IS VERY IMPORTANT FOR KEEPING SEDIMENT OUT OF THE SAMPLE BUCKET**.

Note: If the net is relatively empty after sampling at the first station, steps 4 - 8 may be skipped and the net emptied (according to steps 4 - 8) only as necessary.

4. Carry the net to the shoreline.

5. One volunteer should hold the sampling bucket/pan, while a second volunteer empties the net's contents into the tray.

6. Using the squirt bottle filled with stream water, rinse the inside of the net into the bucket/pan to collect all the organisms.

7. Remove any clinging organisms and place them directly into the sampling bucket/pan.

8. Turn the net inside out and rinse it with stream water, letting the water run through th net into the sample bucket/pan to dislodge any aquatic macroinvertebrates that are still attached to the net. Remove any remaining macros using forceps and place them in the sample bucket/pan. TRY NOT TO ADD SEDIMENT TO COLLECTION BUCKET. STRAIN SAMPLE THROUGH NET AND RINSE AGAIN IF NECESSARY TO REDUCE SEDIMENT.

9. Collect a total of three sediment samples by repeating steps 1 - 8.

10. If using a smaller pan, dump the sample into the five-gallon bucket.

Clean Up

1. **Rinse all nets, pans, WADERS and other equipment VERY well before leaving the site to avoid transporting animals or plants between monitoring locations (Invasive species are often spread by not rinsing equipment, fishing gear, boats, etc.). RINSE EQUIPMENT AGAIN AT HOME OR WHERE YOU HAVE ACCESS TO A WATER HOSE. IF ZEBRA MUSSELS ARE PRESENT AT YOUR SITE, DON'T RINSE EQUIPMENT INDOORS. THE MUSSELS COULD ATTACH THEMSELVES TO YOUR PLUMBING. IF ZEBRA MUSSELS ARE PRESENT, MAKE AN EXTRA EFFORT TO DRY EQUIPMENT.**

2. Have the team coordinator double check that the data form has been completed and that all habitats have been sampled.

Appendix D- Physical/Habitat

All data to be completed for a 100 ft reach (area of water body approximately 25 ft upstream of road crossing/bridge to approximately 125 ft further upstream) facing upstream. Shorter reaches (due to access or safety concerns) should be noted on data form (include approximate length of reach monitored).

I. BACKGROUND INFORMATION

For each of the items below, check the category that is most representative of what you observe in your reach.

<u>Water Color/Odor</u>
Examine the water in the reach for color and odor. The most common color options are provided. Check the color that is most similar to that of the water in your reach. To the extent possible, try to describe any unusual odors. (e.g. fishy, sulfur, etc.)

<u>Stream Width</u>
Stream width is the distance from the water's edge on one side to the water's edge on the other side. Check the box that best represents the average stream width in feet. Make this observation using best judgment of the distance. This can be done by pacing off the distance (counting the number of steps taken) on the road crossing from one edge of the stream to the other. There is no need to measure the distance with a tape measure or similar device, however, it is best to have previously paced off distances of 10, 25 and 50 feet so that the number of strides is known to these category endpoints.

<u>Stream Depth</u>
Check the box on your data form that best represents the average reach depth in feet. If the water is turbid and the depth cannot be determined, check "Unknown". This observation is for the average depth of the stream that is consistently observed. In other words, if the stream is mostly shallow, but is 5ft deep in the channel, the >3ft category should be circled. However, 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. Remember that water often looks shallower than it is.

<u>Stream Flow Type</u>
Check the category that best represents *general flow <u>volume</u> in the stream*. Note that in this case, "average" flow refers to the <u>annual average flow</u>. For example, if a river flow is reduced in the summer, due to dry and hot conditions, check "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 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.

NOTE: Look for signs of high water marks to help you determine if the stream flow is high, average or low. Stream Flow Type is something you will learn over time as you monitor your site over multiple seasons. CRWC has a sense of stream flow levels based on visits and USGS stream gauge data for a number of sites in the Clinton River Watershed.

