Watershed Watch Project Procedures: Collecting Samples for Laboratory Analysis Version 3.0 2005

Watershed Watch
Sample Collection Methods
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1. Introduction

This document describes standard operating procedures of Watershed Watch in Kentucky for deriving reliable data about water quality samples obtained from streams for laboratory analysis by its Volunteer Monitor participants. This section of the document will provide background on the program, explain its organization, and introduce its sampling programs.

a. Background: Watershed Watch in Kentucky

Watershed Watch in Kentucky educates citizens in watershed and stream science and trains them to gather scientific data about streams.

Watershed Watch has these statewide program objectives:

- Provide citizens with an array of scientific data and an understanding of stream science that helps them better appreciate the quality status of a stream for which they are concerned;
- Create an annual synopsis of the overall quality of surface waters on a state and basin basis; and
- Involve citizens who are knowledgeable about water quality in watershed planning, protection, and restoration activities.

b. Overview: Watershed Watch's Synoptic Sampling Program

A major purpose of the Synoptic Assessment program of Watershed Watch is to generate data that volunteer monitors may use to assess conditions of the stream that most interests them.

Watershed Watch trains volunteer monitors to collect the following data streamside:

- Water Quality characteristics measured at the stream including dissolved oxygen, pH, and temperature and, in places, specific conductance;
- Physical characterization of representative stream reaches;
- Biological sampling; and
- Habitat assessment including biodiversity

This document does not discuss procedures and methods for collection of this data.

Volunteer monitors also collect grab samples about stream parameters that cannot be measured streamside and require laboratory analysis. Samples are collected for:

- Pesticides that threaten aquatic life, sampled in the Spring;
- Human pathogens (including bacteria), sampled in the Summer; and
- Major cations and anions, trace constituents, total organic carbon and other water-quality parameters, sampled in the Fall.

Methods and procedures for training volunteers to grab and transport samples, and for laboratory analysis and QA/AC, are the subject of this document.

c. Data Rigor

The KDOW has issued "Agency Guidance for Volunteer Monitoring Data and Reports" that indicates the level of procedural rigor necessary for data, depending on the intended use for the data. The guidance is summarized in the following matrix, which indicates the data-related activities that are necessary depending on the use to which volunteer-generated data will be put:

		Potential Data Rigor Requirements					
Tier	**Data Use**	Consultation with KDOW	Written Study Plan	Compliance with federal standards	SOP and QAPP pre-approved by KDOW	Use of KDOW SOP	Samplers pre-approved by KDOW
I	Incident Reporting	**X**					
	Education Programs	**X**					
	Local Awareness	**X**					
II	Watershed Screening	**X**	**X**	**O**			
	Local Planning Activities	**X**	**X**	**X**			
III	Effectiveness Monitoring	**X**	**X**	**X**	**X**	**O**	**O**
IV	TMDL Monitoring	**X**	**X**	**X**	**X**	**X**	**O**
	Use Support Determination	**X**	**X**	**X**	**X**	**X**	**X**

X = Required KDOW = Kentucky Division of Water SOP = Standard Operating Procedure
O = Optional QAPP = Quality Assurance Project Plan TMDL = Total Maximum Daily Load

Watershed Watch is designed to meet the data rigor of Tier II.

2. Training

a. Standard Sampling Curriculum

Volunteer Monitors who grab samples or supervise the sampling streamside are required to complete a Standard Sampling Training Module developed by the Training Committee and approved by the Science Advisors Committee of the ICC that addresses:

- Sample container handling
- Sample collection
- Sample preservation
- Sample transport and storage
- Documentation and chain of custody record completion
- QA/QC procedures including duplicate samples and field blanks
- Communication with Event Coordinators and lab staff.

The module includes a demonstration, ideally streamside, of sample container handling, collection, and preservation, and requires the volunteer to demonstrate competency.

3. Planning a "Synoptic" Sampling Event

a. Sampling Event Coordinator

For each synoptic sampling event, the Basin Steering Committee identifies a Sampling Event Coordinator who communicates with the receiving laboratory concerning:

- Arrangements for receiving samples (see Section 8);
- Standards for analysis (see Section 9); and
- Standard reporting spreadsheet, including flags for samples outside of standard receiving temperature and holding time ("lab report") (see Section 10)

The Sampling Event Coordinator also:

- Assembles packets of containers and corresponding instructions to Supervising Samplers;
- Makes arrangements for Drop-Off Centers and Runners as indicated;

b. Selection of laboratory

Watershed Watch uses laboratories that meet at least one of the following criteria:

- Listed on the KDOW Certified Drinking Water Lab List;
- Currently providing contract work for KDOW; or
- Approved by EPPC microbiological staff.

