Idaho Volunteer Monitoring Program

Lake Protocols

Prepared by:
Jim Bellatty and
Joan Meitl

Idaho Department of Health and Welfare
Division of Environmental Quality
1410 N. Hilton
Boise, Idaho

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CREDITS

We would like to acknowledge the Freshwater Foundation and the Environmental Protection Agency for portions of the text included in this handbook.

Table of Contents

Appendices

CHAPTER 1

BACKGROUND INFORMATION

INTRODUCTION

The Idaho Division of Environmental Quality (DEQ) established a statewide volunteer water quality monitoring program during the summer of 1987. The broadbased goals of this program are to meet an increased need for long-term water quality monitoring information and to allow for public participation in the water quality data gathering process.

Currently, the volunteer water quality monitoring program includes eleven Idaho lakes and one river segment. These waterbodies range in size from 350 to 80,000 surface acres and are monitored by volunteers representing property owner associations, environmental groups, and members of the Idaho Lake Association Coalition (ILAC).

Specifically, the objectives of this water quality monitoring program are to:

1) Collect reliable water quality data in a cost-effective manner, using volunteer support;

2) Use water quality monitoring data to determine lake trophic status and longterm water quality trends; and

3) Increase community awareness of water quality and water quality protection issues.

This handbook is designed to provide volunteers with the information they need to conduct water quality monitoring of Idaho lakes. It includes an introduction to how lakes work, an overview of water pollution problems and step-by-step directions for collecting water quality data.

UNDERSTANDING HOW LAKES WORK

A necessary prerequisite for deciding how to protect a lake is developing a basic understanding of the properties of a lake. These properties affect plants, animals and the lake itself.

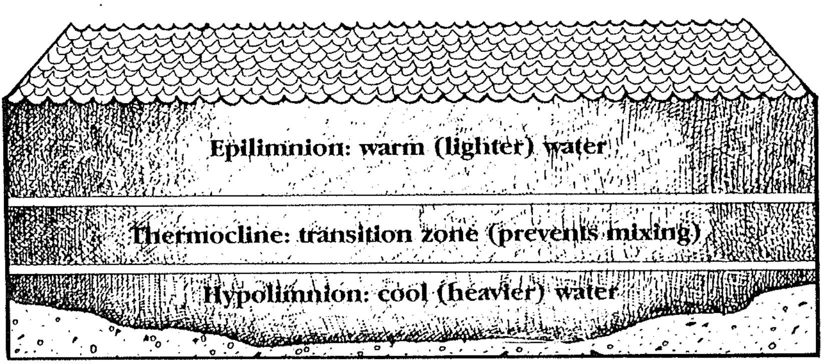
A Physical Look at Lakes

Lakes in temperate climates tend to **stratify** or form layers, especially during summer. This happens because the density of water changes as its temperature changes. Water is most dense at 39°F. Both above and below that temperature, water expands and becomes less dense. This means that in the spring, just before the ice melts, the water near the bottom will be at 39°F. Water above that will be cooler, approaching 32°F just under the ice. As the weather warms, the ice melts and the surface waters begin to heat up. Wind action and increasing density cause this surface water to sink and mix with the deeper water, a process called **spring turnover.**

As summer progresses, the temperature difference (and thus density difference) between upper and lower water becomes more distinct, and most lakes form three separate layers. The upper layer, the **epilimnion,** is characterized by warmer (lighter) water. The epilimnion is roughly equivalent to the zone of light penetration, where the bulk of productivity, or growth, occurs.

Below the epilimnion is another layer, the **thermocline,** in which the temperature declines rapidly. The thermocline is a narrow band of transition which helps to prevent mixing between the layers.

STRATIFICATION: LAKES FORM LAYERS



Below the thermocline lies water much colder than the epilimnion, called the **hypolimnion**. The hypolimnion is the zone of decomposition, where plant material either decays or sinks to the bottom and accumulates.

These temperature conditions will continue until fall. Then surface waters cool until they are as dense as the bottom waters and wind action mixes the lake. This is the **fall turnover.**

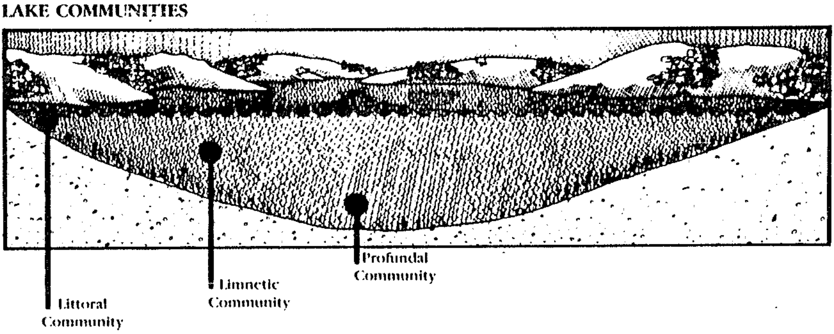
A Biological Look at Lakes

A lake can be divided into zones, or communities, of plants and animals. Extending from the shoreline is the **littoral community,** where aquatic plants are dominant. The size of this community depends on the extent of shallow areas around the lake.

The area of open water is the **limnetic community**. This area is the habitat of **phytoplankton** (algae), **zooplankton** (microscopic animals), and fish. The phytoplankton are very important, serving as the base of the lake's **food chain** and producing oxygen.

The process by which green plants (including algae) produce oxygen from sunlight, water and carbon dioxide is **photosynthesis**. A pigment produced by the plants, chlorophyll, speeds this process. Since sunlight is very important to photosynthesis, oxygen will be produced only as deep as the sunlight penetrates. The depth of light penetration can be measured using a **secchi disc.**

LAKE COMMUNITIES



Below the limnetic zone is the profundal community, where light does not penetrate. This zone or community is dominated by respiration, or oxygen consumption, rather than oxygen production. This zone corresponds roughly to the hypolimnion layer. The community in this zone consists of such organisms as bacteria and fungi. These organisms break down or consume (decompose) dead plants and animals that settle out of the water above. This process consumes oxygen.

A Chemical Look at Lakes

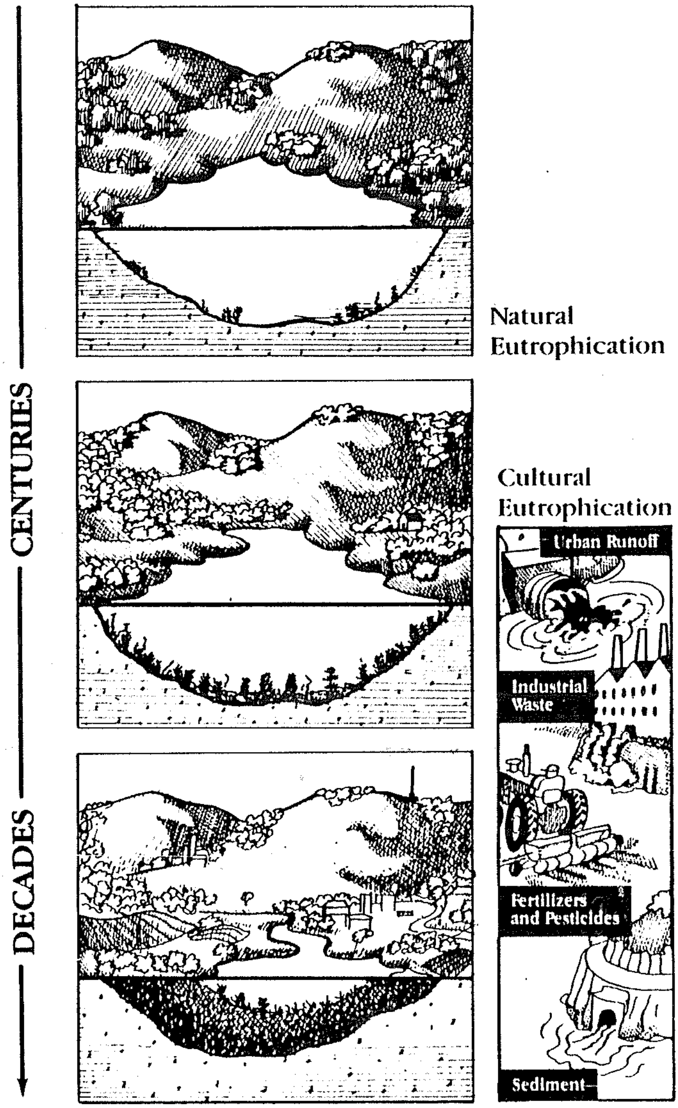
Plants require various substances for growth, including phosphorus, carbon, oxygen and nitrogen. The concentrations of these substances in water control the total amount of plant matter that can grow there. The quantity of each substance needed varies. For example, a high percentage of all plant matter is carbon and a very small percentage is phosphorus. If any one of these substances is absent, plants cannot grow, even if the other substances are abundantly available.

