## 1. TITLE AND APPROVAL PAGE

# Quality Assurance Project Plan for Chemical Testing

# Musconetcong Watershed Association

# River Watcher Volunteer Water Quality Monitoring Program

## August 17, 2008

| | |
|---|---|
| Musconetcong Watershed Association | Signature _____ |
| Project QA Officer | Name / Date _____ |
| NJ Department of Environmental Protection | Signature _____ |
| Volunteer Water Quality Monitoring Coordinator | Name / Date _____ |
| NJ Department of Environmental Protection | Signature _____ |
| Project Manager | Name / Date _____ |

**TABLE OF CONTENTS**

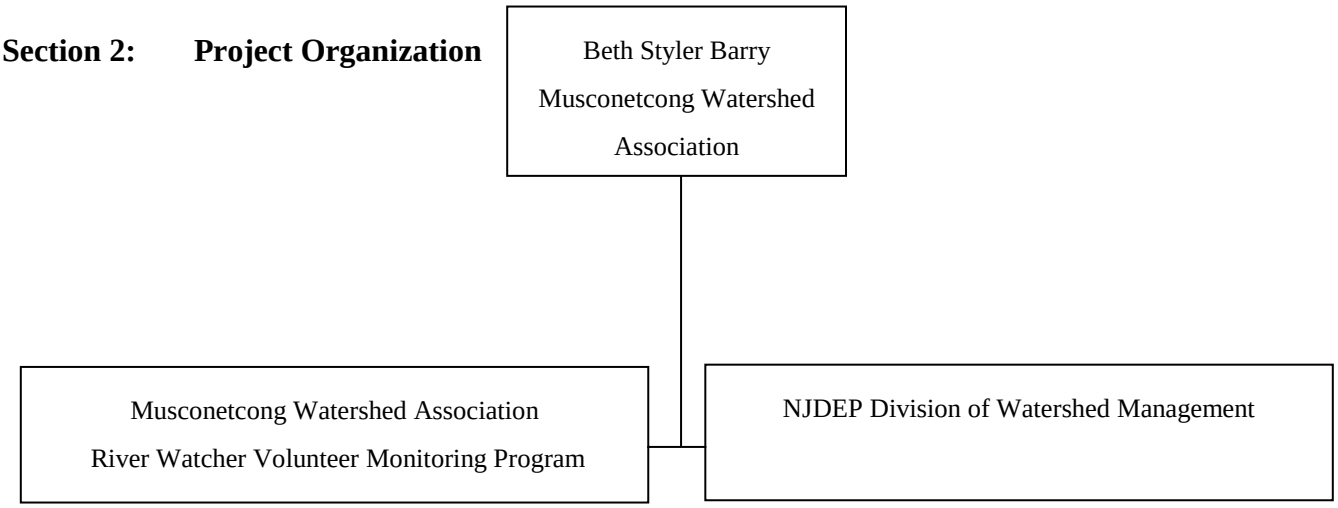
## Section 1: Distribution List

| | | |
|---|---|---|
| Beth Styler Barry<br>Project QA Officer<br>Musconetcong Watershed Assoc.<br>P.O Box 113 Asbury NJ 08802 | beth@musconetcong.org | (908) -537-7060 |
| Nancy Roberts-Lawler<br>Project Coordinator<br>Musconetcong Watershed Assoc.<br>P.O Box 113 Asbury NJ 08802 | nancy@musconetcong.org | (908) -537-7060 |
| Danielle Donkersloot<br>Volunteer Monitoring Coordinator<br>NJ Dept. Environmental Protection<br>401 E. State Street<br>Trenton, NJ 08625 | danielle.donkersloot@dep.state.nj.us | (609) 633-9241 |
| Ralston Bartholomew III<br>MWA Technical Advisory Committee<br>Assistant Professor of Biology<br>Warren County Comm. College<br>475 Route 57 West<br>Washington NJ 07882 | rbartholomew@warren.edu | (908) 835-9222 |
| Christine Hall<br>MWA Technical Advisory Committee<br>RC&D Coordinator<br>NRCS North Jersey RC&D<br>54 Old Highway 22, Suite 201<br>Clinton, NJ 08809 | chall@northjerseyrcd.org | (908) 735-0733 |
| Chris Obrupta<br>MWA Technical Advisory Committee | obropta@envsci.rutgers.edu | (732) 932-4917 |

Extension Specialist
Rutgers Cooperative Extension Water Resources Program
Environmental Sciences
14 College Farm Road
New Brunswick, NJ 08901

Lisa Galloway Evrard evrard@rci.rutgers.edu (732) 932-9800
MWA Technical Advisory Committee
Program Associate
Rutgers Cooperative Extension Water Resources Program
14 College Farm Road
New Brunswick, NJ 08901

## Section 2: Project Organization




### A. QA Project Officer

Beth Styler Barry, Executive Director of the Musconetcong Watershed Association's (MWA) is responsible for management of the River Watcher Program.