II. PHYSICAL APPEARANCE

Check the stream/river/drain upstream, for as far as can be seen from the road stream crossing, for the presence of any of the following characteristics. If a category type (e.g. aquatic plants) is not present in the stream, do not record anything. If a category type can be seen, in any amount, check "present". If a category type is present in a large portion of the water body, check "abundant".

For the items below, check those that are present or abundant in your site reach.

<u>Aquatic Plants</u>
This category refers to aquatic vascular plants—plants with a vascular system that typically includes roots, stems and/or leaves. This includes duckweed, as it is a floating vascular plant. Aquatic Plants have roots and can be submerged under, floating on, or extending out above the water. Examples include pondweed (submerged under), water lilies (floating on) and cattails (extending above). While aquatic plants in the stream can serve as an excellent food source for aquatic organisms, excessive plant growth may indicate excessive amounts of nutrients.

<u>Floating Algae</u>
Floating algae has no root structure and no structure to hold it to the stream bottom. The presence of suspended algae (single celled organisms that may or may not form colonies) or floating algae mats/bundles should be recorded here. This includes algae mats/bundles, whether floating on the surface, suspended in the water column, or present at the bottom.

<u>Filamentous Algae</u>
Filamentous Algae has no roots. However it is made up of long stringy or "ropy" strands that may or may not be attached to other objects in the waterbody.

<u>Bacterial Sheens/Slime</u>
Bacterial sheens occur as oily appearing coatings on the water surface, often with a silverish cast to them. The sheen can be distinguished from petroleum products because they break into distinct platelets when poked with a stick or are physically disturbed, whereas petroleum products remain viscous (sticks together).

Bacterial slimes are bacterial growths that are visible as a slimy-appearing coating on stream or lake bottoms. They can be various colors, including black and orange.

<u>Turbidity</u>
Water appears cloudy—it is not transparent. Turbidity is caused by suspended particles 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 sheen is a layer or coating on the water surface caused by petroleum products. Oil sheens typically have a multi-colored or rainbow appearance.

Foam
Check "present" or "abundant" only if you find unnatural foam (this is very important for scoring).

Natural foam often looks like soap suds on the water surface and can be white, grayish or brownish. Natural foam is produced when water with dissolved organic material (i.e decomposing leaves) has extra oxygen in it. Natural foam (i.e. bubbles) is typically produced in streams when water flows through rocks or rapids or past surface obstructions such as logs, sticks and rocks. Foam can range from a few bubbles to mats several feet high.

Unnatural foam usually comes from a soap product. Natural foam can be distinguished from soap suds by rubbing it between ones 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, the foam is unnatural.

Trash
Use this category to record the presence of general litter, such as paper, bottles, cans, etc., either in the waterbody or along the riparian banks or in the trees and branches above the stream (indicator or high water mark). Such accumulations often suggest how high the water level can rise during storm events or spring runoff. Use some reasonable discretion when completing this category. A single piece of gum wrapper on one bank would not be sufficient cause for checking "present".

If you can safely remove the trash, bags have been provided in the kit and you are welcome to remove of and dispose of litter properly. Be sure to use gloves.

III. SUBTRATE COMPOSITION

Substrate composition is "what the bottom of the river/stream/drain is made of". It is a critical factor in determining what aquatic macroinvertebrates will be present. In general, good quality substrates (from an aquatic habitat perspective) contain a large amount of course material—such as gravels and cobbles—with a minimal amount of fine particles (silt, sand, muck).

Estimate the relative abundance of various substrate types (listed on the data form) in the stream reach. Round off to the nearest 10% increment. For example, do not record 25%, use either 20% or 30%. The composition estimate should include the entire area of the stream/river/drain bottom that is visible in the reach. 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. The total percentage should add up to 100%,

Sand-feels "gritty" to the touch. Individual grains can usually be seen with the eye.

Silt/Detritus/Muck-very fine substance. Smooth to the touch. Can be the result of decomposing plant matter or simply very fine "rock" particles.