In many lakes, phosphorus is the least available nutrient; therefore, its abundance - or scarcity - controls the extent of algal growth. If more phosphorus is added to the lake from sewage treatment plants, urban runoff or farmland runoff, septic tanks, or even from phosphorus-rich sediments stirred up from the lake bottom, more algae will grow.

In turn, the amount of algae in the water will determine how deep light penetrates, as measured by the secchi disc. Combined measurements of phosphorus level, algae abundance (expressed in terms of chlorophyll a), and secchi disc transparency are used to identify the trophic status (the level of growth or productivity) of a lake.

Eutrophication is the process by which lakes are fertilized with nutrients (chemicals absorbed by plants and used for growth). It is a natural aging process (natural eutrophication), but human activities can speed it up, with more algae and weeds the result (cultural eutrophication).

LAKE EUTROPHICATION



A eutrophic or nutrient-rich lake tends to be shallow, "green," and has limited oxygen in the hypolimnion. An oligotrophic lake is relatively nutrient-poor, is clear and deep, and has a hypolimnion high in dissolved oxygen. A mesotrophic lake is intermediate between the two. Factors vary, however, from lake to lake, and assessments are necessarily subjective.

Pollution

When human activities increase the rate of nutrient and sediment enrichment of a lake, pollution is taking place. Pollution sources that discharge to a lake from specific locations, like municipal and industrial wastewater outlets, urban stormwater outlets or other **point sources** are easy to identify, relatively easy to control through treatment projects, and have been the focus of much of the water pollution control work to date.

Pollution sources that are not discharges from a pipe, but instead are washed off the land or seep into groundwater, are known as **nonpoint sources** of pollution or **polluted runoff.** These include runoff from agricultural fields and feedlots, leakage from septic tanks, nutrients from wetland drainage and storm water runoff, and others. Polluted runoff is best controlled through wise land use practices.

Closely associated with eutrophication is **sedimentation.** Wind and water move soils from the surrounding watershed down into a lake. These soils settle on the bottom of the lake, and the lake becomes increasingly shallow. This process is again governed by gravity and forces of rain and wind.

Sedimentation is greatly accelerated, however, by human activities that leave the soil exposed without vegetation for extended periods. Construction activities that leave soils bare, and intensive agricultural activities, such as plowing near lakes and streams or farming steep slopes, leave soils vulnerable to erosion. This problem is best controlled through soil and water conservation practices and maintaining vegetation on soils.

DESIGNING A VOLUNTEER MONITORING PROGRAM

Most volunteer lake monitoring programs are specifically developed to document problems on lakes impacted (or potentially impacted) by cultural eutrophication. There are four basic lake eutrophication problems that can be routinely monitored by volunteers:

- Water clarity;
- An abundance of algae;
- An abundance of aquatic plants; and
- A reduced level of dissolved oxygen in all or parts of a lake.

Although related, each problem nevertheless has a unique set of parameters that will best characterize that problem. Water clarity determines whether or not a lake is suitable for safe and enjoyable swimming, boating and other water contact sports. Clarity can be measured using a secchi disc to determine how deep light penetrates into the water columns. Citizen monitoring programs designed to characterize the problem of algal growth measure: the quantity of algae and the concentration of the essential algal growth nutrient, phosphorus. Abundant aquatic plant growth is usually characterized by mapping the distribution and density of problem plant species. Monitoring programs that select dissolved oxygen depletion as the problem focus, measure temperature and oxygen profiles of the lake. These profiles define the thermal layers and identify any oxygen deficit problems within the water column that may limit available fish habitat.

There are other lake problems that could be a potential focus for a citizen monitoring program. Three notable candidates are:

- Sedimentation (reduction of water depth);
- Lake acidification; and
- Bacterial pollution of bathing beaches.

Citizen volunteer programs that focus on sedimentation as a lake problem to be monitored generally measure sediment buildup over time at a few select sites (e.g. near the mouth of a stream). Monitoring programs that select lake acidification as the problem focus measure the pH and alkalinity of the water. Monitoring programs that select bacterial pollution as the problem focus, measure for the presence of an indicator organism on a regular basis.

The DEQ approach to volunteer water quality monitoring has been to design programs tailored to the level of interest, commitment, and financial resources of each volunteer group. The monitoring programs vary in complexity from relatively simple Secchi disc transparency depth measurements to collecting samples for nutrients, metals, and chlorophyll a. Volunteers also have the opportunity to measure water-column profiles of temperature and dissolved oxygen. Four levels of monitoring are described in the protocols included in Chapter 2. Level one is the simplest and level four is the most complex.

Volunteers are responsible for purchasing their own water quality sampling equipment, including Kemmerer bottles, Secchi discs, and dissolved oxygen kits or meters. The DEQ conducts annual training for volunteers, supplies the sample containers, laboratory forms, preservative acids, and the biological or chemical analyses (see Appendix B for Water Quality Monitoring Equipment Needs).

An annual report is prepared by DEQ for lake or stream segments in the program. Trophic status is determined and changes in water quality conditions over time are evaluated.

Background Lake Information

It is important to have some preliminary information about the lake to be monitored prior to designing a monitoring program including:

- A bathymetric (depth contour) map to locate the deepest point(s) in the lake;
- A watershed map with major inflows and outflows of the lake indicated;
- A historical summary of water quality including documentation of any lake problems (algae blooms, weed growth, fish kills, etc.);
- Updates of any current activities in the watershed that may impact sampling results (point sources such as sewage plant or storm drain outfalls and nonpoint sources such as agricultural, urban, logging and construction areas.

- Updates of any current activities in the lake that may impact sampling results such as dredging, water level drawdowns, and algicide or herbicide applications.

This information can influence the selection of the sampling site(s) in a lake. It is also important in interpreting the results of the data collection efforts.

Sampling Location and Frequency

Volunteers collect water quality samples and perform field measurements at specific open-water locations. The criteria for locating monitoring sites will depend on what we are trying to find out about the water. There are certain criteria that can be considered. Sites can be located:

1) above and below the mouth of any tributary running into the lake;
2) below major construction sites, sewage treatment plant discharge pipes or any other point source discharge;
3) near a farm or animal holding facility that is instituting best management practices and some that are not;
4) at established state (or other) monitoring sites to allow for comparison of data sets.

Lake water samples are also collected at the deepest point in the lake. If the lake is large, additional samples can also be collected in each distinct part of the lake.

Water quality samples are collected once every six weeks, from April through October. A late winter sample is also desirable, if safety allows.

1) mid-April (or as soon as possible after ice out);
2) in early June;
3) in mid July;
4) in late August;
5) in early October; and
6) February

Sampling Depth

Water quality samples are collected at the secchi disc transparency depth and from 1 meter (m) off the bottom. If the water depth is less than the secchi disc transparency depth, samples are collected at the midpoint between the bottom and the surface.

Sample Analyses

Water quality samples are analyzed for:

1) total phosphorus;
2) orthophosphate phosphorus;
3) nitrite + nitrate nitrogen;
4) total Kjeldahl nitrogen;
5) ammonia nitrogen;
6) chlorophyll a;
7) bacteria (if necessary or appropriate); and
8) metals (if appropriate).

Water Quality Profiles

Monitoring volunteers also collect water column profile (surface-to-bottom) data for temperature and dissolved oxygen concentrations. These measurements are taken at specific depth intervals using titration kits or electronic meters and are important for determining the timing and extent of thermal stratification.

Data Management

The water quality sampling results and field measurements are compiled, analyzed, and presented to the citizens in the form of an annual report. The annual report contains a brief description of each participating lake or river, simple graphical summaries, regional comparisons of water quality and trend information.

QUALITY ASSURANCE

Quality assurance, for the purpose of this program, is referred to as a systematic set of checks and balances emphasizing the need to collect reproducible water quality data. The quality assurance elements we have chosen to meet these program goals and objectives include a training course for water quality monitoring volunteers, an annual audit of volunteer monitoring procedures, collecting replicate water quality samples, and quality controls for laboratory analytical methods.