### B. River Watcher Monitors

Four groups of water monitors, who work in teams of four or five, are responsible for monitoring one of four specific sampling sites within the Musconetcong River Watershed (see Appendix A: Map of MWA River Watcher sites for locations). The monitors are trained under a program developed by MWA and set forth in the attached document, *River Watcher Handbook: Volunteer Water Quality Monitoring Program.* This document also sets forth the Study Design and standard operating

procedures under which the field aspects of this program are performed.

The basic tasks performed by the River Watcher Monitors are the sampling and analysis of water quality using LaMotte field test kits. Water quality parameters being analyzed include temperature (air and water), pH, nitrate-nitrogen (nitrate-N), and dissolved oxygen. Sampling is performed on a quarterly basis, the last weekend of January, April, July and October between 10:00 am and 2:00 pm. A broader discussion of field sampling and analysis procedures is presented in Sections 10 and 11 of this document.

The monitors also perform a Visual Assessment using the protocol developed by the New Jersey Department of Environmental Protection Division of Watershed Management and a Macroinvertebrate Bioassessment based on material developed by the Save Our Streams Program of the Izaak Walton League of America. A separate Quality Assurance Project Plan has been developed for those aspects of the River Watcher Program.

**C. Supporting Resources**

River Watcher Program volunteers perform an assortment of administrative and technical functions, including data management, data analysis, and quality control. Summaries of the current supporting resources that are essential to this program follow:

- River Watcher trained volunteers from Warren County Community College perform the entry of historical data into the NJ DEP E2 system. This data was obtained by the MWA volunteer monitors working prior to the start of the River Watcher monitoring program.
- MWA plans to investigate the possibility of a River Watcher volunteer(s) performing entry of data obtained during the quarterly River Watching events.

## Section 3: Problem Definition/Background

The Musconetcong Watershed Association (MWA) was incorporated as a nonprofit 501(c)3 organization in 1992, committed to protecting and improving the quality of the Musconetcong River Watershed, including its natural and cultural resources, through public education and awareness programs, scientific research, promotion of sustainable land management practices, and community involvement. The region served encompasses the Musconetcong River watershed, a drainage area of 157.6 square miles in northwest New Jersey, which includes portions of Morris, Hunterdon, Warren and Sussex counties, and all or parts of 25 municipalities. The Musconetcong River runs 42 miles from Lake Hopatcong to the Delaware River.

In 2006, two segments of the Musconetcong River, a total of 24.2 miles, were designated as a component of the National Wild and Scenic Rivers System. On May 20, 2008 DEP Commissioner

Lisa Jackson signed Amendments to N.J.A.C. 7:9B-1.4 and 1.15 Surface Water Quality Standards and the new rules were published in the June 16, 2008 NJ Register. The Musconetcong River is now classified as a Category One water body from Saxton Falls to the Delaware River, this classification includes all tributaries, named and unnamed. The Musconetcong was upgraded based upon that presence of endangered or threatened species, the ability to support exceptional aquatic communities or its connection to drinking-water sources.

The MWA recognizes the necessity of a comprehensive water monitoring program as an essential component of conservation and stewardship for the Musconetcong Watershed. MWA plans to use the data to assure that water quality remains at a level suitable for recreational uses (i.e. fishing and swimming) and wildlife habitat and for the advocacy of stream protection when proposed projects threaten water quality. Data will be used to observe the impact over time of the implementation of restoration projects (e.g., stream stabilization, riparian restoration, dam removal). The MWA also hopes to measure the impact of preservation of land, improved development controls, and pollution prevention programs including those mandated but the Stormwater Regulations. Collection of accurate data will help the MWA determine if changing land use or discharges are affecting water quality.

The predominant non-point pollution sources in the watershed are those associated with extensive agricultural use in the river corridor and suburban development, the latter is on the increase throughout the Musconetcong River Watershed. Runoff from construction sites, housing developments, storm sewers, and roads is contributing to excessive sediment and nutrient loading. Aging septic systems are also believed to be a potential pollution problem throughout the watershed. Agricultural non-point pollution comes in the form of sediments, nutrients, and pesticides coming from croplands. It is a combination of suburban and agricultural runoff which is suspected of degrading the waterways in the Musconetcong River Watershed.

Current land-use regulations focus not only on the mitigation of past actions, but also on the protection of the existing natural resources. However, because governmental agencies cannot monitor all of the collective and individual actions that impact and degrade the environment, it is essential for MWA to play a role in the stewardship of the environment. This is especially true with regard to non-point source pollution, which is difficult to control through regulatory oversight. Common examples of non-point source pollution are fertilizers, herbicides, pesticides, spilled motor oil, sediment, and animal waste from pets and livestock. River Watcher chemical testing focuses on water quality as impacted by these non-point sources.