Artificial/Human made-Examples include concrete piers, sheet piling or rock riprap (that portion of shoreline erosion protection structures that extends below the water surface is considered substrate).

IV. EMBEDDEDNESS

Embeddedness is the degree to which rocks and snags are covered or sunken into silt, sand, or mud in the stream/river bottom. Embeddedness is a result of large-scale sediment movement and deposition and is a parameter typically evaluated in the riffles and runs of high-gradient streams. The more the substrate (river/stream bottom) is embedded the less its surface area is exposed to water and available as habitat by macroinvertebrates.

Check the category that best describes the bottom of your water body. Using your best judgment, indicate the extent to which the gravel, cobble, or boulders are embedded. If no rocks are visible, dig down a few inches to see if the natural streambed is rocky. Your water body may be naturally sandy or clay-based so no rocks will be present. Indicate if there are no rocks present.

<u>Four embeddedness readings should be taken; two downstream and two upstream</u>. Begin in the downstream area. If your site has riffles, this is where you should take your readings. Make one observation in the riffle (or other midpoint of water body as measured from stream bank to stream bank) and one observation in an area to the left of the midpoint, when looking downstream. Observe the tops and the sides of all rocks greater than three inches across within an approximately two foot squared area. Gently pick up several rocks, one at a time, from the observation area and watch for “plumes” of sediment to rise into the water column as you move the rocks. Record the average embeddedness value for the four observations.

V. RIVER MORPHOLOGY

For the items below, check those that are present or abundant in your site reach.

<u>Riffles</u>
Riffles are areas of naturally occurring, short, relatively shallow, zones of fast moving water followed by a pool. The water surface is visibly broken (often by small standing waves) and the river bottom is normally made up of gravel, rubble and/or boulders. Riffles are not normally visible at high water and may be difficult to identify in large rivers.

Present - A riffle can be positively identified.
Abundant - A series of riffles and pools are visible.

<u>Pools</u>
Pools are areas of relatively deep, slow moving water. The key word here is “relatively”. Water depth sufficient to classify an area as a pool can vary from around 8 inches in small streams, to several feet in wadable streams, to tens of feet in large rivers. Pools are often located on the outside bend of a river channel and downstream of a riffle zone or obstruction. The water surface of a pool is relatively flat and unbroken. The presence of pools in large rivers may be difficult to identify because of an increase in relative scale, and an often limited ability to see to the bottom of deep or turbid stream reaches.

Present - At least one pool can be identified.
Abundant - A series of pools in a riffle pool sequence are visible.

Highest Water Mark

The highest water mark is the maximum height to which the stream water level rises at the site, (during a typical year, not a 50 or 100 year flood) as determined by visible evidence. 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 you can't visibly determine how far the stream rises at the site, check 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 stream banks, or muddy residues left in floodplains or on streamside vegetation.

VI. INSTREAM COVER

For the items below, check those that are present in your site reach.

In-stream cover generally refers to habitat cover that is available to fish to: (1) protect them from predators, or (2) avoid certain-stream conditions such as fast flow or direct sunlight. Check all the in-stream cover types on the data form that are present in the stream reach.

Types of cover include the following:

Undercut Banks

Undercut Banks are areas along the edges of the stream/river/drain where water has "carved out" the sediment from the banks and water now flows below the upper edge of the bank. Roots from trees, shrubs and grasses that are close to the water's edge are often visible and the top of the bank along the water's edge "juts farther out" into the stream than the bank along the water's edge.

Overhanging Vegetation

Overhanging vegetation includes trees, shrubs and grasses (land-based vegetation) that reach out over the water body.

Deep Pools

Deep pools are depressions or "holes" in the bottom of the stream where water is substantially deeper than the average water depth of the stream. *They are typically more than twice the average depth of the reach*.

Boulders

Boulders are stones that are greater than 10 inches across (diameter).