Training

At the beginning of each monitoring season the volunteers attend a water quality training session presented by the Division of Environmental Quality (DEQ) staff. This outdoor workshop provides the volunteers with an opportunity to learn proper use of their water quality sampling equipment and to practice their water quality sampling protocols. Volunteers also can discuss the rationale behind the water quality monitoring strategies and techniques. The training session is also designed to provide a forum for presenting the water quality sampling results from previous monitoring seasons and discussing water quality trends.

The DEQ trains the volunteers to use a "cookbook approach," complete with monitoring checklists, to ensure that volunteers systematically collect their samples in a step by step manner. This is especially important because of the six-week time lag between sampling dates and the tendency to inadvertently forget some of the water quality sampling details.

Field Audit

In addition to water quality sampling training, each volunteer group is required to schedule a field audit with the DEQ staff during the monitoring season. The purpose of this DEQ visit is to take a non-threatening look at sampling procedures and to provide constructive comments for improving water quality sampling techniques.

The field audit includes an informal evaluation of the volunteers' organizational capabilities, their preparation and labeling procedures, paperwork, consistency, meter calibrating techniques, and their ability to preserve and transport water quality samples to the labratory in a timely manner. Thus far, we have found volunteers conscientiously applying the proper water quality sampling techniques and procedures.

Replicate Sampling

During the field audit, the volunteers also collect one set of replicate water quality samples. These replicate samples enable DEQ to estimate the level of sampling precision, or the amount of reproducibility among individual measurements of the same parameter. Although DEQ has not defined acceptable levels of precision for volunteer monitoring parameters, most of the replicate sampling results indicate low levels of sample variability.

Laboratory Quality Controls

Volunteers collect, preserve, and transport their water quality samples to the nearest branch of the Idaho Bureau of Laboratories for the appropriate chemical and biological analyses. Analyses are conducted in accordance with Environmental

Protection Agency (EPA) and the American Public Health Association (APHA) standards. Additional samples are analyzed to estimate analytical accuracy and laboratory precision.

Although no single element in the quality assurance program would be enough to validate the results of a volunteer water quality monitoring program, we feel that a combination of several checks and balances is adequate to meet our program goals and objectives. Volunteer water quality monitoring data are primarily used for determining trophic condition and longterm water quality trends, rather than for regulatory or investigative purposes.

LIABILITY

All water quality monitoring volunteers are required to read and sign the liability statement provided in Appendix A.

COMPLEMENTARY VOLUNTEER ACTIVITIES

Volunteers also have the opportunity to participate in other water quality-related activities and provide comments to the regulatory agencies. In addition to collecting water quality data, volunteers can provide valuable background information through stream and watershed surveys.

Streamwalk

Streamwalk is a stream corridor survey method designed for volunteers by the Environmental Protection Agency Region 10 office. Streamwalk is a standardized, easy to use screening tool for monitoring stream corridor health (see Appendix E).

Shoreline Survey

A shoreline survey form is included in this handbook (see Appendix F). This form can be used by volunteers to report any water quality problems to the local Division of Environmental Quality Field Office.

FUTURE MONITORING CHALLENGES

The Idaho volunteer water quality monitoring program is proving to be a viable water quality management tool for its information and educational value. The water quality data generated from this program complements existing water quality monitoring programs and helps agencies make informed water quality management decisions. As we look toward the future, the challenge for continued volunteer monitoring success will depend on our ability to retain volunteer interest, recruit new members, and assure quality data.

CHAPTER 2

SAMPLING PROTOCOLS

INTRODUCTION

This section focuses on the protocols for a volunteer monitoring program. Four levels of monitoring, each more complex, are detailed. Level 1 is the least complex, with volunteers collecting water transparency measurements. Level 4 is the most complex and includes collection of transparency, water quality, and temperature and dissolved oxygen information.

SAFETY FIRST

Common sense and good judgement on the part of the volunteer dictate when it is appropriate to sample. Under no circumstances should the volunteer be on the water during electrical storms, high winds or other unsafe conditions. If such conditions exist, the trip should be postponed until the unsafe conditions subside.

Before leaving shore, the volunteer must confirm that all the needed safety equipment is on board the boat. Boating safety is a subject that every volunteer needs to take seriously. Confirm that the following boating safety equipment are on board the sampling boat.

- Personal flotation devices for each person on board.
- First aid kit.
- Other equipment that may be required by state and local boating laws. For example, some boats may be required to carry fire extinguishers.

Prior to each sampling trip, go through the Water Quality Monitoring Checklist (Appendix C) to be sure you have all the equipment and supplies needed to conduct your sampling protocol.

SAMPLING PROTOCOLS

Sampling protocols are the techniques used to obtain information about various water quality conditions. The following protocols begin with the most simple and increase in complexity and monitoring intensity. In addition to the protocols listed at each level, volunteers can conduct an assessment of the condition of streams tributary to the lake (Appendix E, for Streamwalk) and shoreline survey (Appendix F) to report water quality problems.

Level One Protocol

Level one protocol includes the measurement of water transparency using a secchi disc.

Step 1 - Sampling Site Location.

Under safe boating conditions only, find the designated monitoring location(s) (see map), triangulating easily recognized landmarks; drop anchor if necessary.

Site Location Descriptions:

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Step 2 - Measure Secchi Disc Transparency Depth.

While looking over the shady side of the boat, lower secchi disc until it disappears from view, slowly raise until it just reappears; note depth and record on field data sheet (Appendix D).

NOTES

Level Two Protocols

This level of monitoring includes water transparency measurements and the collection of water samples from two depths for laboratory analysis.

Step 1 - Label Containers.

Before you sample or get things wet, label your plastic cubitainers (cubi's) with the following information, using the indelible marker provided:

1) Sampling Site Location: ____________________

2) Date: ____________________

3) Time: ____________________

4) Depth: ____________________
(Secchi depth or deep)

5) Preservative: ____________________
(H_2SO_4 and plain for each depth)

6) Chl a: ____________________
(Secchi depth only)

7) Field Dupe: ____________________
(only for the duplicate samples)

Step 2 - Sampling Site Location.

Under safe boating conditions only, find the designated locations (see map), triangulating easily recognized landmarks; drop anchor if necessary.

Site Location Description:

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Step 3 - Measure Secchi Disc Transparency Depth.

While looking over the shady side of the boat, lower secchi disc until it disappears from view, slowly raise until it just reappears; note depth and record on field data sheet.

Step 4 - Measure Maximum Depth.

Lower the secchi disc until it reaches the bottom; note depth and record on field data sheet. It is important to accurately measure maximum depth for collecting the deep water samples.

Step 5 - Collect and Preserve Deep Water Samples.

a. Inflate the 2 deep sample cubitainers, taking care not to smear the inside of lids with suntan oil, boat oil, etc.

b. Lower the Kemmerer bottle to 1 meter off the bottom, send messenger down line; quickly haul to surface.

c. Pour small amount of sample water (through spring loaded spigot on bottom of Kemmerer) into one of the cubitainers, loosely hold lid on and shake well, empty out as much of the rinse water as possible. Repeat. Then pour the remaining water from the Kemmerer. into the cubi (cubi should by 3/4 or more full -800-900 ml).

d. Collect another sample in the same manner.

e. **Carefully** break off an acid vial (while averting eyes and pointing away from others) and shake/pour into the cubi labeled H_2SO_4. This task can be done back at the dock, however, the acid must get in the correct cubitainer, otherwise the analyses performed will be meaningless and pose a potential hazard to the chemist!!

Important safety note: use an extra cubitainer to dispose of the empty acid vials. Sulfuric acid eats holes in most things including clothing, skin, and boats. If spilled, immediately rinse with water!

f. Cap tightly and store collected samples on ice in a closed cooler.

Step 6 - Collect and Preserve Samples from Secchi Depth.

a. Inflate the remaining 3 cubi's labeled secchi depth and repeat the procedures outlined in step 5.

b. In addition, fill the cubi labeled "chl a" and cover it with aluminum foil before putting it into the cooler.

Step 7 - Duplicate Samples.

During one of your sampling sessions, you will need to collect a duplicate set of water quality samples. This may seem like an inconvenience, however, it is included in our program for quality assurance purposes and measures the amount of variation in your water quality sampling. Do not take duplicate samples from the same bottle of water as your normal set of samples. Duplicate samples are obtained by repeating the sample collection procedures in Steps 5 and 6 a second time.