## Section 4: Project Description

Musconetcong Watershed Association staff and volunteers developed the River Watcher monitoring program after researching several local and national models. To promote the protection of the Musconetcong River, MWA has selected water quality parameters that will enhance understanding of overall environmental health (see the River Watcher Volunteer Manual for a discussion of the importance of each testing parameter) and testing methods that have proven successful in citizen based programs throughout the United States.

River Watcher program will use trained volunteer to monitor, document and report water conditions at four locations in the river. Results will be used to motivate local government, businesses and private landowners to initiate and support change in their uses of the land and drainage systems that will enhance water quality within the watershed. The program will provide quality data to regulators, decision-makers, and other interested parties. The monitoring program will help the MWA to identify problems, develop strategies and prioritize activities for improving water quality, as well as to track progress towards water quality improvements.

The MWA has been monitoring using a study design for the River Watcher program submitted to the New Jersey Department of Environmental Protection (NJDEP) in the spring of 2007. The MWA program was designed to meet NJDEP standards and will yield data of a quality that can be used for presentation to local government decision makers.

The following sites will be monitored four times a year:

**Outflow of Lake Hopatcong, Hopatcong State Park** This location will be tested because Lake Hopatcong is at the headwaters of the Musconetcong River.

**Stephens State Park, Hackettstown** This protected area of the Musconetcong River is below the confluence of Lubber's Run, the Musconetcong River's major tributary and below the immediate influence of the upper watershed's many lakes.

**Point Mountain Preserve, Lebanon Township** This location was chosen because it is a Wild and Scenic Segment and it is vulnerable to development.

**Mount Joy Road, Holland Township** The MWA hopes that dam removals in this area will improve water quality over time. The location of this test site will help us to understand the effect of dam removals over time.

Water samples for chemical and physical testing will be taken at all monitoring stations quarterly.

The monitors also perform a Visual Assessment using the protocol developed by the New Jersey Department of Environmental Protection Division of Watershed Management and a Macroinvertebrate Bioassessment based on material developed by the Save Our Streams Program of the Izaak Walton League of America. A macroinvertebrate sample will be tested by the Volunteers twice a year at the October and April test events.

The sampling period is designated as the last weekend of January, April, July and October, plus or minus two days (i.e. Friday through Monday). The recommended time for sampling is 10:00 a.m., and the time allowance range is from 10:00 a.m. to 2:00 p.m. The results of these tests will be entered into a computer database and published in annual reports shared with volunteers, MWA members, the NJDEP, municipal authorities and interested citizens.

Training is provided by the Musconetcong Watershed Association and River Watchers will be required to attend two 3-hour workshops. The first workshop will be an "in-class" training session that will give an overview of the tests to be conducted and the methods that monitors will be using. The second workshop will be an in-depth streamside training session in which monitors will be introduced to equipment, sampling techniques and test procedures.

## Section 5: Measurement Quality Objectives

### A. Data Precision, Accuracy, and Measurement Range

The following table illustrates the precision, accuracy, and measurement range for the River Watcher program's chemical measurements as provided by LaMotte Company manufacturers of the test kits used in the program.

| Matrix | Parameter | Measurement Range | Accuracy | Precision |
|---|---|---|---|---|
| Water | Nitrate-N | 0.2 – 4.0 ppm | ±0.1 ppm | ±20% |
| Water | pH | 4.5 – 10.0 | ±0.1 standard units | ±20% |
| Water | Dissolved Oxygen | 0.0 – 20.0 ppm | ±0.1 ppm | ±20% |

Precision is the degree of agreement among repeated measurements of the same parameter under the same conditions. Precision data indicate how consistent and reproducible the field sampling or analytical procedures have been. Field tests, in general, can be expected to have an error rate of plus or minus 20%. For the chemical assessment, volunteers do not collect and analyze duplicate samples, with the exception of the dissolved oxygen test. For this test, the analysis is performed

twice and the average is reported. The two tests must agree within 0.6 parts per million (ppm) of each other. If they do not agree within 0.6 ppm, the volunteer performs an additional test with two bottles to see if it agrees with one of the first two within 0.6 ppm. The volunteer then averages the three closest results for the final result and disregards the measurement that did not agree within 0.6 ppm. If the additional tests still do not agree within 0.6 of either of the first two tests, the results are not valid, and the stream should be re-sampled. The volunteers should collect the initial water samples at the same time and then perform the analysis. The volunteers record all results plus the average so that both the range and average are documented and reported to the Project QA Officer. The Project QA Officer checks all results when the data sheets are handed in, and contacts the volunteer if results do not seem correct based on historical conditions. If necessary, the Project QA Officer will re-train the volunteers in the proper collection and analytical techniques.

