VOLUNTEER WATER QUALITY MONITOR MANUAL

IZAAK WALTON LEAGUE OF AMERICA
www.IWLA.org/sos

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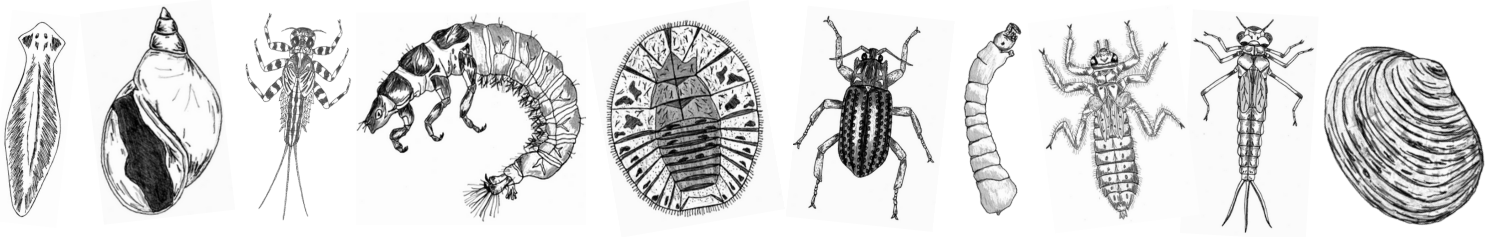


IWLA Overview

The Izaak Walton League is one of America's oldest and most successful conservation organizations. The Izaak Walton League has been at the forefront of every major clean water battle in the United States, from a decades-long push for federal water pollution control in the 1940s to efforts today to restore Clean Water Act protections for critical streams and wetlands. League leaders helped conceive the Wild and Scenic Rivers Act of 1968 and broke the political ground necessary for passage of the landmark 1972 Clean Water Act. Community members around the country use our pioneering Save Our Streams program to monitor local waterways, plan restoration projects, and report water quality problems. Today, our clean water priorities include engaging youth in the outdoors, cleaning up nonpoint source pollution, and halting the spread of invasive species.

The Izaak Walton League's **Save Our Streams program** is the only nationwide program training volunteers to protect waterways from pollution and bring information about water quality to their communities. The program began in 1969 when water pollution problems were easy to see – like massive oil spills and burning rivers. Early Save Our Streams volunteers cleaned up trash from their local waterways and reported problems like streams becoming clogged with silt. In the 1980s, the League recognized that with the right training, volunteers could collect scientifically valid data to assess water quality in local streams – a conviction that has proven true. Ever since, the League has been teaching volunteers to study stream health and report their findings to decision-makers. Today, trained volunteer stream monitors across the country are uncovering pollution problems and urging their local leaders to take action on water quality. The work of these volunteers also creates a critical record of water quality over time, making it possible to quickly identify pollution problems that develop in the future.

SOS Program Overview

What pollutes our Waterways?

Trash, oil spills, runoff – we know there are many different toxins that can pollute our water. But where does this pollution come from, and how can we stop it? Pollution enters our freshwater from either point or nonpoint sources. Point source pollution has a clear cause you can point to, like a broken pipe. Nonpoint source pollution is harder to identify, and doesn't have a clear single source. Nonpoint source pollution is the most prevalent threat to water quality today.

Point Sources versus Nonpoint Sources from Indiana County Conservation District

How does nonpoint source pollution get into our water? Every time it rains or snows, natural and man-made pollutants on the land are washed into streams and wetlands. These pollutants include pesticides, fertilizers, metals, plastics, manure, road salt, and motor oil from farms, lawns, roads, and landfills. Eroded soil from construction zones, logging operations, and land disturbances clogs streams, and bacteria from septic tanks and animal waste runoff can make wildlife and humans sick.




Volunteer Water Quality Monitoring

Every state in the US is required under the federal Clean Water Act to report on water quality to Congress in a 305(b) report. If a state reports that a waterway is impaired or polluted, the federal government can provide funding and other resources to help restore and protect it. Unfortunately, less than 30% of waterways in the US are monitored professionally, leaving a huge gap in knowledge of our water quality status. This is where volunteer water quality monitors come in. Because they regularly visit and monitor the same sites year after year, SOS volunteers are often the first ones to discover and report at-risk streams and creeks – ensuring that their site becomes a state priority.

We have the right to know whether or not streams are safe for swimming, fishing, playing, and drinking. Save Our Streams monitors help achieve that goal by collecting water quality data from local streams and educating the public about the importance of clean water.