Also, be sure to fill out a separate set of laboratory forms for these duplicate samples and write "field dupe" at the top of the form.

Step 8 - Go to the Next Sampling Station.

Follow steps 2 through 6.

Step 9 - Transport the Samples to the Laboratory.

Laboratory forms must be completed prior to submitting samples for analyses. The field data sheets should be turned in with lab forms and samples, to be forwarded to DEQ with your sampling results.

Samples must be transported to the labratory with in a specific timeframe. You will be given a schedule for sample delivery to the lab at your annual training session. The lab manager, chemist and phone number for you area labratory will also be provided at the annual training session.

Chemist: ______________________________

Lab Manager: ______________________________

Phone #: ______________________________

NOTES

Level Three Protocols

Level Three monitoring includes each of the measurements included in levels one and two. In addition, volunteers measure dissolved oxygen and temperature at both sample collection depths.

Step 1 - Label Containers.

Before you sample or get things wet, label your plastic cubitainers (cubi's) with the following information, using the indelible marker provided:

1) Sampling Site Location: ______________________

2) Date: ______________________

3) Time: ______________________

4) Depth: ______________________
(Secchi depth or deep)

5) Preservative: ______________________
($\underline{H_2SO_4}$ and plain for each depth)

6) Chl a: ______________________
(Secchi depth only)

7) Field Dupe: ______________________
(only for the duplicate samples.)

Step 2 - Sampling Site Location.

Under safe boating conditions only, find the designated locations (see map), triangulating easily recognized landmarks; drop anchor if necessary.

Site Location Description:

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Step 3 - Measure Secchi Disc Transparency Depth.

While looking over the shady side of the boat, lower secchi disc until it disappears from view, slowly raise until it just reappears; note depth and record on field data sheet.

Step 4 - Measure Maximum Depth.

Lower the secchi disc until it reaches the bottom; note depth and record on field data sheet. It is important to accurately measure maximum depth for collecting the deep water samples.

Step 5 - Collect and Preserve Deep Water Samples.

a. Inflate the 2 deep sample cubitainers, taking care not to smear the inside of lids with suntan oil, boat oil, etc.

b. Lower the Kemmerer bottle to 1 meter off the bottom, send messenger down line; quickly haul to surface.

c. Pour small amount of sample water (through spring loaded spigot on bottom of Kemmerer) into one of the cubitainers, loosely hold lid on and shake well, empty out as much of the rinse water as possible. Repeat. Then pour the remaining water from the Kemmerer into the cubi (cubi should by 3/4 or more full -800-900 ml).

d. Collect another sample in the same manner.

e. **Carefully** break off an acid vial (while averting eyes and pointing away from others) and shake/pour into the cubi labeled H_2SO_4. This task can be done back at the dock, however, the acid must get in the correct cubitainer, otherwise the analyses performed will be totally meaningless and pose a potential hazard to the chemist!!

Important safety note: use an extra cubitainer to dispose of the empty acid vials. Sulfuric acid eats holes in most things including clothing, skin, and boats. If spilled, immediately rinse with water!

f. Cap tightly and store collected samples on ice in a closed cooler.

Step 6 - Measure Deep Water Dissolved Oxygen.

a. Collect another sample from 1 meter off bottom.

b. Slowly pour a small amount of water from the Kemmerer bottle into the Hach Dissolved Oxygen Kit flask. Do not aerate the sample.

c. Perform Dissolved Oxygen Analysis according to kit instructions and record on field data sheet.

d. Pour titration waste into an extra cubitainer, not into the lake. Discard the cubi later.

Note: If the deep sample dissolved oxygen level drops below 5 or 6 ppm (mg/l), it would be desirable to obtain a D.O./Temp. meter and collect profile information. Profile measurements of temperature and dissolved oxygen are described in the Level Four Protocols.

Step 7 - Measure Deep Water Temperature.

Pour some of the remaining deep water sample into an extra cubi or flask and use the thermometer to measure the water temperature. Let sit for at least 30 seconds before taking the reading. Record in degrees Celsius on the field data sheet.

Step 8 - Collect and Preserve Samples from Secchi Depth.

a. Inflate the remaining 3 cubi's labeled secchi depth and repeat the procedures outlined in step 5.

b. In addition, fill the cubi labeled "chl a" and cover it with aluminum foil before putting it into the cooler.

Step 9 - Measure Secchi Depth Dissolved Oxygen.

Collect another sample with the Kemmerer bottle at the secchi disc transparency depth and follow the procedures outlined in Step 6.

Step 10 - Measure Secchi Depth Water Temperature.

Use the remaining secchi depth sample to measure the water temperature as outlined in Step 7.

Step 11 - Duplicate Samples.

During one of your sampling sessions, you will need to collect a duplicate set of water quality samples. This may seem like an inconvenience, however, it is included in our program for quality assurance purposes and measures the amount of variation in your water quality sampling. Do not take duplicate samples from the same bottle of water as your normal set of samples. Duplicate samples are obtained by repeating the sample collection procedures in Steps 5 and 8 a second time.

Also, be sure to fill out a separate set of laboratory forms for these duplicate samples and write "field dupe" at the top of the form.

Step 12 - Go to the Next Sampling Station.

Follow steps 2 through 11.

Step 13 - Transport the Samples to the Laboratory.

Laboratory forms must be completed prior to submitting samples for analyses. The field data sheets should be turned in with lab forms and samples to be forwarded to DEQ with your sampling results.

Samples must be transported to the labratory with in a specific timeframe. You will be given a schedule for sample delivery to the lab at your annual training session. The lab manager, chemist and phone number for you area labratory will also be provided at the annual training session.

Chemist: ______________________________

Lab Manager: ______________________________

Phone #: ______________________________

NOTES

Level Four Protocols

This level of monitoring is the most complex with the volunteer collecting water quality information included in levels one and two. In addition, volunteers measure dissolved oxygen and temperature profiles with field meters.

Step 1 - Label Containers.

Before you sample or get things wet, label your plastic cubitainers (cubi's) with the following information, using the indelible marker provided:

1) Sampling Site Location: ______________________

2) Date: ______________________

3) Time: ______________________

4) Depth: ______________________
(Secchi depth or deep)

5) Preservative: ______________________
(H_2SO_4 and plain for each depth)

6) Chl a: ______________________
(Secchi depth only)

7) Field Dupe: ______________________
(only for the duplicate samples.)

Step 2 - Sampling Site Location.

Under safe boating conditions only, find the designated locations (see map), triangulating easily recognized landmarks; drop anchor if necessary.

Site Location Description:

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Step 3 - Measure Secchi Disc Transparency Depth.

While looking over the shady side of the boat, lower secchi disc until it disappears from view, slowly raise until it just reappears; note depth and record on field data sheet.

Step 4 - Measure Maximum Depth.

Lower the secchi disc until it reaches the bottom; note depth and record on field data sheet. It is important to accurately measure maximum depth for collecting the deep water samples.

Step 5 - Collect and Preserve Deep Water Samples.

a. Inflate the 2 deep sample cubitainers, taking care not to smear the inside of lids with suntan oil, boat oil, etc.

b. Lower the Kemmerer bottle to 1 meter off the bottom, send messenger down line; quickly haul to surface.

c. Pour small amount of sample water (through spring loaded spigot on bottom of Kemmerer) into one of the cubitainers, loosely hold lid on and shake well, empty out as much of the rinse water as possible. Repeat. Then pour the remaining water from the Kemmerer into the cubi (cubi should by 3/4 or more full -800-900 ml).

d. Collect another sample in the same manner.

e. **Carefully** break off an acid vial (while averting eyes and pointing away from others) and shake/pour into the cubi labeled H_2SO_4. This task can be done back at the dock, however, the acid must get in the correct cubitainer, otherwise the analyses performed will be totally meaningless and pose a potential hazard to the chemist!!

Important safety note: use an extra cubitainer to dispose of the empty acid vials. Sulfuric acid eats holes in most things including clothing, skin, and boats. If spilled, immediately rinse with water!

f. Cap tightly and store collected samples on ice in a closed cooler.

Step 6 - Collect and Preserve Samples from Secchi Depth.

a. Inflate the remaining 3 cubi's labeled secchi depth and repeat the procedures outlined in step 5.

b. In addition, fill the cubi labeled "chl a" and cover it with aluminum foil before putting it into the cooler.