Accuracy is assured in both field collection and sample analysis through standardized sampling efforts conducted by trained volunteers. All field methods used to collect and analyze samples for pH, nitrate-N, and dissolved oxygen are detailed in the attached document, *River Watcher Manual: Volunteer Water Quality Monitoring Program* included. All volunteers are required to attend an annual Quality Assurance/Quality Control session that employs a single-blind method of evaluating procedures of all monitors. Each volunteer must perform the suite of tests and the results are compared against a known standard for pH. If the results do not agree within 20%, the volunteer must repeat the test until a satisfactory result is obtained. During these sessions, any inaccuracies in analysis can be corrected and equipment and chemicals can be inspected for replacement if needed. Volunteers are instructed how to inspect their chemicals and equipment (color comparators, thermometers, test tubes, etc.) on a regular basis and contact the Project QA Officer for replacements throughout the year. This helps to ensure confidence in the reported data.

**B. Data Representativeness**

Representativeness is a qualitative term that describes the extent to which sampling design adequately reflects the environmental conditions of a site. The representativeness of the data is dependent on the sampling procedures adequately represent the true condition of the sample site. Monitoring sites are selected based upon the ability of the site to represent the impact on water quality from changes in the upstream drainage area. Choice of sample site, sampling of water, and use of only approved/documented analytical methods will ensure that the measurement data does represent the conditions at the investigation site, to the fullest extent possible.

It is well known that water flowing past a given location is constantly changing in response to many factors including weather. Sampling schedules have been designed with respect to frequency, locations, and methodology in order to maximize representativeness, where possible and applicable.

### C. Data Comparability

One of the ways that MWA ensures comparability between stations and sampling events is that all volunteers are trained in and follow the same standardized protocol established for the River Watcher Program. These protocols are documented in the *River Watcher Manual: Volunteer Water Quality Monitoring Program* (Appendix A)and included in the test kit that accompanies volunteers into the field. All volunteers collect and analyze samples the last weekend of January, April, July and October between 10:00 am and 2:00 pm. This sampling time frame was selected to evaluate the data relative to diurnal fluctuation and for technical consistency. If volunteers are unable to perform sampling on Saturday or Sunday due to inclement weather or high river conditions, they are allowed to sample within one week of the designated time, but must stay within the 10:00 am to 2:00 pm sampling timeframe. Any data collection performed outside these days or times is not included in the database used for analysis.

Volunteers are given maps to specific sites at the sampling locations where data collection is to take place. These maps are included in the binder, which is part of the field sampling kit. This allows comparability over time at the same location.

### D. Data Completeness

Completeness refers to the amount of valid data obtained compared to the amount of data collected and analyzed. It is expected that at least 90% of the samples collected will yield acceptable results.

There is no fraction of the planned data that must be collected in order to fulfill statistical criteria. . Completeness in this project's case, is the number of data sets collected, compared to the number planned. While many factors can influence collection of data in a volunteer monitoring program (volunteers have a conflict and cannot sample, inclement weather, equipment failure), to optimize completeness, every effort is made to avoid sample and data loss. Spare equipment kits are stored at the MWA office and the River Watcher Coordinator is able to monitor during days when volunteers may not be able to monitor. If inclement weather (icy bank conditions, heavy rains, flood conditions, etc) prevent volunteers from perform sampling due to inclement weather or high river conditions, sampling may take place within one week of the designated time, but must stay within the 10:00 am to 2:00 pm sampling timeframe. The completeness goal for this project is 100%; completeness will be considered achieved when 100% of the sampling sites have been monitored in a season.

## Section 6: Training Requirements and Certification

### A. Training Logistical Arrangements

All volunteers must attend a training session prior to beginning their sampling. Training of volunteers in field procedures occurs during two three-hour sessions, one in the classroom and one

held in the field.

The field training focuses on sampling safety, proper water sample collection and field measurement/observation techniques, and how to properly complete all parts of the data sheet. This is performed with hands-on demonstration of techniques by trained instructors (MWA staff or experienced volunteers) followed by volunteers performing those same techniques. Volunteers are also given a manual containing instructions on how to complete the data sheet and perform each test, site maps of the sampling location, sampling dates, emergency contact phone numbers, and background information on the Musconetcong Watershed and the parameters for which they sample.

**B. Description of Training and Trainer Qualifications**

Ms. Styler Barry, Executive Director, has 8 years experience in water quality and environmental monitoring for the MWA and, prior to her position with the MWA worked as an Analytical Chemist for many years in the pharmaceutical industry. She has been trained in U.S. EPA's Rapid Bioassessment Protocols for both macroinvertebrate sampling and habitat assessment. Ms. Styler Barry received a BS Biochemistry from Rutgers University and a MA in Environmental Management from Montclair State University. Beth reviews all documents and data for quality assurance purposes and reviews data evaluation.

