Guidance for Michigan Clean Water Corps (MiCorps) member programs for developing Quality Assurance Program Plans (QAPPs)

Adapted from MDEQ guidance for Water Quality Monitoring Studies

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All volunteer monitoring programs participating as MiCorps member programs, or grantees receiving federal or state monies for the purpose of conducting water quality monitoring, are required to prepare a quality assurance program plan (QAPP). A QAPP is a written document that provides the framework for how environmental data will be collected to achieve program objectives and describes the procedures that will be implemented to obtain data of known and adequate quality. The QAPP must be prepared by the member organization or grantee (or their consultant) and approved by MiCorps staff prior to study and analysis. This document has been prepared in conjunction with a QAPP Review Checklist (see separate document at www.micorps.net/resourcesqa.html) to facilitate the preparation of approvable QAPPs for water quality monitoring studies. The use of this document is intended to improve the quality of draft QAPPs so that minimal revisions are necessary. You will probably find it helpful to look at the check list as you write your QAPP.

Components of a QAPP

In general, there are ten major components of a QAPP. Since MiCorps is currently focused on programs monitoring macroinvertebrates and assessing habitat, this guidance is tailored to that type of monitoring. Programs that include an emphasis on water chemistry sampling are not currently covered by MiCorps and will need to address additional components. The components, along with the sections in which they are included, are:

Section A:
- A program overview and description, including the person(s) responsible for carrying out the program.
- Data Quality Objectives (DQO).

Section B:
- Sampling methods and other operating procedures.
- Equipment maintenance procedures.
- Data management and analysis procedures.
- Internal quality control checks.

Section C:
- Data validation and reporting.
- Performance and system audits.
- Data quality assessment and reporting.
- Corrective action for addressing all quality assurance/quality control noncompliance problems.

These components are integrated into the sections described below. In evaluating QAPPs, MiCorps staff follow a checklist (referenced above) that includes all the sections below. The following is specific guidance for completing each section. Examples specific to volunteer macroinvertebrate monitoring are included for most subsections. Authors may combine sections in their QAPPs, but it is suggested that they describe such deviations or reference sections where the relevant elements are discussed so that reviewers will be able to find the relevant material.

SECTION A: PROGRAM DESCRIPTION AND QUALITY OBJECTIVES

A1. Title and Approval Sheet

Fill in the information on the cover sheet form (www.micorps.net/documents/qapp_cover.doc). Once the QAPP is complete, make sure to have the cover signed by all necessary parties. Initial QAPP drafts should be submitted electronically to your assigned QAPP reviewer or Ric Lawson, the MiCorps QA Manager, at rlawson@hrwc.org. After the QAPP has been accepted, the approval sheet should be signed and mailed in duplicate to MiCorps. A copy with MiCorps approval signature will be returned for inclusion with the original program documentation.

A2. Table of Contents

Please develop a table of contents indicating the page number for each major section.

A3. Distribution List

Indicate the name and organization for each individual who will receive the QAPP.

A4. Program Organization

Identify key personnel (including advisors) within the program team and include their organizational affiliation and contact information. List their roles and responsibilities in the program and identify lines of authority and reporting responsibility. An organizational chart may be included to illustrate lines of responsibility. **Be sure to indicate the person or position responsible for maintaining primary QA oversight** (i.e. the QA Manager).

This section of the QAPP shall also indicate personnel roles with the following responsibilities (individuals may have multiple responsibilities):

1. Management Responsibilities – All managers and their respective responsibilities shall be listed. This includes the grantee and subcontractors.

2. Field Responsibilities – All field sampling personnel and their respective responsibilities shall be listed. A single term “volunteers” or volunteer roles (e.g. collectors, pickers) is preferable to listing all volunteers.

3. Laboratory Responsibilities – The identity of any laboratories and key laboratory staff associated with the program shall be listed. The location of the laboratory (city and state) and the parameters that will be tested at each laboratory shall be included. For macroinvertebrate programs, the lab would be the location where collections are sorted and identified.

4. Corrective Action – Program personnel responsible for initiating, developing, approving, and implementing corrective actions shall be listed.

A5. Problem Definition/Background

Describe the purpose or goals of monitoring along with the expected outcomes or actions to be taken based on results. Include the major questions or issues to be addressed and background information. This section may be extracted from your program proposal.