4. Sampling Site Selection

a. Objectives

The site selection process in Watershed Watch attempts to accommodate its two major purposes:

- The interest of the Volunteer Monitor, who often desires to focus learning activities on a stream reach where she or he lives, works, learns, or plays; and
- The need of the program and its stakeholders to collect information from a stream reach near the bottom of a watershed, where data will be most representative of the condition of the watershed.

b. Site Selection Maps

The following maps are used during training to assist Volunteer Monitors and Trainers with Site Selection:

- Kentucky Atlas and Gazetteer, ISBN Number 0-89933-216-1
- Topozone: http://www.topozone.com (Set to DD.DDDD coordinates)
- Arcview Shape Files including Counties, Roads and Streams with current Watershed Watch Site List.

c. Rationale

Because site selection in Watershed Watch attempts to balance the interest of the Volunteer Monitor in a particular stream reach with the program's objective of collecting information about watershed conditions, site selection occurs as part of Volunteer Monitor training so that trainers can encourage participants to:

- Join a team at an existing site;
- Open a new site at a location that will represent the condition of an undocumented watershed; or
- Choose a stream reach that will represent the condition of their stream of interest.

d. Accessibility and Appropriateness

The site selection unit in Watershed Watch training identifies the following factors as important in site selection:

- Proximity to existing Watershed Watch sites;
- Access to the site using public rights of way and/or the permission of the property owner;
- Physical safety in accessing the stream via the streambank;
- Wadeability of the stream;
- Representativeness of the stream reach (channel morphology and riffles)
- Reach mixing (sites near major tributaries or point sources should be avoided to minimize backwater effects or poorly mixed flows);
- Proximity to major man-made disturbances like bridges or dams; and
- Known health risks in the stream, e.g., proximity to a treatment plant or "straight pipes."

e. Health and Safety

The following health and safety factors are addressed in the training:

- Notifying others of itinerary and whereabouts;
- Never visiting an isolated site alone;
- Never sampling in high water;
- Bewaring of hunters, poisonous reptiles, and sudden high water;
- Carrying identification;
- Taking a cellular phone when available; and
- Wearing disposable, powderless gloves when handling sample preservatives such as acid.

5. Location and Description of Sampling Sites

a. Diagram depicting physical setting

The Volunteer Monitor documents the physical setting of the site using a standard form, "Physical Characterization/ Water Quality Field Data Sheet," which may be found in Appendix D.

b. Coordinates

Latitude and longitude are determined for the site in one of two ways:

- The Volunteer Monitor determines them using a handheld GPS unit and submits the coordinates with the "Physical Characterization" form. In this instance, the GPS unit must be tuned to the coordinate specifications called for in http://kywater.org/dow/gps/; or
- A copy of the 1:24,000 topographic map for the stream reach is mailed to the Volunteer Monitor with the first sampling container for the site with a request that the monitor identify the site on the map and return it to the Data Manager.

c. Photographs

The Volunteer Monitor is requested to submit two photographs of the stream reach with the "Physical Characterization" form:

- Upstream of the sample point looking downstream at the sample point (marked "downstream:); and
- Downstream of the sample point looking upstream at the sample point (marked "upstream").

6. Preparation for Sampling

a. Containers and Preservatives

Containers and preservatives for samples are obtained by Steering Committees through the ICC purchasing cooperative or independently and meet the criteria found in Appendix E, "Environmental Sample Preservation and Holding Times."

The container is pre-marked with the unique Site Number by the Sampling Event Coordinator designated by the Steering Committee before it is mailed to the Supervising Sampler for the site.

A "Chain of Custody" form (see Appendix F for the template) is prepared for each site and preprinted with the Site Number, usually by the Data Manager. It is enclosed by the Sampling Event Coordinator with a set of instructions. Samplers should open and read their packet upon receipt.

7. Sampling Procedures

The purposes of the following streamside sampling procedures are to assure that the sample container correlates with the documented sampling activity and to prevent water samples from contamination during the sampling process.

a. Completing the "Chain of Custody" form

The Watershed Watch Chain of Custody form (Appendix F) serves to document and record the transfer of the samples from the stream to the laboratory, functions as a field measurement form, and provides a place for field observations. Listed below are data elements of the form:

Sample identification: the following information is preprinted on the form by the Steering Committee's Data Manager:

- Site Number
- Stream Name
- Watershed Number
- Sampling Location
- County
- Name of and contact information for Supervising Sampler

The following identifying information is entered by the Supervising Sampler streamside when the sample is taken:

- Date and Time of sample collection
- Corrections to any preprinted information

Field measurements: The following information is entered by the Supervising Sampler when and where the sample is taken:

- Comments on general stream conditions
- Flow
- Flow Rate
- Rain in past 48 hours
- Dissolved oxygen
- pH
- Temperature
- Conductivity

Signatures: The Supervising Sampler signs the form at the time she or he relinquishes it to the laboratory or to the next person who will have custody of the sample as it is transported to the laboratory. Signatures are annotated by the date and time they are signed.

b. In-stream sampling location and approach

Samples are taken by wading to reduce sample contamination. A maximum safe wading depth depends on the size of the person sampling, the stream's velocity and depth, and the streambed material. Caution should always be used when wading streams deeper than three feet. Additional caution should be used when the streambed is composed of loose or slippery material. Algae-coated cobbles can be slippery and as dangerous as ice. A personal floatation device should be worn when wading streams three feet or greater in depth.