Step 7 - Develop Dissolved Oxygen/Temperature Profile.

a. Carefully follow the calibration instructions on the back of the dissolved oxygen/temperature meter to assure valid results.

b. Determine the number of measurement points, based on the maximum depth of the lake (see Step 4). For shallow lakes, readings should be taken at 5 meter intervals, from the surface to the bottom. For deeper lakes, readings should be taken at ten points throughout the profile. Record these readings on the Field Data Sheet, Appendix D.

Step 8 - Duplicate Samples.

During one of your sampling sessions, you will need to collect a duplicate set of water quality samples. This may seem like an inconvenience, however, it is included in our program for quality assurance purposes and measures the amount of variation in your water quality sampling. Do not take duplicate samples from the same bottle of water as your normal set of samples. Duplicate samples are obtained by repeating the sample collection procedures in Steps 5 and 6 a second time.

Also, be sure to fill out a separate set of laboratory forms for these duplicate samples and write "field dupe" at the top of the form.

Step 9 - Go to the Next Sampling Station.

Follow steps 2 through 8.

Step 10 - Transport the Samples to the Laboratory.

Laboratory forms must be completed prior to submitting samples for analyses. The field data sheets should be turned in with lab forms and samples to be forwarded to DEQ with your sampling results.

Samples must be transported to the labratory with in a specific timeframe. You will be given a schedule for sample delivery to the lab at your annual training session. The lab manager, chemist and phone number for you area labratory will also be provided at the annual training session.

Chemist: ____

Lab Manager: ____

Phone #: ____

NOTES

APPENDIX A

LIABILITY STATEMENT

Idaho Volunteer Water Quality Monitoring Program

Liability Statement

The Idaho Department of Health and Welfare, Division of Environmental Quality, Water Quality Bureau intends that citizen volunteers participating in this program are not acting on behalf of the Department of Health and Welfare in any official capacity. As such, it is the Department's intent that citizen volunteers are not authorized to be considered agents, employees, or authorized representatives of the Department for any purpose, and that citizen volunteers are not entitled to the same benefits enjoyed by the Department employees.

Citizen volunteers must recognize the potential for injury to themselves and their real and personal property, and to other persons and their real and personal property, which may result from citizen volunteer activities conducted under the Citizen's Volunteer Monitoring Program. The Department intends that citizen volunteers expressly assume all risks and liability for any injuries to, or caused by, citizen volunteers under this program.

Citizen volunteers will be instructed in proper sampling techniques and cautioned that if there is ever any doubt, they should give safety priority over sampling. Every participant will also receive a copy of the volunteer water quality monitoring workplan and sampling procedures.

Please sign the bottom of this page and return it to:

Local Division of Environmental Quality Field Office

Your signature certifies that you have attended the annual volunteer water quality monitoring training session and received/read a copy of the workplan and sampling procedures.

____________________________________ _______________
Idaho Water Quality Monitoring Volunteer Date

APPENDIX B

WATER QUALITY MONITORING EQUIPMENT NEEDS

IDAHO VOLUNTEER MONITORING EQUIPMENT NEEDS

Groups or individuals participating in the Idaho Volunteer Monitoring Program will need to acquire a standardized set water quality sampling equipment: a Kemmerer Sampling Bottle with a rope and messenger, a Secchi disc and rope, a thermometer, and a dissolved oxygen kit or meter. There are several options for purchasing this equipment: 1) as individual pieces, or 2) as partial kits. The equipment, costs, and vendors are listed below. Find a choice or combination of choices which will meet your needs.

1) Individual Items	Cost
a. 1.2 liter Stainless Steel Kemmerer Sampling Bottle without carrying case. Order # 1200-E35 from the Wildco Supply Co.	$132.45
b. Barrel Messenger Order # 45-B10 from the Wildco Supply Co.	22.65
c. Celsius Thermometer Order # 3001-B18 from the Wildco Supply Co.	11.50
d. Secchi disc Order # 58B10 from the Wildco Supply Co.	47.10
e. Dissolved Oxygen Kit Order # OX-2P from the HACH Company	39.95
Wildco Shipping	5.50
HACH Shipping	3.00
Total	$262.15

2. Kits	Cost
a. 1.2 liter Stainless Steel Kemmerer Sampling Bottle Kit containing 100 ft. rope, barrel messenger, and carrying case. Order # 1200-E32 from the Wildco Supply Co.	$226.00
Secchi disc, thermometer, dissolved oxygen kit and shipping charges as above.	104.05
Total	$333.05

b. 1.2 liter Acrylic (clear plastic) Kemmerer Sampling Bottle Kit with barrel messenger and celsius thermometer (installed). Without carrying case. Order # 1200-J15 from the Wildco Supply Co. — $249.70

Secchi disc, dissolved oxygen kit, and shipping charges as above. — 92.50

Total — **$345.25**

* Secchi discs can be purchased locally from:

Marvin Moore
E. 23157 Highway 3
Cataldo Idaho 93910
208/687-4128

for approximately $20.00, a savings of $27.10 from the manafactures' cost.

3. Miscellaneous Items

a. Small airtight ice cooler

b. Roll of aluminum foil

VENDOR ADDRESSES/PHONE NUMBERS

Wildco Supply Co.
301 Cass St.
Saginaw, MI 48602
517/799-8100

HACH Company
P.O. Box 389
Loveland, CO 80539
800/227-4224

APPENDIX C

WATER QUALITY MONITORING CHECKLIST

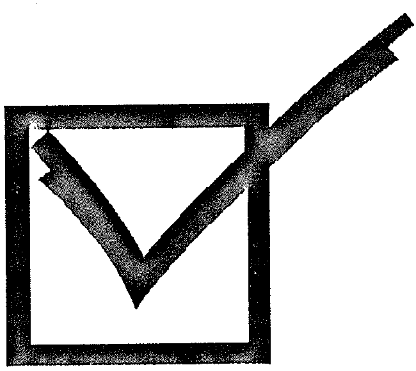
WATER QUALITY MONITORING CHECKLIST

Level One

- ☐ Secchi Disc and rope
- ☐ DEQ forms, and a pen

Level Two

- ☐ Kemmerer Bottle, rope and messenger
- ☐ Secchi Disc and rope
- ☐ Cubitainers, lids and marking pen
- ☐ Acid vials
- ☐ Aluminum foil
- ☐ Ice
- ☐ Cooler
- ☐ Laboratory forms, DEQ forms, and a pen



Level Three

- ☐ Kemmerer Bottle, rope and messenger
- ☐ Secchi Disc and rope
- ☐ Cubitainers, lids and marking pen
- ☐ Acid vials
- ☐ Thermometer
- ☐ Dissolved oxygen kit
- ☐ Aluminum foil
- ☐ Ice
- ☐ Cooler
- ☐ Laboratory forms, DEQ forms, and a pen

Level Four

- ☐ Kemmerer Bottle, rope and messenger
- ☐ Secchi Disc and rope
- ☐ Cubitainers, lids and marking pen
- ☐ Acid vials
- ☐ Dissolved oxygen/temperature meter
- ☐ Aluminum foil
- ☐ Ice
- ☐ Cooler
- ☐ Laboratory forms, DEQ forms, and a pen

APPENDIX D

FIELD DATA SHEET

IDAHO VOLUNTEER MONITORING PROGRAM

Field Data Sheet

Date:________ Samplers: ____________________________________

Lake/Stream Site: ____________________________________

Secchi Disc Transparency Depth (Meters): ____________________

Maximum Depth (Meters): ______________________________

Depth	Temperature	Dissolved Oxygen (mg/l)
______	__________	______________________
______	__________	______________________
______	__________	______________________
______	__________	______________________
______	__________	______________________
______	__________	______________________
______	__________	______________________
______	__________	______________________
______	__________	______________________
______	__________	______________________
______	__________	______________________

Conditions/Comments:______________________________________

____

____

____

____

APPENDIX E

STREAMWALK

Welcome to Streamwalk

At last! For you field sampling pleasure, we have completed Streamwalk! Streamwalk is a stream corridor survey method designed for volunteers. It requires limited training and produces data useful at all levels, local to national.

Streamwalk was inspired by several citizens who asked our Environmental Protection Agency (EPA) Region 10 office to create a standardized, easy to use screening tool that would focus not on the water column, but on the stream corridor. We responded by forming a workgroup composed of several volunteers and agency representatives to develop such a methodology.