> *Example:*
> *“The primary goals of the Adopt-A-Stream Program of volunteer monitoring are to provide reliable data about the conditions of the entire river system, educate the watershed residents about what the river needs from them and engage residents and communities in actions to protect the river*

system. The primary actions we envision taking based on monitoring results are to report the trends and conditions of the stream sections studied. As clarified in other sections of this document, we do not present any results on the ecological conditions until we have three years of benthic community data plus a habitat assessment and one season of temperature measurements. In the event that an extreme change in benthic macroinvertebrates and habitat is observed (such as oil in the sediment and an impoverished community), we will notify the appropriate authorities about the unverified results immediately and stay in contact with them as they investigate the situation. Our goal is to assist in removing causes of stream deterioration."

A6. Program Description

This section of the QAPP shall include a brief description (i.e. summary or abstract) of the entire program, its specific objectives and how the program is designed to obtain the information necessary to accomplish the objectives.

A7. Data Quality Objectives

This section of the QAPP addresses the data quality objectives (DQO) and requirements used to decide whether or not data are acceptable to use in program reporting and the MiCorps Data Exchange. **This is a critical section of the QAPP, and is often the section that requires the most revision following review. This section also has direct implications for program methods and should be viewed as the foundation of the QAPP.** Please consider the guidance in this section carefully. Data quality objectives should be listed for each parameter (i.e. measure, such as "total diversity" or temperature) being analyzed. Each QAPP must discuss precision, bias, completeness, representativeness and comparability. If quantitative measures are not available, other methods should be used to determine if the data quality objectives have been met.

You will find below a description of each term along with the type of language and methods that should be included in the QAPP. This text may be used as is or altered to meet program-specific objectives.

Precision: Precision evaluates how consistently a method produces the same results. Along with bias, precision measures get as close to the accuracy (i.e. how close the measurements are to the true value) of results as is possible when conducting biological monitoring. Measures of precision and bias are critical to assuring that a program's data are credible and reflect actual conditions. There are a number of methods to calculating precision statistics. No single method is perfect, and data type should be taken into account. For macroinvertebrate measures, we recommend the following language.

Suggested language: The following techniques will be reviewed during training and in retraining of team leaders every three years: [1] collecting style (must be thorough and vigorous), [2] habitat diversity (must include all habitats present and be thorough in each one), and [3] the transfer of collected macroinvertebrates from the net to the sample jars (thoroughness is critical).

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

Essentially, each measure is compared to the median of all samples taken from a given site. Note that this examination necessitates that stream data records include the personnel of the monitoring team. If

you need help calculating median and standard deviation statistics, contact Ric Lawson, the MiCorps QA Manager (rlawson@hrwc.org, 734-769-5123x13.

In addition, the Program Manager will seek opportunities to compare results with those from an external sampling group, such as MDEQ. Every attempt will be made to collect duplicate samples in such a situation.

Sample results that exceed these standards should be then noted as "outliers" and examined to determine if the results are likely due to sampling error or a true environmental variation. If sampling error is determined the data point should be removed from the data record. Volunteer teams that generate more than one outlier should be observed by the Program Expert at the next sampling event and be considered for retraining.

The Program Expert will make the final identifications for each sample. MiCorps staff will conduct a method validation review with the designated Program Expert to ensure his or her expertise, preferably prior to the first training session held by the Program Expert. This will be conducted with each new Program Expert added to a MiCorps monitoring program. This review will consist of a joint sampling event, with MiCorps staff jointly collecting, sorting and identifying the macroinvertebrates with the Program Expert. Any monitoring issues will be addressed on site. If no major concerns remain, the Program Expert will be considered "certified" by MiCorps.

Bias: Bias is a measure of systematic error. Bias can be introduced by the methods used in all sampling events or by individual samplers or teams. The above examinations should serve to measure bias in the methods of the program. Procedures must be in place to detect bias in sampling teams.

Suggested language: Sites will be sampled by different team leaders at least once every three years in each season (two events among six sampling events, if conducted twice per year) to examine the effects of bias in individual collection styles. The new measure should be within two standard deviations of the median of past measures. Sites not meeting this DQO will be evaluated as above by the Program Expert.

Completeness: Completeness is a measure of the proportion of data obtained that is judged to be valid. Completeness combines the results from all teams to give the manager a measurement of how the program is functioning overall. Not all data generated in a study is automatically acceptable for use in addressing the objectives of the study since data may fail QA reviews.

Suggested language: 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 Program Manager will consult with MiCorps staff to determine the main causes of data invalidation and develop a course of action to improve the completeness of future sampling events.