Aquatic Plants

This category refers to aquatic vascular plants—plants with a vascular system that typically includes roots, stems and/or leaves. This includes duckweed, as it is a floating vascular plant. Aquatic Plants have roots and can be submerged under, floating on, or extending out above the water. Examples include pondweed (submerged under), water lilies (floating on) and cattails (extending above).

Logs or Woody Debris

Logs and woody debris (small or large branches, leaves, roots or trunks) in the stream or along the water's edge can slow or divert water to provide important habitat for fish and aquatic macroinvertebrates. Excessive amounts of debris or logs can cause localized flooding.

Check the category "logs or woody debris" and note in the "Additional Comments" if log jams or dams (created by logs, beavers or humans) are present (also note general size of log jams).

VII. STREAM CORRIDOR

Check the category that is most representative of your water body reach for each criteria listed below.

Riparian Vegetative Width

The riparian vegetative width is the width of the streamside natural vegetation (plant) area along the stream/river/drain banks.

The width is measured from the edge of the water body to the far side of the section of natural vegetation. Natural vegetation including trees, shrubs, old fields, wetlands, or planted vegetative buffer strips (often used in agricultural areas and stormwater runoff control). Agricultural crop land and lawns are **not** considered natural vegetation for the purposes of this question.

Check the appropriate distance (ft) that represents the **average** width of the vegetation zone for each side of the water body. Left and right banks are determined from the perspective of facing downstream.

Bank Erosion

Bank erosion occurs when soils are removed from the banks of the water body. Bank erosion may occur as a result of natural flow conditions, or may be caused by human activities.

Determine the severity of erosion that has taken place and check the appropriate category. Record the most severe examples of erosion observed on either bank within your site reach.

0 - Banks appear stable; no evidence of erosion. These banks are most likely well vegetated or structurally stabilized, and have no evidence of exposed tree roots or leaning trees due to eroded soil. They are not being altered by water flows, livestock access, or recreational access.

L - Low evidence of erosion. Stream banks are stable but are being lightly altered. Less than 10% of the stream bank is receiving any kind of stress. Less than 10% of the bank is sloughing, broken down, or actively eroding.

M - Moderate evidence of erosion. At least 75% of the stream bank is in stable condition. 10%-25% of the stream bank is sloughing, broken down, or actively eroding.

H - High evidence of erosion. Less than 75% of the stream bank is in stable condition. Over 25% of the stream bank is sloughing, broken down, or actively eroding. Stream bank sidewalls may have been scraped by machinery or scouring flows. Banks may be slumped; banks may be severely undercut. Tree roots may be exposed or fallen/leaning trees may be present.

Streamside Land Cover

Check the dominant type of plant cover that exists at the stream bank "edge" (within the first 20 feet or so of the water's edge) along the site reach.

Bare - Bare ground. No, or almost no, streamside vegetation.

Non-woody Plants -	Grasses, wildflowers, ferns, sedges
Shrubs -	Shrubs and small trees; woody vegetation less than 15 feet high.
Trees -	Woody plants 15 feet or taller

Stream Canopy

The stream canopy cover is the amount of leafy vegetation that extends out over a stream (at any height) and shades the water from direct sunlight. Canopy cover helps keep the water cool, increasing the oxygen levels in the water and providing healthy habitat conditions organisms. Estimate the percent of the water body reach shaded by vegetation (when trees are fully-leaved) and check the option on the data form that best represents this estimate.

VIII. ADJACENT LAND USE

When looking along your site reach and UPSTREAM, check the bank (left or right) where the specific land use is found. Check the appropriate left or right stream bank designation for the following land uses that are adjacent to the stream. If the land use is not present, check "none".

Wetland

A Wetland may have standing water part or all of the year, "hydric" or wetland soils and vegetation that is common to wetlands. Riparian (river) wetlands, marshes, swamps, fens, vernal pools, and bogs are examples of wetlands. Be cautious about indicating areas of land unnaturally flooded by stormwater.

Shrub or Old Field-Meadow or field that hasn't been recently cultivated or grazed. Often represented by tall grasses and shrubs.