Nancy Roberts-Lawler is the QA project officer and Coordinator for the River Watcher program. She has 10 years experience educating volunteers in environmental monitoring; prior to her position with MWA Nancy worked for the NJDEP Volunteer Monitoring Program on the design team for the Volunteer Monitoring section of the E2 Water quality Data Management System, and trained many volunteers and NJDEP staff in its use. She trains River Watcher volunteers in sampling techniques, researches documentation and writes reports, and reviews all data for quality assurance/quality control of field and laboratory procedures as well as performs data evaluation.

## Section 7: Documentation and Records

During training, volunteers are instructed in the proper completion of a field data sheet. Each River Watcher field data sheet must be completed on-site at the time sampling occurs. These sheets are used to record analytical results. A sample data sheet is included in the attached document, *River Watcher Manual: Volunteer Water Quality Monitoring Program*. Volunteers keep a copy of each data sheet with their records. The results are reported to the MWA office following sampling via fax, e-mail, or regular mail. E-mailed data sheets are kept electronically and printed so a hard copy may be stored with the other data sheets. Data is reviewed by the Project QA Officer for completeness. Results are compiled in the River Watcher progress reports. Data sheets are held for at least five years. Data is also entered into the New Jersey DEP E2 Online Water Quality Monitoring Database.

MWA collects the names and contact information for all volunteers during trainings and keeps a

record of active volunteers in its River Watcher database. This database includes the site name at which the volunteer monitors.

## Section 8: Sampling Process Design

### A. Rationale for Selection of Sampling Sites

**Outflow of Lake Hopatcong, Hopatcong State Park** Lake Hopatcong is at the headwaters of the Musconetcong River, MWA will test here to determine water quality at the outflow of the dam.

**Stephens State Park, Hackettstown** This protected area of the Musconetcong River is below the confluence of Lubber's Run, the Musconetcong River's major tributary and below the immediate influence of the upper watershed's many lakes.

**Point Mountain Preserve, Lebanon Township** This location was chosen because it is a Wild and Scenic Segment and it is downstream from an area vulnerable to development.

**Mount Joy Road, Holland Township** The MWA will be involved in dam removals up stream of this site. The location of this test site will help us to understand the effect of dam removals on water quality over time.

a. At this time all sites will be located on the main stem of the river. Over time, MWA plans to expand the program and may select sites on tributaries.

b. The area must be safely accessible for volunteers of all abilities and try to avoid sites with steep, slippery, or eroding banks. The area must also contain a safe place to park.

c. Sampling locations are located in the main river current and away from the banks when possible.

d. A well-documented area/landmark/location has been mapped for easy replication of the same sampling spot over the span of many years. All sites have been mapped using GPS points.

**B. Sample Design Logistics**

All sampling logistics are outlined in the attached document, *River Watcher Manual: Volunteer Water Quality Monitoring Program*. A brief outline is contained in the table below.

| | Parameter | # of Samples per site | Sampling Frequency | Sampling Period |
|---|---|---|---|---|
| Chemical Tests | Nitrate-N | 1 | Quarterly | January, April, July and October |
| | pH | 1 | Quarterly | January, April, July and October |
| | Dissolved Oxygen | 2-3 | Quarterly | January, April, July and October |

| Parameter | Sampling Equipment | Sampling Method |
|---|---|---|
| Nitrate-N | LaMotte Comparator and Axial Reader, nitrate reducing reagent, mixed acid, 10 ml test tube | Single grab sample |
| PH | LaMotte Octet Color Comparator, wide range indicator, 5 ml test tube | Single grab sample |
| Dissolved Oxygen | LaMotte direct reading titrator | Modified Winkler Titration performed on 2-4 single grab samples |

**Section 9: Test Kit Storage Requirements**

River Watcher test kits must be stored as close to room temperature as possible (25°C) and away from excessive heat, humidity, moisture, direct sunlight and cold conditions. Kits are not to be stored in automobiles or outdoor sheds between sampling events. Do not refrigerate test kits.

**Section 10: Sample Handling and Custody Procedures**

All water samples are collected and analyzed in the field. Volunteers are responsible for following the proper techniques for sample collection and analysis per their training and the testing procedures outlined in the *River Watcher Manual: Volunteer Water Quality Monitoring Program* document. pH must be analyzed within fifteen minutes of collection. The performance of the nitrate test is not time sensitive and can be preformed any time during the approximately two hours that volunteers spend at the site. Dissolved Oxygen samples must be fixed immediately after collection and can then be analyzed up to eight hours after sample fixation.

At this time, all sampling is being done in the field and there is no sample custody procedure needed.

## Section 11: Analytical Methods Requirements

The data that are collected by the volunteers include air and water temperature, nitrate-N, pH, and dissolved oxygen. The analytical methods for each test are detailed in "River Watcher Chemical Test Procedures" of the *River Watcher Manual: Volunteer Water Quality Monitoring Program* (See Appendix A).