Representativeness: This refers to the degree to which the measured data reflect the true conditions in the environment being studied. Since this cannot usually be measured directly, a qualitative discussion of the site selection and sampling methodologies should be presented. The site selection methodology should include a rationale that directly addresses the goals of the program and does not lead toward conclusions being drawn beyond the scope of the data collected. Generally, sampling sites should be located at or above stream junctions and then move upstream to segment the watershed into increasingly smaller contributing basins or better pinpoint a problem source. The sampling methodology should indicate that all representative habitats will be sampled and documented.

Example language: *Study sites are selected to represent the full variety of stream habitat types available locally, emphasizing the inclusion of riffle habitat. All available habitats within the study site will be sampled and documented to ensure a thorough sampling of all of the organisms inhabiting the site. Resulting data from the monitoring program will be used to represent the ecological conditions of the contributing subwatershed. Since not enough resources are available to allow the program to cover the entire watershed, some subwatersheds will not initially be represented. Additional subwatershed sites will be added as resources and volunteers allow.*

Comparability: Comparability is a measure of the confidence with which one data set or method can be compared to another. At the core of this measure is the degree to which sampling methods are identical across all sampling events. The primary goal is for the data on all parts of a given watershed to be comparable, despite being measured by different people at different times. MiCorps seeks to establish standard methods for all programs within MiCorps to increase the degree of comparability across the state.

Suggested language: *To ensure data comparability, all volunteers in the watershed will follow the same sampling and site selection methods and use the same units of reporting. Program directors and trainers will learn the standard MiCorps monitoring methods at annual trainings by MiCorps staff and will train their volunteers to follow those methods to ensure comparability of results among all MiCorps programs. To the extent possible, the monitoring of all study sites will be completed on a single day.*

To be sure standard methods are followed, please include the following (or similar) language in your sampling methodology: *"For each sampling event that is not completed on a single day, monitoring by volunteers will be completed within the same two week period. If a site is temporarily inaccessible, such as due to prolonged high water, the monitoring time may be extended for two additional weeks. If the issue concerning inaccessibility is continued beyond the extended dates, then no monitoring data will be collected during that time and there will be a gap in the data. If a team is unable to monitor their site during the specified time, the Team Leader will contact the Program Manager as soon as possible and no later than the end of the first week in the sampling window in order for the Manager to arrange for another team to complete the monitoring." If no team is available, the Program Manager will, if feasible, sample the site. Otherwise, the site will go unmonitored for that season.*

A8. Special Training/Certifications

Identify any specialized training or certifications that are required. MiCorps training or equivalent should be included. Volunteer team leaders must also be trained for macroinvertebrate and habitat assessment. Indicate who has received the MiCorps training or what the plans are for obtaining and providing training of MiCorps methods.

SECTION B: PROGRAM DESIGN AND PROCEDURES

B1. Study Design and Methods

Describe your study design in detail. Include planned frequency of monitoring each site, study locations and the methodology used to select sites and for volunteers to find sites. A watershed map locating all study sites and an example of the maps that will be used by volunteers should be included. Indicate the information that is critical to the monitoring program and which information is for context information or other uses. Identify potential sources of variability and how this variability will be reported.

This section of the QAPP shall include a list and description of study methods that will be used to monitor each parameter. Include standard operating procedures (SOPs) for each procedure with sufficient detail to indicate how the quality of resulting data will be confirmed. Include methods used to preserve the macroinvertebrate collections and to prevent contamination from sites previously sampled with the same equipment (e.g., net). Add a detailed list of all monitoring equipment (see recommendations on the MiCorps website at http://www.micorps.net/documents/Stream%20Equipment%20List.pdf) and the location where equipment is normally stored. Include actions to be taken (by whom) when problems occur. SOPs can be included as appendices to the QAPP.

> *Example:*
> *Sampling the benthic community: Multiple collections will be taken from each habitat type present at the site, including riffle, rocks or other large objects, leaf packs, submerged vegetation or roots, and depositional areas, while wading and using a D-frame kicknet. The trained Streamside*

Leader will record the number of locations sampled within the monitored reach in each habitat type and note the locations sampled on a site map. The trained Collector will transfer the material from the net into white pans. The remaining volunteers (Pickers) will pick out samples of all different types of macroinvertebrates from the pans and place them into jars of 70% ethyl alcohol for later identification. During the collection, the Collector will provide information to the team Streamside Leader in response to questions on the data sheet that review all habitats to be sampled, the state of the creek, and any changes in methodology or unusual observations. The streamside leader will instruct and assist other team members in detecting and collecting macroinvertebrates in the sorting pans, including looking under bark and inside of constructions made of sticks or other substrates.. Potential sources of variability such as weather/stream flow differences, season, and site characteristic differences will be noted for each event and discussed in study results. There are places on the data sheet to record unusual procedures or accidents, such as losing part of the collection by spilling. Any variations in procedure should be explained on the data sheet. (See appended data sheet.)