Forest-An area of land covered primarily by trees; includes small woodlots. May be a natural forest or a forest planted by people.

Pasture-A field that is showing signs of being recently or actively grazed by livestock (vegetation is cropped close to the ground).

Crop Residue-An area of land that has been recently used to grow crops. Remnants of corn stalks, grains, or other vegetable crops can be seen. An agricultural crop residue remains, after harvest which covers 30% or more of the field surface.

Rowcrop-Agricultural cropland planted in rows and cultivated.

Residential Lawn, Park-An expanse of maintained grass, often found in residential lawns and parks.

Impervious Surfaces-Land surfaces that prevent water from entering the soil/ground. Impervious surfaces include rooftops, sidewalks, cement, parking lots, pavement and compacted fields or lawns.

Disturbed Ground- Soil has been disturbed (plowed, cleared, bulldozed, excavated) for construction or agriculture. Vegetation is not present but may be present nearby.

Bare Ground-No vegetation is present, but it is not disturbed ground. Includes areas of high foot traffic.

IX. POTENTIAL SOURCES OF WATER CONCERNS

Look at the way land is used near your site. Which of these land uses might be a potential source of pollution for your stream/river/drain? Think about how pollution might travel from each land use source to the water then rank each source on the severity of impact it might have on water quality at your site. Use your best judgment; remember this is designed to provide general information on land use over time. Note any changes in land use since the prior monitoring season in the "Additional Comments" section.

None=no impact/not present, S=slight, M=moderate, H=high

Potential Source	Description
Crop Related Sources	… there is a reasonably clear pathway for pollutants to enter the water body from the farmed area.
Grazing Related Sources	… there is clear evidence that grazing of animals near or in the water body has resulted in the degradation of stream banks or stream beds, increased sediment in the water body, nutrient enrichment , and/or potential bacterial contamination (animal wastes).
Intensive Animal Feeding Operation	… there is a reasonably clear pathway for pollutants to enter the water body from runoff from the operation or land application of animal manure.
Transportation Runoff (i.e. highways, bridges)	…there is clear evidence that transportation infrastructure is creating increased flow, runoff of pollutants, or erosion areas in or adjacent to the water body.
Channelization	… there is clear evidence that the natural river channel has been straightened to facilitate drainage.
Dredging	… there is clear evidence that a water body has been recently dredged (bottom dug out). Evidence might include: spoil piles on side of water body, disturbed bottom, disturbed banks.
Removal of Streamside Vegetation	… there is clear evidence that vegetation along the water body has been recently removed (within the last few years).
Potential Source	**Description**
Bank & Shoreline Erosion/ Changes/Destruction	… there is clear evidence that the banks or shoreline of a water body have been modified through human activities or natural erosion processes.
Human Regulation of Water Flow	… there is reasonably clear evidence that flow modifications in the watershed have created unstable flows resulting in stream bank erosion
Upstream Impoundment (i.e. dam, lake level control structure)	... there is reasonably clear evidence that an upstream impoundment has contributed to impacts on downstream sites. Impacts may be: nuisance algae, increased temperatures, stream bank erosion from unstable flows.
Construction: Highway/Road/Bridge	… there is clear evidence that on-going or recent construction of transportation infrastructure is contributing pollutants to the water body.
Construction: Land Development	… there is clear evidence that on going or recent land development is contributing pollutants to the water body.
Urban Runoff (incl. residential	… there is a reasonably clear pathway for pollutants to enter the