### Nitrate-Nitrogen

Volunteers use a two tablet reagent Octa-Color Slide system to screen for nitrate-nitrogen from 0 to 15ppm (0 to 66ppm as nitrate) – LaMotte Chemical Products; Cat. No.3354.

### pH

Volunteers use an Octet color comparator test kits; wide range 3.0 to 10.0 pH units in 1.0 unit increments; accuracy ±0.2 pH units. LaMotte Chemical Products; Cat. Nos. 2117/P-3100 (3.0 to 10.0 units).

### Dissolved Oxygen

Volunteers use azide modification of Winkler titration method (NFM 6.2.3-Iodo); range 0 to 20 mg/l in 0.1 mg/l increments; reagents sufficient for 25 tests at 0 to 20 mg/l range -- LaMotte Chemical Products; Cat. No. 5860.

## Section 12: Quality Control Requirements

### A. Field QC Checks

The River Watcher program trains its volunteers in the correct visual assessment, sample collection, and chemical sample analysis procedures outlined in *River Watcher Handbook: Volunteer Water Quality Monitoring Program* (See Appendix A). At least once per year, the Project QA Officer, experienced volunteers or trainers accompany new volunteers in the field to evaluate their collection and analytical techniques and correct any errors found.

### B. Laboratory/Data Analysis QC Checks

It is mandatory for all volunteers to attend a Quality Assurance/Quality Control session once a year. Volunteers are required to attend a training session each spring. At these sessions, volunteers perform each test (pH, nitrate-N and dissolved oxygen) on a water sample of a known concentration. A control sample for nitrate-N is prepared by New Jersey Analytical Laboratories at a concentration specified by the QA Project Officer. The QA Project Officer prepares standards for pH using LaMotte pH buffers. The volunteer results are compared to the known standard to determine the accuracy in which they are performing the tests. For dissolved oxygen, a bucket of water is used as the sample. The QA Project Officer tests the bucket water for these two tests to determine the known result against which all volunteer results are compared. If the results for any test do not agree within 10%, measures are taken to determine the cause and the volunteer must repeat the test until a satisfactory result is obtained. Any problems with expired chemicals, faulty equipment, or faulty testing procedures are addressed at these sessions so that greater accuracy is ensured moving forward.

In addition, the QA Project Officer reviews each data sheet upon receiving it. If the result for a parameter is outside of the acceptable range, the QA Project Officer will contact the volunteer to ensure that their equipment is working properly and that their chemicals are not expired. The QA Project Officer will provide replacement equipment and chemicals and re-training as needed.

## Section 13: Equipment Testing, Inspection and Maintenance Requirements

MWA inspect all equipment and chemicals before distributing them to volunteers. In addition volunteers inspect all reagents and equipment before each sampling session. Volunteers check to see that the color comparators are intact, markings on test tubes are legible, and syringes are in good working order. Replacement equipment is available through the Musconetcong Watershed Association office. All records documenting receipt of equipment and initial condition are held at the Musconetcong Watershed Association office.

Volunteers are also instructed to check chemical expiration dates on a regular basis. Expiration dates are generally marked on the chemical bottle. Each River Watcher Kit contains a list of each kit component and its expiration date. A copy of this kit component identification sheet is attached.

When chemicals are near expiration volunteers contact MWA to obtain replacements.

## Section 14: Instrument Calibration and Frequency

At this time there is no equipment used for the pH, dissolved oxygen or nitrate analysis, therefore a discussion of calibration is not applicable.

## Section 15: Inspection/Acceptance Requirements

The River Watcher program uses LaMotte Company customized chemical kits for chemical sampling, which include chemicals and equipment for temperature, pH, nitrate-N, and dissolved oxygen. All kits are purchased from LaMotte under the supervision of the QA Project Officer. Replacement equipment (e.g. thermometers, test tubes, axial readers, water sampling bottles) and chemicals are purchased from LaMotte. The QA Project Officer inspects all kits prior to volunteer trainings. If a kit does not meet standards it is replaced. In addition, volunteers are instructed to inspect equipment to ensure it is in good working order prior to sampling. Volunteers also check chemical expiration dates and contact the Watershed Association for replacements if equipment is damaged or chemicals are expired. If it comes to the attention of the QA Project Officer that data was collected using faulty equipment or expired chemicals, this data is not used.