Outline procedures for sample preservation. Custody information is required when there is a transfer of custody of monitoring samples. If samples remain in a single person's or team's custody from collection through analysis and data recording, please indicate this and state who is responsible for them.

This section of the QAPP should also include a description of the process or procedure that will be used by the organization (or subcontractors) to document that samples collected and analyzed as a part of the monitoring program were always in a state of custody or protection, which means that the samples that are analyzed or identified are the samples that were collected. Chain of custody is accomplished through a combination of field and laboratory records that demonstrate possession and transfer of custody from one individual or team to another.

Example:
At the collecting site, all invertebrate sample jars receive a label written in pencil, stating date, location, name of collector, and number of jars containing the collection from this site, which is placed inside the jar. The data sheet also states the number of jars containing the collection from this site. The team leader is responsible for labeling and securely closing the jars, and the team manager is responsible for returning all jars and all equipment. Upon return to the Program building, the collections are checked for labels, the data sheets are checked for completeness and for correct information on the number of jars containing the collection from the site, and the jars are secured together with a rubber band and site label and placed together in one box. They are stored in the central office until they are examined and counted on the day of identification (one or two weeks later). The data sheets are used on the identification day, after which they remain on file indefinitely. At the time of identifying the sample, the sample identifier checks the data sheet and jars to ensure that all the jars, and only the jars, from that collection are present prior to emptying them into a white pan for sorting. If any specimens are separated from the pan during identification, a site label accompanies them. For identification, volunteers sort all individuals from a single jar into look-alike groups, and then are joined by an identification expert who confirms the sorting and provides identification of the taxa present. These identifications are then verified by the Program Expert. When identification of a sample is complete, the entire collection is placed in a single jar of fresh alcohol with a poly-seal cap and a printed label inside the jar and stored at the Program office indefinitely. The alcohol is carefully changed (to avoid losing small specimens) in the jars every few years.

This section of the QAPP needs to include a list of parameters to be analyzed into the raw data of the monitoring program. Post-collection analysis is covered under section B5. The parameter list should include the following:

- frequency and time frame of monitoring (if not included previously),
- taxonomic level of macroinvertebrate identification, such as order or family, etc.
- literature and equipment used for identifying macroinvertebrates and analyzing samples,

- description of the analytical method for each parameter,
- sample disposal procedures, and
- procedures for addressing failures.

Example:
Parameters:

- *Macroinvertebrate community will be monitored and identified to family level at least annually in either April or September. Literature references used for identification are included in Appendix X.*
- *Habitat will be monitored at least every five years in the summer or fall. See Section B2 for monitoring procedures and methods of metric computation.*
- *Maximum/minimum summer stream temperatures are monitored in every site at least one year in July and August.*

Timing:

- *The benthic population is sampled within a 2-week period in mid-April and mid-September;*
- *The winter stonefly population is sampled in mid-January. Most sites are sampled on a single day, although additional population samples may be collected within a two-week period.*
- *The physical characteristics of the sites are measured once every 3 to 5 years, during the summer or fall;*
- *The in-stream maximum/minimum temperatures are monitored weekly, during July and August.*

Prepare a check list of quality control procedures for use with equipment maintenance, field activities, and data analysis, such as listed below.
Equipment Quality Control:

- Check to make sure equipment is in working order and not damaged
- Clean equipment before and after taking it into the field
- Label equipment with their dates of purchase and dates of last usage
- Check the expiration date of chemical reagents prior to each use
- Check the batteries of all equipment that requires them
- Make sure equipment is calibrated appropriately before conducting each test

Field Procedures Quality Control:

- Collect replicate samples
- Conduct repeat and/or side-by-side tests performed by separate field crews
- At least once every three years in each season: change the composition of the field crews to maintain objectivity and minimize individual bias
- Review field records before submitting for analysis to minimize errors

The frequency of the quality assurance checks to be performed should be included in the description. The description should include details on procedures for determining control limits and exceedences, and actions to be taken when control limits are exceeded.