The sampler approaches the sampling site from a downstream location, walking upstream to the sampling site, to avoid disturbing bottom sediments that could contaminate the water quality sample. An ideal wading location is in the center of the stream and at the head of a riffle so that water current produces a good flow past the sampling point.

c. Sampling for parameters <u>other than</u> bacteria

The sampler first contaminates gloves, if worn, with stream water. Sample bottles are then contaminated with stream water. Pre-marked sample bottles are rinsed once with stream water. The sample bottle is then lowered from the surface to the bottom of the stream until the sample bottle touches the stream bottom, without disturbing sediments. Upon reaching the bottom, the bottle is raised to the surface, matching the transit rate when the bottom was lowered. Repeat until the bottle is filled with stream water. Rinse the bottle cap in the stream and cap the bottle.

d. Sampling for bacteria

The sampler first contaminates gloves, if worn, with stream water before sampling with the container. Do not pre-rinse the container, and avoid contaminating the inside of the container, especially with an ungloved finger. Dip the pre-marked sample container to a depth of about four inches with the open end facing upstream. Push the mouth of the container upstream at this depth until the container is nearly full. The mouth of the container should at all times be upstream of the sample collector and any disturbed sediments. Leave enough airspace in the top of the sample container so the sample can be remixed just before filtration at the laboratory. Immediately chill the sample in an ice slurry (see following section).

e. Sample preservation

Sample preservation procedures prevent reduction or loss of water quality variables of interest. Variable loss can occur between sample collection and laboratory analysis because of physical, chemical, and biological processes that result in chemical precipitation, absorption, oxidation, reduction, ion exchange, degassing, or degradation. Preservation stabilizes variable concentrations for a limited period of time. Some samples, particularly of bacteria, have a very short holding time before laboratory analysis may begin.

In all Watershed Watch sampling events, sample containers are placed in a container with a slurry of chilled water and ice immediately following sample collection to maintain them at 4 degrees Centigrade plus or minus 2 degrees without freezing until analyzed.

Sample preservation instructions are included with the sample bottles mailed or delivered to the Supervising Sampler prior to each sampling event.

f. Chemical treatment

If a sample requiring acidification/ chemical treatment will not be delivered to the laboratory within six hours of its collection from the stream, the following procedures are required:

Glass ampoules containing the preservative and appropriately protected for shipping are distributed by the Sampling Event Coordinator with the sampling containers and instructions to Supervising Samplers. Instructions are sent that include these precautions:

> "Preservatives in the glass ampoules are highly concentrated acids that must be handled carefully. Even a small drop of the solution can burn your skin. Use of latex gloves and safety glasses is highly recommended. Rinse each ampoule with water several times before discarding."

The following instructions are given:

1. After filling the container, carefully snap the neck of the ampoule and add it to container.
2. Label the container with the letter "N" for Nitric Acid, or "S" for Sulfuric Acid, as appropriate.
3. Place the container on ice.
4. Carefully rinse the empty preservative ampoules before discarding.

8. Transport of Samples to the Laboratory

Chilled samples should be delivered to the laboratory as soon as possible; bacteria samples, and samples that require acidification but have not been treated, must be delivered to the laboratory within six hours from the time of collection.

a. Documenting changes in custody of the sample

When the Supervising Sampler takes a sample directly to the laboratory, she or he signs, times, and dates the Chain of Custody form in the left column when custody is relinquished to the laboratory. The staff member of the laboratory who receives the sample similarly signs, times, and dates the form opposite the signature of the person relinquishing it. Identical times and dates on the same line means the sample changed custody without an intermediate step, which would disqualify the sample from regulatory use.

b. Drop-Off Centers

Because of the vast number of Watershed sites sampled on the same day and the few number of receiving laboratories, "Drop-Off Centers" may be established if these criteria are met:

- The instructions that accompany sample bottles identify the person responsible for the drop-off center, and provide directions, contact telephone number, and specific times of operation when the responsible person will be available to accept samples; and

- The center has sufficient refrigeration/cooler space to immediately chill samples transferred from Volunteer Monitors' coolers.

c. Runners

Runners may be designated to collect samples from Drop-Off Centers or Volunteer Monitors in the field. Sample runners are responsible for:

- Communicating with volunteers and drop-off locations on their route prior to sampling in order to coordinate swift collection and transfer;
- Having sufficient cooler space to immediately chill samples transferred from Volunteer Monitors' coolers;
- Communicating with the destination laboratory so it is prepared to accept the samples delivered;
- Fully understanding the delivery times required for samples; and
- Confirming that the numbering of sample containers corresponds to the number on Chain of Custody forms;
- Signing Chain of Custody Forms when receiving and relinquishing samples;
- Checking bottle caps to assure they are securely tightened (avoid over-tightening); and
- Packing samples carefully in the receiving container to prevent bottle breakage, shipping container leakage, and sample degradation.