## Section 16: Data Acquisition Requirements

Water quality standards for the River Watcher monitoring program are taken from the literature and documentation provided by the NJDEP in the Surface Water Quality Standards, N.J.A.C. 7:9B (available at http://www.state.nj.us/dep/wms/bwqsa/swqshome.html). These standards establish the values for which streams are considered non-polluted and are used to gauge stream health in the Musconetcong River Watershed. The following table shows the standard used for each test. Values for nitrate-N should not exceed the value shown. Results for pH should not be outside the range shown. Results for dissolved oxygen should not be below the value shown.

| Parameter | Surface Water Quality Standard |
|---|---|
| Nitrate-N | 10 parts per million (ppm) |
| pH | 6.5-8.5 Standard pH units |
| Dissolved Oxygen | 4.0 ppm ±0.6 ppm |

## Section 17: Data Management

The sampling team inspects field data sheets for completeness before leaving the site. Data sheets are submitted to the QA Project Officer via e-mail, fax, or mail and reviewed for accuracy and completeness. Within 72 hours, the QA Project Officer will contact any samplers whose data sheets contain significant errors or omissions. The field Chemical Data Results sheets require the volunteers to record the site name, date, time, samplers' names, current weather conditions, results for the nitrate-N, pH and dissolved oxygen tests and record kit identification numbers. Significant errors may include, but are not limited to, an air or water temperature that is not within a reasonable range for the time of year, an indication of a weather condition that the QA Project Officer knows did not occur on the specified date, sampling on a day of the beyond one week before or beyond the designated sampling date, beginning sampling outside of the required 10:00 am to 1:00 pm start range, or using results of the dissolved oxygen test that do not agree within 0.6 ppm of each other. If a problem with air or water temperature is found, the QA Project Officer will instruct the volunteer to inspect the thermometer to ensure that there are not any cracks or breaks in the liquid column. If a malfunction to the measuring device is found, the inaccurate data will not be used. In addition, data will not be used if collected outside of the acceptable date and time range. Omissions would include a lack of information in any of the above-mentioned fields. If the site name, date, or start time is missing, the QA Project Officer can contact the volunteer for this information. If any of the other aforementioned information is missing, it cannot be collected for this sampling event, since weather, air temperature, water temperature and water quality chemical measurements must be representative of the day and time the sample was collected, and could have changed in the time since sample collection.

The data is entered into the New Jersey DEP E2 Volunteer Water Quality Monitoring database (http://www.state.nj.us/dep/wms/bwqsa/vm/) and checked for accuracy prior to submission to New Jersey DEP. All data is entered into the database by the Project QA Officer or a trained River Watcher volunteer. Individual results for the dissolved oxygen test as well as the average are entered so that both the average and range of results are available. A copy of the data entry procedures is kept in the office and is available to the volunteer. Integrated within the database are checks preventing erroneous data from being entered. If a value falls out of possible range for the equipment the program refuses to take the data. As a QA/QC check, the QA Project Officer will review the finalized data for accuracy. All of the data sheets are filed by site after being entered into the New Jersey DEP E2 Volunteer Water Quality Monitoring database. These sheets are kept in the binders at MWA for one year and then stored in boxes for at least five years in case they are needed.

## Section 18: Assessment and Response Actions

Review of sampling activities is the responsibility of the QA Project Officer. Experienced, trained

volunteers can also perform this task if deemed qualified by the QA Project Officer. Each volunteer must attend an annual Quality Assurance/Quality Control session where the QA Project Officer evaluates his or her performance (see sections 6.A and 12.B). In addition, MWA plans to investigate the possibility of field audits where each volunteer team will have their performance in the field evaluated by one of these individuals annually. Volunteers in need of performance improvement will be re-trained on-site during the evaluation/QA/QC session or as quickly as possible. If errors in sampling techniques are consistently identified, re-training may be scheduled more frequently for that volunteer team. These re-trainings will be scheduled throughout the year, on an as needed basis, and are not limited to the regularly scheduled trainings in the spring of each year. When possible, the re-training will occur before the next sampling date.

All field and laboratory activities may be reviewed by NJDEP quality assurance officers as requested. The MWA QA Officer performs data quality audits twice yearly. Any identified procedural problems will be corrected based on recommendations from the QA Officer.

**Section 19: Reports**

Interim reports are produced and distributed through the quarterly newsletter, *The Musconetcong River News*. The QA Project Officer is responsible for all report production and distribution. *The Musconetcong River News* is distributed to all volunteers, municipals officials, appropriate NJDEP staff, and other watershed association staff. In the future, reports will also be forwarded to the county, state and groups/agencies as appropriate. These reports will consist of data results, interpretation of data (if possible), results of QC audits, internal assessments, and volunteer achievements. These reports utilize River Watcher data and are distributed to the appropriate municipal officials and NJDEP staff.

**Section 20: Data Review, Validation and Verification**

Data is reviewed for compliance with State Surface Water Quality Standards (SWQS). Any data not meeting SWQS are flagged so that follow-up sampling can be performed at that site if deemed necessary.

All River Watcher program field data are reviewed by the Project QA Officer to determine if the data meet quality assurance/quality control plan objectives. Decisions to reject or qualify data are made by the Project QA Officer.