Benthic Macroinvertebrate Monitoring

Hundreds of SOS volunteers collect stream quality data from almost 12,000 stream stations across the country. Monitors collect, identify, and sort benthic macroinvertebrates from the stream. By identifying which macroinvertebrates live in a local stream, volunteers can calculate a stream health score.

Aquatic Benthic Macroinvertebrates

The macroinvertebrates we collect in the SOS program are animals that are:

- AQUATIC - live in water
- BENTHIC - are bottom dwelling
- MACRO - are large enough to see without magnification
- INVERTEBRATES - do not have a backbone, such as crustaceans, insect larvae, and worms




Macroinvertebrates are monitored to assess the water quality conditions in a stream. Macroinvertebrates spend much or all of their life in a stream, and the number and diversity of organisms living in the stream are influenced by:

1. the quality of the water
2. the availability and condition of in-stream habitat

Macroinvertebrate populations are threatened by chemical and thermal pollution, sedimentation, and habitat loss. Different types of macroinvertebrates tolerate different levels of pollution and stream conditions – some are tolerant to poor conditions and others are highly sensitive. Healthy streams have an abundant and diverse macroinvertebrate population, which contribute to a healthy ecosystem. Macroinvertebrates are most abundant in riffles (areas of fast moving water), where oxygen is more plentiful or in areas around banks or in-stream structures that provide more protection.

By collecting, counting, and identifying macroinvertebrates we can calculate a stream health score.

Quality Assurance Project Plan

SOS has a QAPP that establishes the quality of our methods and data. By certifying in and following SOS protocols, the data you collect is considered reliable and useful. The SOS program utilizes two different benthic macroinvertebrate collection protocols depending on stream type:

Rocky Bottom and **Muddy Bottom**

Data Use

Data collected and submitted to the Clean Water Hub by certified Save Our Streams monitors can be used by city, state, and federal agencies. Your findings may be used to:

- Inform water quality decisions
  - Restoration projects
  - Proposed developments
  - Show how land use has affected water quality over time
- Educate local decision-makers, stakeholders, and community members about the health of local streams

SOS Certification

By successfully completing all requirements of the Save Our Streams Quality Assurance Program, we are able to ensure that the data you collect are reliable and meet the standards of the Izaak Walton League of America.

The steps to become a certified SOS volunteer monitor are listed below:

1. View training webinars
2. Attend a field training
3. Pass macroinvertebrate identification and protocol exams
4. Receive your certificate and start monitoring!

Maintaining SOS Monitor Certification

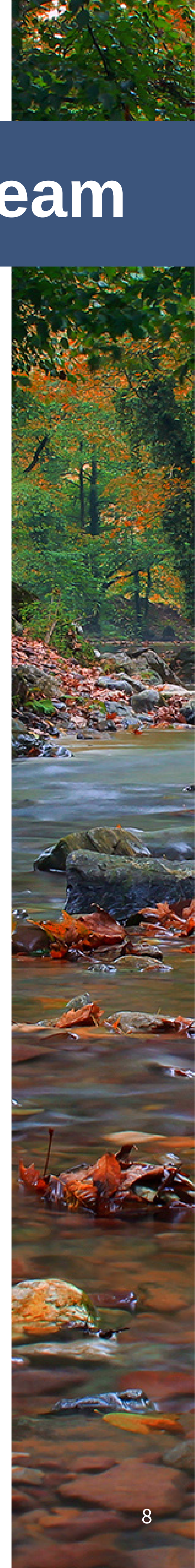
Monitors must submit data at least **once every 2 years** in order to maintain active certification. To ensure monitors get credit for monitoring, be sure to list all certified monitors on your data submissions. If your certification lapses, you will need to recertify.

Volunteer Pledge

As a Save Our Streams monitor, I pledge to:

- Collect and submit stream health data so that it may be shared with my community, government officials and agencies, and stakeholders.
- Monitor consistently to establish a reliable timeline of my stream's health.
- Follow sampling and identification protocol to produce the highest quality data possible.
- Ensure the safety of myself and my team whenever sampling in the field.
- Respect landowners and always ask for permission before accessing private land for monitoring.
- Respect sampling sites by minimizing physical impact on wildlife habitat.
- Carry a copy of a state permit for monitoring during every monitoring event.
- Behave respectfully and cordially whenever interacting with the public.
- Represent Save Our Streams and the Izaak Walton League of America in a professional manner, and...

Serve as a voice for my local streams and waterways.