9. Laboratory Analysis

Labs selected by Watershed Watch are asked to use standard methods of analyis.

10. Data Management

The laboratory sends its results to the project data manager. The Data Manager coordinates review of copies of the printed report by the Sampling Event Coordinator, Steering Committee Chair and Science Advisor for errors, omissions, and suitability. Draft copies are sent to supervising samplers for review and comment. Once approved by the Basin Steering Committee the monitoring data is posted on the basin web site and released at the annual conference

11. Quality Control and Assurance

a. How Watershed Watch Assures the Quality of its Data

Quality Control and Assurance (QA/QC) is the responsibility of everyone in the chain of custody of a sample, its analysis, and the data that results.

A first level of QA/QC is compliance with procedures and methods in the Standard Sampling Curriculum.

The second level of QA/QC is an understanding of and compliance with these Standard Operating Procedures among everyone involved in the sampling event.

The third level of QA/QC is discrete procedures for analyzing quality using the data generated in the sampling program. These procedures are the responsibility of the Laboratory's internal QA program and the Steering Committee's Data Manager and Quality Assurance Officer.

A fourth and final level of QA/QC are activities at the statewide level by the Quality Assurance Committee that include:

- Review of QA/QC reports submitted with data by Steering Committees;
- Audits of Steering Committee QA/QC activities; and
- Comparison of data with statewide and nationwide databases;

The remainder of this section outlines QA/QC procedures that apply to Tier III and IV data uses.

b. Duplicate Samples and Field Blanks

The Sampling Event Coordinator selects sites for duplicate samples and field blanks in consultation with the Steering Committee's Science Advisor and Quality Assurance Officer. Sites selected for duplicate and blank samples should be chosen to be representative of the range of conditions encountered and to rotate through different sampling teams. Sites expected to be at or near method detection limits should be included. Duplicates should also be collected where high concentrations are expected.

1. Duplicate Samples

Watershed Watch uses concurrent duplicate samples to assess variability in sample collection, processing, and analysis.

Supervising Samplers for the sites selected by the random selection process receive a pre-marked duplicate sample container in addition to the pre-marked sample containers with instructions for taking and submitting a duplicate sample. All other procedures for samples are followed for Duplicate Samples.

2. Field blanks

Watershed Watch uses field blanks to assess for bias from contamination of the sample during any stage of sample collection, processing, and analysis.

Supervising Samplers for the sites selected by the random selection process receive a pre-marked field blank container in addition to the pre-marked sample container. The Supervising Sampler is instructed to obtain bottled water in a food store and pour the amount required for a sample into the container pre-marked for the field blank sample at the site and time the routine sample is taken. All other procedures for samples are followed for field blanks. An example of instructions to Supervising Samplers for taking field blanks may be found in Appendix G.

Watershed Watch Chain of Custody Record

Sample #	Stream Name	Date sample taken

Sampling Location (correct or add location info if necessary)	Time sample taken

Name of "Supervising Sampler" on site when sample collected:

Lab Notes:

If name not correct, please enter proper name in Comment Box		Sampler ID#
	Telephone:	

Flow Rate	48 Hr Rainfall "	Turbidity	Water Chemistry	
			Oxygen ppm	pH SU
☐ 0-Dry	☐ 0	☐ 0-Clear		
☐ 1-Ponded	☐ 0.1	☐ 1		
☐ 2-Low	☐ 0.5	☐ 2		
☐ 3-Normal	☐ 1.0	☐ 3-Turbid	Conductivity	Temp C
☐ 4-Bank Full	☐ 1.5			
☐ 5-Flood!	☐ 2.0 +			

General comments, questions, corrections, concerns or suggestions.

When transporting samples to the lab, it is necessary to have each person that controls the sample to sign when they receive it AND when they relinquish it.

Relinquished by:	Time/Date	Received by:	Time/Date

This form must accompany your sample to the lab. The first signature in the "relinquished by" column must match the "supervising Sampler's" name!

Make a copy for yourself, then send the original on its way with your sample runner. Please correct errors on the pre-printed part of this record. If you have questions or difficulties, please contact us at 1-800-928-0045 Ext 473