## Section 21: Validation and Verification Methods

Data sheets must be filled out completely with the names of all monitors present at the time of sampling and analysis. The Project QA Officer checks each data sheet for precision, missing or illegible information, errors in calculation and values outside of the expected range. If questions arise, monitors are contacted for clarification. The Project QA Officer is responsible for ensuring that maintenance records show all monitoring equipment in use to be in compliance with the requirements of this QAPP (see Sections 15, 16, & 17). The Project QA Officer ensures that all monitors listed on the data sheet have completed required training for the parameters tested and have attended at least one QC session within the past year (see section 8). When review is complete and any questions have been resolved, each data sheet is signed and dated by the Project QA Officer. If data quality questions can not be adequately resolved, data will not be entered into the NJ DEP E2 data system and the Project QA Officer will arrange for corrective measures (i.e. monitor re-training, equipment re-calibration, etc.). Any changes made to data are initialed, and any action taken as a result of the data review is specifically recorded on the data sheet below the reviewers' signatures.

All data is entered into the NJ DEP E2 data system (see http://www.state.nj.us/dep/wms/bwqsa/vm/) which is designed to flag any values which fall outside of the expected range for each parameter. On a quarterly basis the Project QA Officer prints out the data and proof reads it against original data sheets. Errors in data entry are corrected and inconsistencies are flagged for further review. Data will be presented annually using graph and report formats to document baseline water quality, identify trends and detect deficiencies in data collection or program design.

As stated in Section 6.A, all volunteers are required to attend an annual Quality Assurance/Quality Control session that employs a single-blind method of evaluating procedures of all monitors. Each volunteer must perform the suite of tests and the results are compared against a known standard for each test. If the results do not agree within 20%, the volunteer must repeat the test until a satisfactory result is obtained. During these sessions, any inaccuracies in analysis can be corrected and equipment and chemicals can be inspected for replacement if needed. Volunteers are instructed to also inspect their chemicals and equipment (titrators, thermometers, test tubes, etc.) on a regular basis and contact the office for replacements throughout the year. This helps to ensure confidence in the reported data.

## Section 22: Reconciliation with Data Quality Objectives

As soon as possible after each sampling event and Quality Assurance/Quality Control session, calculations and determinations for precision, completeness, and accuracy will be made and corrective action implemented if needed. If data quality indicators do not meet program specifications as stated in Section 6.A, data will be flagged. The cause of failure will be evaluated. If the cause is found to be equipment failure, calibration/maintenance/inspection techniques will be reassessed and improved. If the problem is found to be sampling team error, team members will be re-trained. Any limitations on data use will be detailed in both interim and final reports, and other

documentation as needed.

As stated in Sections 6 and 12, all volunteers must attend an annual Quality Assurance/Quality Control session where their techniques are measured against known standards as a check for accuracy in analytical procedures. If an error of greater than 20% is found, the volunteer must repeat the test until a satisfactory result is obtained. Any problems with expired chemicals, faulty equipment, or faulty testing procedures are addressed at these sessions so that greater accuracy is ensured moving forward. If necessary, the volunteer will be re-trained in sampling collection and analytical techniques.

If failure to meet project specifications for precision and accuracy as stated in Section 6.A is found to be unrelated to equipment, methods, or sample error, specifications may be revised for the next sampling season. Revisions will be submitted to the NJDEP quality assurance officers for approval. Revisions may include sending a percentage of samples to an outside lab to confirm the accuracy of field results, performing more frequent field audits, and/or having volunteers analyze duplicate samples in the field.

**B. Intended Usage of Data**

With four active monitoring stations and a plan for on-going, long-term monitoring, the River Watcher program is unique in the Musconetcong River Watershed. According to EPA (http://www.epa.gov/volunteer/),by using standardized sampling procedures, reporting formats, and reporting to a public, carefully designed data management system, the data collected by volunteer citizen monitors is of high enough quality to use as a basis for a water quality assessment. Supplemented and enhanced by data collected in other water quality monitoring efforts in the watershed, the data gathered through River Watcher can be a very effective tool in protecting and improving the environment within our watershed.

The data collected under River Watcher are intended to be most useful as a characterization tool, which will indicate the areas with particularly significant water quality problems. Using this information, it is the ambition of this program to encourage and promote strategies for environmental improvement through individuals, government, and businesses.

Water quality results are also summarized and distributed to all volunteers and interested parties through a quarterly newsletter, *The Musconetcong River News,* as well as in the MWA *Annual Report*. Interested parties include municipal officials, other watershed groups, and representatives of NJDEP. In addition, data may be distributed to municipal officials through targeted mailings which

include data interpretation and recommendations on how the data can be used to enact environmentally proactive ordinances, including stream corridor protection, septic system maintenance, and fertilizer use.