10 Reasons to Monitor a Stream

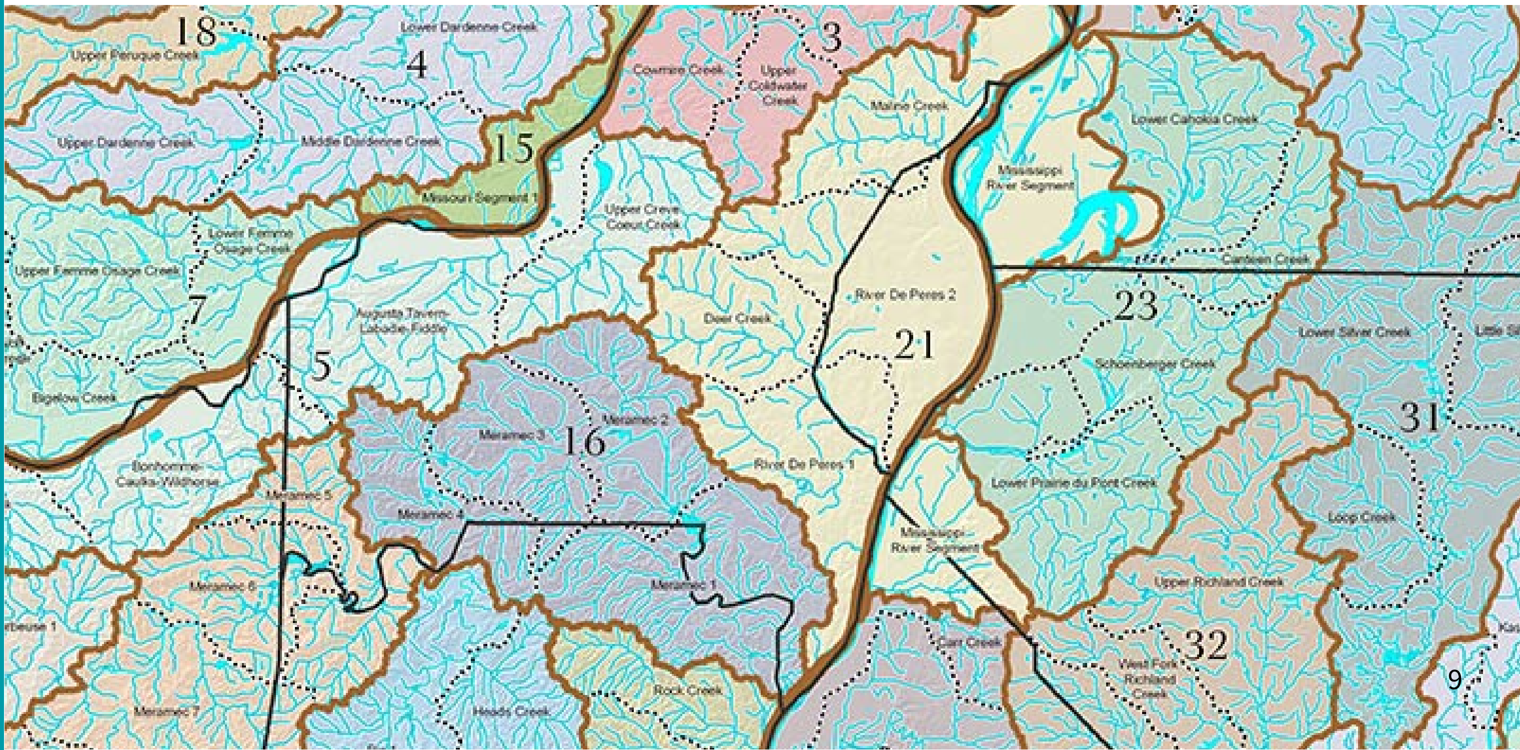
1. To help assess the health of the many miles of streams across the country.
2. To establish baseline stream health data. This is helpful when discussing whether land-use changes have impacted your streams.
3. To evaluate impacts of upstream land-use practices on your stream.
4. To keep track of changes in your stream – seasonally and over a period of time.
5. To assist local agencies in determining the effectiveness of Best Management Practices (BMPs) and where more BMPs are needed.
6. To observe and record changes at your site - erosion, loss of trees, increased litter, etc.
7. To identify and report significant pollution events like oil or sewage spills - you are your sites' voice!
8. To build community pride or community concern for the condition of local streams.
9. To raise awareness about potential health and safety concerns in streams where children and pets may play.
10. To connect your friends, family, or community members to their local natural spaces.

Monitoring Best Practices

Being a Save Our Streams monitor comes with a responsibility to act and speak with integrity and always follow best practices when it comes to monitoring and data reporting. In order to help you maintain the reliability and integrity of SOS data, we've included some tips, reminders, and common pitfalls to avoid when it comes to collecting and/or reporting your SOS data.