Our objectives in developing Streamwalk were to:

- encourage citizen commitment to protecting streams
- educate people about the relationship between streams and watersheds
- develop a screening tool to identify potential problem areas
- provide a standardized data collection method so regional and trend comparisons can be made
- focus experts' limited resources on suspected problem areas

Streamwalk is designed to be promoted and used by volunteers. EPA's role is limited. We will collect survey data, enter it into a computer and provide this information to any interested person. We also will update Streamwalk based on feedback from users.

We have attached a package of information on Streamwalk: the Streamwalk manual and checklist. We hope that this information package will inspire you to start your own Streamwalks. Share it with anyone you think will find it of interest.

If you have any questions, please call Gretchen Hayslip (206/553-1685).

STREAMWALK

Introduction

Citizens throughout the Pacific Northwest are sampling the water quality of rivers and streams in ever-increasing numbers. This is exciting and positive, but it also creates problems. Quality assurance and quality control, water quality comparisons and trend monitoring are all virtually impossible because a multitude of inconsistent sampling techniques are utilized. Data management is difficult because data is fragmentized and dispersed. Furthermore, water quality sampling typically misses nonpoint source related problems such as runoff from storm events, and it fails to identify stressed riparian habitats.

Our Environmental Protection Agency (EPA) Region 10 office in Seattle was asked by several groups to create a standardized, easy to use screening tool for monitoring stream corridor health. We responded by forming a workgroup composed of several citizens and agency representatives to develop both a monitoring checklist and a data management system. We decided to call it Streamwalk.

Streamwalk is designed to be used by lay people, people who are interested in learning more about their streams and rivers. We anticipate that the data that people will collect will be used as a screening tool to focus people's attention on areas that might be of concern, and to help direct further evaluation by experts. And, if all goes as we hope, if enough good data is collected, we should be able to make comparisons between and evaluate trends over time for rivers or streams.

Streamwalk will be most satisfactory for you, the Streamwalk user, if you can work with a resource agency that is interested in using your data. If you have access to such an agency, nurture the relationship and count yourself lucky. If you don't, we'd recommend that you spend some time working with an appropriate agency to develop such a relationship.

Our objectives in developing Streamwalk are to:

- encourage citizen commitment to protecting streams
- educate people about the relationship between streams and watersheds
- develop a screening tool to identify potential problem areas
- provide a standardized data collection method so regional and trend comparisons can be made
- focus experts' limited resources on suspected problem areas

To develop a useful checklist takes time and feedback from users. So, go on out there, give it a try, and let us know how it went. At the worst, you will have spent an enjoyable day outside getting to know a stream.

Who's in Charge?

You are. Although EPA is heading up the development of Streamwalk, we visualize this as a self-driven grass roots tool. We are not proposing a high level of federal involvement. We hope you will use this to develop a locally organized long term citizen stream monitoring program, or to get together with an existing stream monitoring organization or agency. Organizing with others offers training and consistency.

We see a limited role for EPA. We will update Streamwalk based on your suggestions. We will serve as a central repository for Streamwalk data collected in our region (although anyone with a PC can take care of their own data management). We will provide copies of our data management system and printouts of data collected on specific streams upon request. We also expect to keep information on which streams have been walked and what the segment designation was so that anyone can call us to find out if they are the first to walk a stream or if they need to repeat the walk completed by an earlier streamwalker.

Before the Streamwalk

As mentioned above, the best and probably most satisfying approach to Streamwalk is to locate an existing organization that is interested in or already has a stream monitoring program. Such a group can offer expert help on organizing Streamwalks and on "reading" streams. Such organizations also like to know what you are doing so that they can perhaps coordinate with you or take advantage of your data. They will provide consistency to your data over time.

If you cannot locate any organization willing to work with you on Streamwalk, begin on your own. First, choose the general area for your Streamwalk. You may wish to collect data along a familiar stream, one that is close to your residence or place of work, one that does not cascade down a steep mountain side, or a favorite. You may decide to do a series of streams in a watershed to collect baseline data, or to concentrate your efforts in areas suspected of being polluted.

Next, do your groundwork. Obtain information about your Streamwalk area. Find a USGS topographic (topo) map of your area. These topo maps are excellent in that they show buildings, elevations, waterways and roads. We recommend a 7 1/2 minute quad map (1:24,000 scale where 11 inches = 4 miles). They are available at local sporting goods stores.

Topo maps can be used to select segments, as a reference for future walks and also as a template to sketch your sites on your data sheets. We will use them to identify your exact location when we enter your data into our data management system. In fact, if you can send in a marked up copy with your data sheets, data management will be easier.

Then, select your specific Streamwalk site. We suggest that you target a stream reach (a stream section with fairly homogenous characteristics). It might not exceed one mile; far less or a little more is entirely appropriate. It will be easier for future streamwalkers to locate your site if it is bounded by clear landmarks (roads, highways and tributaries).

Sketch a map of your site on the checklist. The map will be used to identify locations of possible problem areas discovered during your Streamwalk. Be generous with space; fill up most of the page. Add several landmarks to your map. If you use several of the same landmarks as are shown on the USGS map, computer data entry will be easier. Add a north arrow. Draw a scale bar to indicate what you think the scale is.

Finally, pull out a copy of the Streamwalk checklist. You will use your map and one checklist form per Streamwalk.

Now you are ready to begin your walk. But please, consider the following Streamwalk-related precautionary tips:

- **Always** work with someone.

- Do not put yourself in danger to gather habitat survey information. The stream bed can be very slippery and uneven, sometimes at unpredictable times and places.

- Be careful of ticks, poison oak, nettles, insects. Bring repellent. Wear long pants and boots: wind breakers help to block nettles.

- Consider landowners' rights. Try to get the permission of landowners to cross any private land, posted or not. do not enter posted areas without permission. Take advantage of any public access points.

- Watch out for irate dogs. Walk cautiously and practice good dog etiquette.

- The water is not potable; do not drink it.

- Do not walk on unstable banks; your footsteps could speed erosion.

- Be alert for spawning areas (redds) and do not walk on them. They will look like a round or elliptical area of clean gravel about 1-3 feet long. During fall through spring, when redds are evident, try not to walk in the stream. In the summer, if you are careful, the stream bed might be the easiest route for conducting your streamwalk.

- Do not attempt to walk across streams that are swift and above the knee in depth. These can be dangerous.

- IF FOR ANY REASON YOU FEEL UNCOMFORTABLE ABOUT THE CREEK CONDITIONS OR SURROUNDINGS, PLEASE STOP YOUR STREAMWALK. YOU AND YOUR SAFETY ARE MUCH MORE VALUABLE THAN ANY OF THE OBJECTIVES OF THE STREAMWALK!

The following is a recommended list of items to have along on your Streamwalk:

- Comfortable rubber boots
- Snag and thorn-proof clothing
- Clip board with waterproof cover
- Streamwalk data forms
- Two pencils (preferably mechanical)
- Folding ruler
- Compass
- Camera and film
- Sharp machete or clippers
- Leather gloves
- A buddy

The Streamwalk: Begin with the Checklist

Part 1. General Information.

Fill out this section as best you can. You must at least describe the stream name and your segment beginning and ending points. Without this information your data will be useless.

Sketch of Stream Survey Area.

Sketch your segment on your checklist. Clearly identify on your map where you are doing your survey. During the Streamwalk, you will be noting any sites or information of interest on this map.

Part 2: Stream Characterization.

This section is designed to give resource agencies an overall picture of your stream or river. To fill out this section, you will have to make generalizations about your segment. This may be hard if its character changes along the segment. You can approach this in several ways. You can pay attention to the "feel" of the area and take a few width and depth measurements as you walk. At the end, you can average your notes and fill out Part 2.

A second method more acceptable to some, is to split your segment up into smaller segments and to take measurements at the segment boundaries. You would then have a number of sets of information that you will again average at the end of Part 2. Either way, or another is OK. Again, the purpose is to provide resource agencies with some general stream characterization.

Part 3. Nature and Cause of Condition.

This section is designed to get information about potential problem conditions anywhere along your walk. So, anytime you note what you think might be of significant interest (use the checklist Nature of Condition categories as a guide), stop. Proceed in the following manner:

- Mark your location clearly on your map sketch. Use a number. Put the same number in the "Site Numbers" column on the checklist. For the first stop you make on your Streamwalk, enter '1' on the map and in the site Numbers column; for the second, use '2', and so on.

- Then work across the checklist. Put an L (light), M (moderate), or S (severe) in the category (ies) you think best represents the nature of the condition. For example, if at your first site, you decide that the banks have been extensively modified with wheel ruts, mark an 'S' (severe) in the first row under 'Banks artificially modified'.