Example:
Since our evaluation is based on the diversity in the community, we attempt to include a complete sample of the different groups present, rather than a random sub-sample. We do not assume that a single collection represents all the diversity in the community, but rather we consider our results reliable only after repeated collections spanning at least three years. Our results are compared with other locations in the same river system that have been sampled in the same way. All collectors attend an in-stream training session, and most sites are sampled by different collectors at different times to diminish the effects of bias in individual collecting styles. Samples where the

diversity measures diverge substantially from past samples at the same site are resampled by a new team within two weeks. If a change is confirmed, the site becomes a high priority for the next scheduled collection. Field checks include checking all data sheets to make sure each habitat type available was sampled, and the team leader examines several picking trays to ensure that all present families have been collected. All lab sorting is rechecked by an expert before completing identification.

B2. Instrument/Equipment Testing, Inspection, and Maintenance

List all critical instruments and equipment to be used in the monitoring program. Describe the testing, inspection and maintenance procedures for each apparatus. Indicate the testing needs to verify proper function. For macroinvertebrate monitoring, the critical equipment to maintain includes nets (firmly attached to poles and free of holes) collection jars (with poly seal tops), forceps (with tips that meet), and waders that are clean, dry and do not leak. Describe inspection procedures and include the individual(s) responsible for inspection and maintenance. Indicate how deficiencies will be resolved and documented. Note where the equipment is stored.

This section of the QAPP shall include a description of the calibration procedures and the frequency with which these procedures will be performed for field instruments, if any are used. This section may be included as a single chart. Set up a log so you can demonstrate that your equipment is being calibrated regularly.

Each calibration procedure shall also include the acceptance criteria and the conditions that will require recalibration. The accuracy of the calibration standards used must be properly documented.

Example:
Stream water conductivity is measured from collected samples at one time at the end of the sampling day, with a Myron L TechPro Series Model AR1 conductivity meter that is calibrated that day, prior to measurements, with a potassium chloride standard (1413 uS/cm) purchased from Hanna Instruments .

Temperature equipment: Taylor maximum/minimum thermometers, which are checked for accuracy in ice water and in boiling water prior to use. Adjustments are made when needed by resetting the location of the scale and then tightening the screws to be snug. If the mercury has separated or there are bubbles in it, the two following methods are followed to correct the problem. The thermometer is swung downward with care several times, or it is immersed completely in water at about 130° F (but lower than 135° F).

B3. Inspection/Acceptance for Supplies and Consumables

Prepare a list of monitoring supplies and consumables. Record when they were purchased and dates when they should be replaced. Note criteria for acceptance for use in the program, along with any procedures for storage and retrieval and who is responsible for this activity.

B4. Non-direct Measurements

This section is not necessary for most programs. Summarize any data or information that is used in conjunction with volunteer collected data but you did not measure directly (e.g. model outputs, data from agency databases, etc.). The specific use should be described along with acceptance criteria and the nature of its uncertainty.

B5. Data Management

Indicate how data and records will be maintained and reported. Include the method of data storage and back up and who (list title) will be responsible for maintaining records. Identify how long and where

records will be maintained. Include copies of all data collection forms and a description of the qualifications of volunteer data collectors.

Example:
Raw data will be entered and managed in Microsoft Excel workbooks. MathCAD will be used to graph stream channel shape and calculate cross-sectional area for each transect, at bank full and pin-to-pin. All data is backed up bi-weekly and a tape is kept off premises. Computer passwords provide data security.

Describe the system that you will use to store and manage the monitoring data from field collection to analysis. Include locations of storage, details about how the data is handled at each step and the individuals responsible for each step. Also include the name or description of the database management software (e.g. Access, Excel, etc.) that will be used to store and analyze the study data.

Examples:
- *Data will be entered from data sheets directly into the online MiCorps database by a single, trained volunteer for storage within the MiCorps data exchange system. Data sheets will be filed at the central office for a period of at least five years.*
- *Data will be entered by the data manager into the program's MS Access database for long-term storage. Once a year, all new data will be exported to a MiCorps compatible format and sent to MiCorps for inclusion in their data exchange system. Data sheets will be filed at the central office for a period of at least five years.*

- Describe any metrics, indicators or other measures that will be calculated from the raw field or lab data and include methods of computation. Include units of measure if applicable. Describe statistical analyses used to analyze the aquatic community data.