Choosing Your Site

- Try to choose a site that is **representative of the stream as a whole**.
  - Avoid monitoring immediately downstream of nearby disturbances such as log jams, bridges, tile outlets, storm drain discharges, altered habitat, etc.
  - Aim for the area of the stream with the highest flow volume during chemical monitoring.
- **Choose your site from a watershed monitoring perspective**. Having several monitoring sites throughout a watershed can help triangulate potential pollution sources or problem tributaries.
- **Take care to avoid trespassing on private land**. Always seek permission ahead of time from a landowner on private land and a government agency when monitoring on public land.



Consistent Monitoring

Establish a monitoring schedule for your site(s) and stick to it. Water quality can vary from year-to-year, month-to-month, and even day-to-day. Consistent monitoring can help establish what a "normal" baseline is at a site, allowing you to compare results across time or between locations. Additionally, consistent baseline data can help set a restoration standard to return to in the event of a pollution problem in the future.

- Macroinvertebrate monitoring should occur once in the fall and once in the spring. Chemical monitoring can be done as often as possible. Monitoring must be done consistently for several years to create a reliable baseline.
- **Do not monitor with the goal of seeking out problems.** You will likely have months or years of un-alarming data, but you should continue establishing a baseline and monitoring to catch and quantify any future pollution problems.
- **Avoid jumping to conclusions or making claims based on limited data.** One or two data points does not constitute a trend.
- **Do not purposely target extreme weather conditions that would alter water quality conditions.** Aim to monitor so you can get results that are representative of the stream normally. Create a monitoring schedule ahead of time and adhere to it to limit your variables.
- **Do not pick and choose your sites and times.** Whenever possible, aim to monitor the same sites at the same time of day on a recurring schedule.

Maintaining Equipment

Good science relies on standardized protocols and equipment. Be sure to check your gear before and after you monitor, and repair or replace any items that are worn, broken, or expired. Always ensure that your gear fully dries out between sampling events. If monitoring multiple sites in a day, thoroughly clean equipment between sites to prevent the spread of invasive species or cross-contamination.

Chemical Equipment Maintenance

Chemical test kits will expire roughly every 1-2 years. Expired materials will not produce reliable results. Always be sure to check expiration dates before you go out to do chemical monitoring. Avoid exposing chemical test kits to prolonged excessive heat, cold, or sunlight. If you find abnormal chemical results, repeat your tests to verify. It is helpful to do the repeat test with another kit if possible, to ensure the abnormal results are not due to the test kit you used.

Monitoring Car Sign

Place this sign on your car dashboard or window to let curious people passing by know that you are parked there in order to conduct stream monitoring.

Stream Water Quality Monitoring in Progress

Certified volunteer monitors are sampling the health of this local waterway. Please contact the Save Our Streams coordinator with any questions or concerns: SOS@iwla.org

What's Save Our Streams? Find out at **IWLA.org/SOS**

Biological Monitoring Equipment

You can find a **list of recommended equipment on our website** with suggested links to purchase.

Supplies for Both Rocky and Muddy Bottom Streams:

- Waders or close-toed shoes
- Aquatic thermometer
- Folding Table
- White plastic table cloth
- Sorting tray – White ice cube trays work best
- Sorting utensils – spoons, tweezers, pipettes, spray bottle
- Magnification – hand lens, microscope, etc.
- First aid kit
- Neoprene Gloves (optional)
- SOS datasheets and instructions
- Clipboard
- Macroinvertebrate ID materials
  - Voshell: *A Guide to Common Freshwater Invertebrates of North America*
  - IWLA: *A Guide to Aquatic Insects and Crustaceans*
  - Creek Critters App
- Landowner permission forms (if applicable)

For Rocky Streams:

- 3×3 ft kick-seine net (1/32 inch or 500 micron mesh)
- 2 Net poles (Wood dowels; 1.25" x 48")

For Muddy Streams:

- D-net (1/32 inch mesh net)
- Shallow light-colored pan
- Sieve bucket (optional)

Check Your Equipment Before Going Out in the Field

Before each monitoring session, check to make sure all of the materials are clean, in good condition, and not expired.

Chemical Monitoring Equipment

You can find a **list of recommended equipment on our website** with suggested links to purchase.