- Continue to move across the checklist and select the cause of the condition; mark either 'P' (probable), 'L' (likely) or 'D' (definite). If you decide the cause of the condition is probably due to activities by a homeowner, mark an 'L' (likely) in the first row under "Residential Landscaping/Clearing' column.

Each site number should be clearly referenced to a point on the map.

- Occasionally, you might find that a very long stretch of the stream is experiencing a condition that you would like to note. You will want to make it clear that the condition is not isolated. In such a situation, consider each 100 feet of the condition as one site. In other words, if a condition covers about 400 feet, you will fill this out on your checklist as four sites.

- You might also find a number of conditions occurring in a very short stretch, less than 100 feet. In this situation, include them all as one site. For example, if you encounter four piles of junk in the stream in about a 100 foot stretch of river, consider this occurrence as one site and note it accordingly on the checklist.

On your map, please note locations of wetlands, pipes or anything else you think is important. By referencing these and problems to a site on your map, you will make it easier for experts to go out to your site and evaluate the situation.

When you are all done, look over the checklist. Make sure that you have clearly filled out all of the information you can. Do not worry if you have left sections blank. Do not worry if you have not filled out anything in Part 3. This means that your segment is undisturbed. This is also valuable information.

Take pictures while you are on your streamwalk. You might want to bring a waterproof camera. A waterproof camera can be improvised by keeping your camera inside a zip-type plastic bag until ready to take a picture.

Include notes about any stream life you might encounter or relevant conversations with landowners. This can be a wealth of information. Above all, remember, this is not a test! Just do the best you can. And enjoy yourself.

Data Management

EPA has developed a computerized database system (dBase III+) for keeping track of Streamwalk data. At present, the system simple provides a means to "capture and preserve" the information. It will produce lists of stream segments identified and surveyed, survey dates and results including conditions noted as severe, causes noted as definite, etc., and a few other such listings. To date, we only have about a dozen records. When more data comes in to our office, we will develop a more informative set of out-puts. We are planning, for example, to produce maps which can indicate problem areas and which use colors to indicate severity and/or to differentiate causes (Geographic Information System).

EPA is planning to enter data collected during Streamwalks into the database (unless we are overwhelmed by information). Those who have questions about the database or who wish to maintain their own database may obtain copies of the structure and programs by contacting Grover Partee (see below).

For More Information or To Provide Feedback

Please write:
Streamwalk
US EPA Region 10
1200 Sixth Ave., ES-097
Seattle, WA 98101

or call:
Gretchen Hayslip
(206)553-1685

Grover Partee
(206)553-6697

Susan Handley
(206)553-1287

Specific Notes on the Streamwalk Checklist

Part 1: General Information

The sections requesting name, date and time, etc. are self-explanatory. Enter the stream name and segment number. If you know the EPA river reach number of your segment, enter it in the EPA use only block. Use your topo map to estimate the river miles surveyed. And fill out as clearly as possible, the blocks for Segment beginning and ending points. Use identifiable roads (such as state highways), substantial and readily identifiable houses, bridges, culverts, etc. to provide good reference points so that others may trace your footsteps.

Part 2: Stream Characterization

Width of Streamside Corridor

The streamside corridor (riparian zone) is a fairly ambiguous term describing how much of the streamside area is directly affecting the quality of the stream. If, along with the stream, forms the habitat of the river. It includes vegetation that shades the water, holds the soil in place, adds nutrients to the stream in the form of leaves and during flooding, and provides habitat for streamside wildlife. Estimate as best you can the average width of this zone.

Streamside Vegetation

A description of the presence and type of streamside vegetation provides much information about the stream due to its important role in molding the stream environment. Vegetation acts as a filter for sediment and pollution coming in from the near land. It provides habitat for the many creatures that are dependent on and influence the stream. Branches, logs and leaves enter the stream from this region. And, it provides shade, which keeps the water cool. On the checklist, mark the category which typifies this area. Check all the categories that apply.

Stream Cover

This is related to streamside vegetation. It focuses on several important values of streamside vegetation: offering protection and refuge areas for fish and other organisms, shading the stream and keeping the water cool, and providing "launching" areas for insects that might fall into the river. Estimate as best you can, about how much of the river is overhung by vegetation, whether it be grasses, shrubs or trees.

Artificial Bank Protection

This category includes such streamside modification as riprap (a sustaining wall built of rocks) and bulkheads. It may also include placed wrecked auto bodies, refrigerators, and washing machines. People in the past have thought that such modifications helped stabilize stream banks. Unfortunately, not only do they drastically degrade habitat for streamside and in stream dwellers, they can cause bank erosion in flood conditions.

Presence of Logs or Woody Debris in Stream

Logs and woody debris (not twigs and leaves) can slow or divert water to provide important fish habitat such as pools and hiding places.

Stream Depth and Width

Riffles and runs are fish spawning areas. There, the currents are swift and the water shallow. Pools are deeper than adjacent areas, and quiet. They provide feeding and resting places for fish. Try to take measurements of the depths and widths of both riffles and runs, and pools. Estimate the width as being what you see the day you are out; do not estimate the potential width. Be extremely careful if the water is above the knee and is swift. Do not attempt to cross in high flows especially if you are alone. If it feels even mildly unsafe, do not try it at all. Take measurements several times along your Streamwalk. Do the best you can but don't get carried away with accuracy. Remember, this is a screening tool, not the last word.

Pools and Riffles

The number and percentage of surface area of pools compared with riffles (pool to riffle ratio) is a good measure of a stream's nature. Keep a running estimate of the pools and riffles you see as you walk along the stream. Enter their total numbers and percentage on the checklist. If you have trouble filling this out, leave it blank.

Stream Gradient

Estimate as best you can, the drop in the stream over a 50 foot length. A low gradient stream is slow moving and relatively flat while a steep stream typically contains rapids.

Substrate

The substrate is the stream bottom. Number the categories 1-6 with 1 being the most and 6 the least typical type of substrate you encounter. Do not give a category a number if you don't see it during your streamwalk.

Silt/clay/mud: This substrate has a sticky, cohesive feeling. The particles are fine. The spaces between the particles hold a lot of water, making the sediments behave like ooze.

Sand (up to .1 inch): Sand is made up of tiny particles of rock. It feels wonderful underfoot

Gravel (.1 - 2 inches): A gravel stream bottom is made up of stones ranging from tiny quarter inch pebbles to rocks of about 2 inches.

Cobbles (2 - 10 inches): The majority of rocks on this type of stream bottom are between 2 and 10 inches. The average size is about that of a grapefruit.

Boulders (greater than 10 inches): Most of the rocks on the bottom will be large, greater than 10 inches.

Bedrock: This kind of stream bottom is solid rock.

Part 3: Nature of Condition

If you notice any of the following conditions, note it on the checklist with L (light), M (moderate), or S (severe). Use your own judgement as to whether or not to note a concern on the checklist. A notation indicates a need for further attention.

Streamside Conditions

Natural plant cover degraded: Indicate if streamside vegetation is trampled, missing, or replaced by landscaping or cultivation.

Banks collapsed/eroded: Note if banks have been collapsed or eroded.

Banks artificially modified: Indicate if banks have been artificially modified, for example: channeled, riprapped, lined, or diverted into a culvert.

Instream Conditions

Mud/silt/sand on bottom/entering stream: Excessive mud or silt entering the stream and clouding the water can interfere with fishes' ability to sight potential prey. It can also clog fish gills and smother fish eggs in spawning areas on the stream bottom. Mud/silt/sand can be an indication of poor construction practices in the watershed; where runoff coming off the site is not adequately contained. It can also be a perfectly normal occurrence, especially if, for example, a muddy bottom is found along a very slow-moving segment or a wetland. Use your best judgement.

Stream disturbed: Please note if the stream has been dredged, filled, or channelized or if other large scale activities such as log removal are apparent.

Aquatic weeds: You may see beds of plants growing in the water. Whether or not this is a problem can be difficult to assess because they can be indicators of high quality habitat, such as in a wetland, or a shallow, muddy backwater. sometimes, however, they can be a symptom of excessive sediment buildup which provides a nice fertile substrate for the plants to grow on.

Algae/scum floating/covering rocks: Evidence of algae (very tiny plants that can color the water green or can resemble seaweed) or scum in the water can point to a problem such as an upstream source adding too much nutrient (fertilizer) to the water.