Example:
- *Macroinvertebrates: Data are summarized for reporting into four metrics: all taxa, insects, EPT (Ephemeroptera + Plecoptera + Trichoptera), and sensitive taxa. Units of measure are families counted in each metric. A Stream Quality Index (SQI) is also computed. The method for calculating that metric is included in Appendix X*
- *Habitat: specific measures are used from habitat surveys to investigate problem areas at each site. The percentage of stream bed composed of fines (sand and smaller particles) is calculated and changes are tracked over time as an indicator of sediment deposition.*
- *Temperature: Temperatures for monitoring sites are reported as mean of maximum or minimum summer stream temperatures, along with maximum of maximum and minimum of minimum.*

Some suggestions for data analysis quality control include:
- Check all calculations twice
- Hard copies of all computer entered data should be reviewed for errors by comparing to field data sheets
- Have qualified professionals review your data analysis methods and results periodically.

SECTION C: System Assessment, Correction and Reporting

C1. System Audits and Response Actions

This section of the QAPP describes the performance and system audits that will be used to assess the capability and performance of your program. Assessments should be done both internally by members of your group, and externally, by qualified outside experts. A system audit evaluates the process of the program, including on-site reviews of field sites and facilities where data is processed and analyzed. A performance audit evaluates how well people are doing their jobs of collecting and analyzing the data. List everyone who will assist in these evaluations, their relationship to the program and how often the audits occur.

Examples:

- *Side-by-side sampling will take place during which a team of our volunteers and an outside expert will sample the same stream. Agreement in sample composition between the two should be 70% or greater.*
- *Data sheets will incorporate essential QAPP procedures, such as the number of net samples taken from each type of habitat.*
- *Volunteer team leaders trained by MiCorps will monitor that quality assurance protocols are followed and report any issues possibly affecting data quality.*

This section of the QAPP shall also include the data quality assessment process that will be used to assess the scientific and statistical quality of the data collected. This section shall describe how the data will be inspected for technical problems and for statistical significance. Methods used to evaluate the data statistically to verify assumptions (i.e., distribution and independence) shall be described.

Example:
The total diversity reported by each team must equal at least 70% of the diversity previously found at the site. Sites with results less than 70% will be re-sampled by experts to verify or discard such unusual results, which could be the result of less-than-thorough sampling.

Finally, this section of the QAPP shall include a description of the corrective actions that you will take in response to any shortfalls. Corrective actions can be required during field activities, laboratory analyses, data validation, and data assessment. All corrective actions should be documented in a record book.

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

C2. Data Review, Verification, and Validation

You will need to set up a review, verification and validation process to ensure that your data was properly collected and recorded. This section establishes the criteria you will use to review and validate the data. Validating refers to either accepting, rejecting or qualifying data (such as rejecting outliers or documenting incomplete method adherence) before using it for analysis and/or decision making. Make sure that your data collection forms are standardized, which facilitates spot-checking that they are completely and correctly filled out. Designate someone to review and sign-off the data before it is stored in a computer or file cabinet. Establish a schedule for comparing raw data forms to computer entries. Finally, describe how monitoring results will be confirmed. For example, you might have an entomologist confirm your macroinvertebrate identifications or you might use a reference collection of voucher samples. Record the processes used by experts, such as examination under a dissecting microscope (state the maximum enlargement) and consultation with a dichotomous key from a text that you name.

A description of the data reporting actions that the organization intends to take to communicate the data to MiCorps and other interested parties should also be provided. You will likely need to refer back to section A7, where the data quality objectives were described. Specific types of information that should be provided in this section of the QAPP include:

- Any rationale used to determine whether or not data are acceptable.
- Any statistical methods used to determine data significance.
- Any equations used to determine whether or not data meet the quality assurance objectives/requirements of the monitoring program.

- An outline and timeline for the draft and final reports to be prepared for the water quality monitoring program.

  Examples:
  - *The total diversity reported by each team must equal at least 70% of the diversity previously found at the site, as verified by the program manager. Sites with results less than 70% will be re-sampled by experts to verify or discard such unusual results, which could be the result of less-than-thorough sampling.*
  - *Reports on progress will be submitted to MiCorps as required, with all quality issues noted.*

C3. Reconciliation with Data Quality Objectives

Describe how and when you will determine if your data meets the DQOs in section A7, and what you will do if it does not. It is best to assess your data as soon after it is collected as possible so you can begin corrective actions. If you find limitations in your data, they need to be identified and reported to the program manager and data users.

C4. Reporting

Identify the status reports that are needed to report on any quality control issues. The organization should include a list of needed or potential reports, their form (i.e. formal, informal), and who should receive the reports. Quality control reports can be included as part of quarterly program reports.