runoff, geese/ nuisance wildlife)	water body from an urban/residential area. Possible pathways: gully erosion, pipe/storm sewer discharge, wind erosion, runoff from lawns or impervious surfaces.
Land Disposal	… there is a reasonably clear pathway for pollutants to enter the water body from an area where waste materials (trash, seepage, hazardous waste, etc.) have been either land applied or dumped. Possible pathways: gully erosion, pipe discharge, wind erosion, or direct runoff.
On-site Wastewater Systems	… there is reasonably clear evidence of nutrient enrichment and/or sewage odor or waste is present, and there is reason to believe the area is un-sewered.
Forestry	…there is a reasonably clear pathway for pollutants to enter the water body from the forest management area. Possible pathways: logging to the edge of the water body, gully erosion, pumped drainage, erosion from logging roads, wind erosion.
Mining	… there is a reasonably clear pathway for pollutants to enter the water body from the mined area. Possible pathways: gully erosion, pumped drainage, runoff from mine tailings, wind erosion.
Recreation/Tourism (General)	… you are unable to clearly identify the recreational source as related to a golf course, or recreational boating activity. Foot traffic causing erosion would fall into this category.
-Golf Courses	… there is a reasonably clear pathway for pollutants to enter the water body from the golf course area. Possible pathways: overland runoff, gully erosion off course, wind erosion.
-Marinas/Recreational Boating: boat access via water	… if you can reasonably determine that releases of pollutants to a water body such as seepage of oil/gasoline are due to recreational boating activities.
-Marinas/Recreational Boating: bank erosion	…. you can reasonably determine that stream bank erosion is due to wake (or paddle boat access) from recreational boating activities.
Debris in Water	… debris in the water either is discharging a potential pollutant, or is causing in stream impacts due to modifications of flow. Examples: Leaking barrel, refrigerator, tires This doesn't include litter (e.g. paper products).
Industry Source	… there is reasonably clear evidence that an upstream industrial point source has contributed pollutants.
Municipal Source	… there is reasonably clear evidence that an upstream municipal (city, governmental) point source has contributed pollutants.
Natural Sources (i.e. log jams)	… there is reasonably clear evidence that natural sources are contributing pollutants. Possible examples: stream bank erosion, pollen, foam, etc.
Source(s) Unknown	… if you see an impact but are unable to clearly identify any likely sources.

X. ADDITIONAL COMMENTS

Write any other pertinent observations that were made during the survey. These may include the presence of wildlife in or along the stream, people using the stream for recreation (boating, swimming, fishing), or some unusual event or observation. Indicate whether observations are made upstream or downstream of the road crossing.

Digital pictures of your site and the adjacent upstream and downstream sections or land uses are welcome. Please provide them to CRWC on CD (medium or high quality images preferred).

Appendix B – Site List
(Current as of 2022)