Foam/oil/strange color: This is a bit of a tricky category because this type of thing can be naturally occurring or a problem. For example, an iridescent sheen on the water might be from rotting leaves or it might be from some upstream pollutant. If you are not sure, mark it on the checklist.

Junk in stream: This is your chance to point out very straightforward problems: litter, tires, hot water heaters, car bodies, and garbage dumps.

Part 3. Cause of Condition

Now that you have characterized the problem, try to identify its cause (either past or present). Note whether you think the category is a possible (P), likely (L) or definite (D) cause of the condition. Urban/suburban runoff is described below. The remaining categories are self-explanatory.

Urban/Suburban Runoff

This kind of runoff is typically from paved roads or parking lots.

- Single family - Homes either rural or suburban.
- Multi-family - Condominiums or apartment buildings.
- Commercial - Shopping centers.
- Light industrial - Corporate/office buildings.
- Heavy industrial - Industrial factories.

STREAMWALK CHECKLIST

Part 1: General Information

Date____ Time____ Investigator______________________________
(Name)

Experience: ☐ Student ☐ Citizen Volunteer ☐ Prof. Stream Resource Specialist

Affiliation______________ Phone #___________ Address____________________

Stream Name______________ Segment #___________ County________________

River Miles Surveyed_________ Segment Beginning Point____________________

Segment Ending Point______________________

Part 2: Stream Characterization

Width of Streamside Corridor
Left Bank (looking downstream)
☐ 0-5' ☐ 5-20' ☐ 20-50' ☐ 50-100' ☐ 100'+
Right Bank (looking downstream)
☐ 0-5' ☐ 5-20' ☐ 20-50' ☐ 50-100' ☐ 100'+

Streamside Vegetation
☐ None or little ☐ Grasses ☐ Shrubs (to 20') ☐ Trees (greater than 20')
Any conifers present? ☐ none ☐ occasional ☐ common

Stream Cover
☐ 0-25% ☐ 25-50% ☐ 50-75% ☐ 75-100%

Artificial Bank Protection
☐ 0-10% ☐ 10-50% ☐ 50-75% ☐ 75-100%

Presence of Logs or Woody Debris in Stream?
☐ none ☐ occasional ☐ common

Any Fish Present?
☐ yes ☐ no

Stream Depth and Width

Riffles and Runs:
Average Depth_________
Minimum Depth_________
Maximum Depth_________
Average Width_________
Minimum Width_________
Maximum Width_________

Pools:
Average Depth_________
Minimum Depth_________
Maximum Depth_________
Average Width_________
Minimum Width_________
MaximumWidth_________

Pools #_____ Riffles #_______ Pools %________ Riffles %________

Stream Gradient ☐ Low ☐ Moderate ☐ Steep

Substrate (rank 1 [most] to 6 [least] typical)

_____Silt/Clay/Mud _____Sand (up to .1") _____Gravel (.1-2")

_____Cobbles(2-10") _____Boulders(greater than 10") _____Bedrock (solidrock)

Sketch of Stream Survey Area
(Mark Sites Here)

Date: ____________ Initials: ____________ Stream Name: ____________ Segment Number: ____________

Part 3: Specific Stream Segment Sites

Nature of Condition

(Leave Blank or Mark either "L"-Light, "M"-Moderate, "S"-Severe)

Site Numbers*

Streamside Conditions			In-Stream Conditions					
Natural Plant Cover Degraded	Banks Collapsed/Eroded	Banks Artificially Modified	Mud/Silt/Sand on Bottom/Entering Stream	Stream Disturbed	Aquatic Weeds	Algae/Scum Floating/Covering Rocks	Foam/Oil/Other Yukkies	Junk in Stream

Cause of Condition

(Leave Blank or Mark either "P"-Possible, "L"-Likely, "D"-Definite)

Urban/Suburban							
Industrial/Municipal Effluent	Residential Landscaping/Clearing	Single-Family Runoff	Multi-Family Runoff	Commercial Runoff	Light Industrial Runoff	Heavy Industrial Runoff	Recreational Use

Cause of Condition

(Leave Blank or Mark either "P"-Possible, "L"-Likely, "D"-Definite)

Site Numbers*	Construction Activities					Agricultural Activities				Logging Activities			Mining		Other				
	Road	Single Family Housing	Multi Family Housing	Commercial	Light/Heavy	Livestock Access	Manure Drainage	Irrigation Return Flows	Cultivation Bordering Stream	In Streamside Zone	In Watershed	Road Construction	Land Disturbance	Effluent/Drainage					

Photographs Included? ☐ *yes* ☐ *no*

Comments:

* *(Assign new site numbers for every observation made. Start with "1". Use additional Part 3 forms if you want to add more sites)*

APPENDIX F

SHORELINE SURVEY WATER QUALITY COMPLAINT FORM

SHORELINE SURVEY/WATER QUALITY COMPLAINT

IDAHO VOLUNTEER MONITORING PROGRAM
DIVISION OF ENVIRONMENTAL QUALITY

1. DATE: ____________________

2. TIME: ____________________

3. LOCATION:

____

____

____

____

4. PROBLEM:

____

____

____

____

5. DEQ ACTION:

____

____

____

____

____

6. FOLLOW UP (IF DESIRED):

NAME: ____________________________________

PHONE: ____________________________________

SEND TO: DIVISION OF ENVIRONMENTAL QUALITY

APPENDIX G

GLOSSARY

Glossary

Acid Rain: Rain with a higher than normal acid range. Caused when polluted air mixes with cloud moisture.

Algal Bloom: An unusual or excessive abundance of algae.

Alkalinity: Capacity of a lake to neutralize acid.

Biomanipulation: Adjusting the fish species composition in a lake as a restoration technique.

Ecosystem: A community of interaction among animals, plants, and microorganisms, and the physical and chemical environment in which they live.

Epilimnion: Most lakes form three distinct layers of water during summertime weather: The epilimnion is the upper layer and is characterized by warmer and lighter water.

Eutrophication: The aging process by which lakes are fertilized with nutrients. **Natural eutrophication** will very gradually change the character of a lake. **Cultural eutrophication** is the accelerated aging of a lake as a result of human activities.

Eutrophic Lake: A nutrient-rich lake - usually shallow, "green" and with limited oxygen in the bottom layer of water.

Fall turnover: Cooling surface waters, activated by wind action, sink to mix with lower levels of water. As in spring turnover, all water is now at the same temperature.

Hypolimnion: The bottom layer of lake water during the summer months. The water in the hypolimnion is denser and much colder than the water in the upper two layers.

Lake Restoration: Actions directed toward improving the quality of a lake.

Limnetic Community: The area of open water in a lake providing the habitat for phytoplankton, zooplankton and fish.

Littoral Community: The shallow areas around a lake's shoreline, dominated by aquatic plants. The plants produce oxygen and provide food and shelter for animal life.

Mesotrophic Lake: Midway in nutrient levels between the eutrophic and oligotrophic lakes.

Nonpoint Source: Polluted runoff - nutrients and pollution sources not discharged from a single point: e.g. runoff from agricultural fields or feedlots.

Oligotrophic Lake: A relatively nutrient-poor lake, it is clear and deep with bottom waters high in dissolved oxygen.

Photosynthesis: The process by which green plants produce oxygen from sunlight, water and carbon dioxide.

Phytoplankton: Algae - the base of the lake's food chain, it also produces oxygen.

Point Sources: Specific sources of nutrient or polluted discharge to a lake: e.g. stormwater outlets.

Profundal Community: The area below the limnetic zone where light does not penetrate. This area roughly corresponds to the hypolimnion layer of water and is home to organisms that break down or consume organic matter.

Respiration: Oxygen consumption.

Secchi Disc: A device measuring the depth of light penetration in water.

Sedimentation: The addition of soils to lakes, a part of the natural aging process, makes lakes shallower. The process can be greatly accelerated by human activities.

Spring Turnover: After ice melts in spring, warming surface water sinks to mix with deeper water. At this time of year, all water is the same temperature.

Thermocline: During summertime, the middle layer of lake water. Lying below the epilimnion, this water rapidly loses warmth.

Trophic Status: The level of growth or productivity of a lake as measured by phosphorus content, algae abundance, and depth of light penetration.

Water Density: Water is most dense at 39‹F and expands (becomes less dense) at both higher and lower temperatures.

Watershed: The surrounding land area that drains into a lake, river or river system.