ID	Municipality	County	Subwatershed	Waterbody	Latitude	Longitude
UC1	Independence Twp.	Oakland	Upper Clinton	Clinton River	42.722800	-83.422600
UC2	Independence Twp.	Oakland	Upper Clinton	Clinton River	42.744378	-83.411630
UC3	Independence Twp.	Oakland	Upper Clinton	Sashabaw Creek	42.723900	-83.352300
UC4	Independence Twp.	Oakland	Upper Clinton	Clinton River	42.733800	-83.415747
UC5	Waterford	Oakland	Upper Clinton	Clinton River	42.644952	-83.403275
SP1	Orion Twp.	Oakland	Stony/Paint	Paint Creek	42.796312	-83.290681
SP2	Village of Orion	Oakland	Stony/Paint	Paint Creek	42.782900	-83.239100
SP3	Orion Twp.	Oakland	Stony/Paint	Paint Creek	42.767600	-83.218600
SP4	Washington Twp.	Macomb	Stony/Paint	Stony Creek	42.785400	-83.086800
SP5	Oakland Twp.	Oakland	Stony/Paint	Stony Creek	42.731500	-83.101900
SP6	Oakland Twp.	Oakland	Stony/Paint	Stony Creek	42.781700	-83.178900
SP8	Rochester Hills	Oakland	Stony/Paint	Paint Creek	42.696300	-83.147000
SP9	Rochester	Oakland	Stony/Paint	Paint Creek	42.682400	-83.129500
SP14	Oakland Twp.	Oakland	Stony/Paint	Paint Creek	42.731900	-83.161400
SP15	Rochester Hills	Oakland	Stony/Paint	Stony Creek	42.696200	-83.116600
SP18	Lakeville	Oakland	Stony/Paint	Stony Creek	42.820793	-83.149552
SP20	Rochester	Oakland	Stony/Paint	Paint Creek	42.687311	-83.141108
SP25	Oakland Twp.	Oakland	Stony/Paint	Gallagher Creek	42.732285	-83.164077
SP26	Rochester Hills	Oakland	Stony/Paint	Paint Creek	42.710928	-83.157064
CM3	Auburn Hills	Oakland	Clinton Main	Clinton River	42.634800	-83.222900
CM4	Pontiac	Oakland	Clinton Main	Galloway Creek	42.669100	-83.258900
CM5	Rochester Hills	Oakland	Clinton Main	Clinton River	42.665100	-83.153900
CM6	Rochester Hills	Oakland	Clinton Main	Clinton River	42.671900	-83.096800
CM7	Pontiac	Oakland	Clinton Main	Clinton River	42.627117	-83.309106
CM8	Auburn Hills	Oakland	Clinton Main	Galloway Creek	42.697698	-83.231785
CM9	Rochester Hills	Oakland	Clinton Main	Avon Creek	42.664914	-83.157097
CM 10	Rochester Hills	Oakland	Clinton Main	Galloway Creek	42.663725	-83.215710
CM 12	Rochester Hills	oakland	Clinton Main	Clinton River	42.671854	-83.094625
CM11	Rochester Hills	Oakland	Clinton Main	Clinton River	42.656931	-83.197161
RR4	Warren	Macomb	Red Run	Big Beaver Creek	42.550400	-83.077800
RR6	Sterling Heights	Macomb	Red Run	chrissman drain	42.601383	-83.057351
RR9	Sterling Heights	Oakland	Red Run	Big Beaver Creek	42.544022	-83.063464
RR11	Sterling Heights	Macomb	Red Run	Plumbrook Drain	42.568346	-82.978244
CREW1	Shelby Twp.	Macomb	Clinton River East	Middle Branch	42.697500	-83.031400
CREW3	Shelby Twp.	Macomb	Clinton River East	Clinton River	42.700900	-82.995800
CREW4	Clinton Twp.	Macomb	Clinton River East	Utica Drain	42.624865	-82.959617
CREW5	Macomb Twp.	Macomb	Clinton River East	Clinton River	42.642900	-82.933300
CREW6	Sterling Heights	Macomb	Red Run	Clinton River	42.595425	-83.011655
CREW8	Shelby Twp.	Macomb	Clinton River East	Price Brook Drain	42.715597	-82.978116
CREW10	Macomb Twp.	Macomb	Clinton River East	Gloede Drain	42.642783	-82.957978
CREW11	Clinton Twp.	Macomb	Clinton River East	kuku creek	42.599122	-82.939933
CREW 12	Clinton Twp.	Macomb	Clinton River East	Gleode drain	42.623927	-82.950132
CREW 13	Shelby Twp	Macomb	Clinton River East	Clinton River	42.656700	-83.072650
NB1	Ray Twp.	Macomb	North Branch	North Branch	42.766481	-82.928483
NB2	Clinton Twp.	Macomb	North Branch	North Branch	42.620997	-82.897503
NB3	Armada Twp.	Macomb	North Branch	East Coon Creek	42.843909	-82.886982
NB13	Ray Twp.	Macomb	North Branch	North Branch	42.795600	-82.963200
NB15	Macomb Twp.	Macomb	North branch	McBride Drain	42.697207	-82.920850
NB16	Ray Twp.	Macomb	North Branch	North Branch	42.764240	-82.922652
LSC4	St. Clair Shores	Macomb	Lake St. Clair	Contrell Drain	42.540100	-82.862600
AB1	New haven	Macomb	Anchor Bay DD	Salt River	42.723511	-82.787000
UC6	Independence Twp.	Oakland	Upper Clinton	Clinton River	42.741303	-83.445385
UC7	Waterford	oakland	Upper Clinton	Clinton River	42.704420	-83.390379

Appendix E - CRWC Site Map