Transparency Tube

Dissolved Oxygen Test Kit

Phosphate Test Kit

Nitrate/Nitrite Test Strips

pH Test Strips

Chloride Test Strips

Additional supplies:

- Waste container
- SOS datasheets and instructions
- Pencils/pens
- Clipboard

Aquatic thermometer

Check Your Equipment Before Going Out in the Field

Before each monitoring session, check to make sure all of the materials are clean, in good condition, and not expired.

Equipment Cleaning & Storage

Help Stop Aquatic Hitchhikers!

Stopping the spread of invasive species and bacteria is critical to protecting our stream habitats. It is important to clean and disinfect your boots and equipment before moving from one stream site to another. You can do any of the following to prep your equipment between sites:

- Wash with biodegradable soap
- Leave in full sun for several days
- Let equipment dry completely before sampling another site

**Felt bottomed waders/boots are NOT recommended, as they can easily carry invasive species from site to site.*

Storing Equipment

Once equipment is fully dry, store in a cool dry space. If possible, store waders laying flat or hanging to avoid weaking the material.

Establishing a New Site

Permission

When finding a new site to monitor, ensure that you have all of the needed permissions to use that property. If it is county/city/state/federal land be sure to have the proper additional permits. If it is private property, be sure to have written permission from the landowner (permission and liability release form on page 14).

Site Requirements

Monitoring sites should meet the following requirements for use in the SOS program:

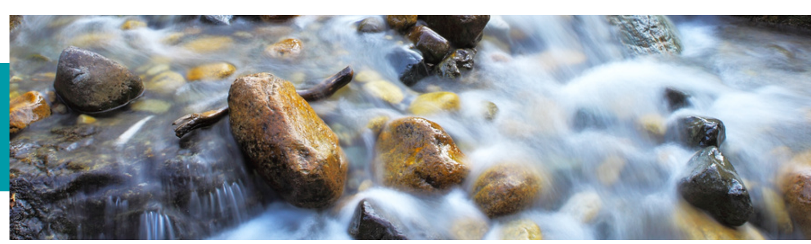
- At least 1/4 mile from another site
- Easy and safe access to the stream site
  - Wadable: the water level in the stream must not exceed the height of your knees
- Has the necessary habitat to sample within a 50 foot span

Rocky Habitat - 2 riffles within 50 foot span

- **Riffle**: a shallow, fast-moving area of water with a depth of 3 to 12 inches and cobble-sized stones (2 to 10 inches) or larger

Muddy Habitats - at least one of the below within 50 foot span

- Woody debris: dead or living trees, roots, limbs, sticks, leaf litter, and other submerged organic matter
- Steep Bank/Vegetated Margin: area along the bank consisting of overhanging vegetation, plants living along the shoreline, and submerged root mats
- Sand/rock/gravel substrate: streambed composed of coarse, rocky substrate
- Silty bottom: streambed composed of fine, silty substrate



Property Owner Permission and Liability Release Agreement

______________________________(organization/monitor) is participating in the Save Our Streams program to monitor the condition of local rivers and streams, to collect baseline data and ensure that water quality is properly maintained. As part of the survey, trained local volunteers collect biological samples to assess stream health conditions on a biannual basis at consistent specific sites. This monitoring will last approximately 1-4 hours per site. This agreement is intended to grant permission to volunteers to access private property for site-specific data collection in the watershed, as well as to release and hold harmless the property owner from liability arising from that access.

I, ______________________________ the property owner, hereby grant permission to ________________________________(name of organization/monitor), its volunteers, and necessary project partners, to enter my property for the sole purpose of site-access and water monitoring that takes place on or near my property to accomplish regular baseline data collection.

Address:____
Monitoring Dates: (or until program completion) _____________________________________

I agree that my permission is granted on a voluntary basis, can be revoked at any time, and I have neither received or expect to receive any form of compensation in exchange for my permission.

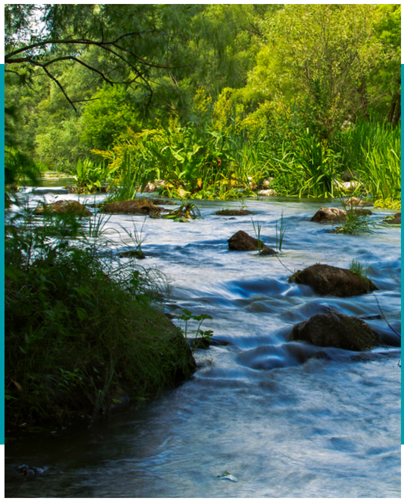
I agree to hold the organization listed above, its volunteers, and necessary project partners, harmless from and forever discharge them from any and all liability for damages, injury, or loss which may be sustained as a result of their entry into the private property described in this agreement.

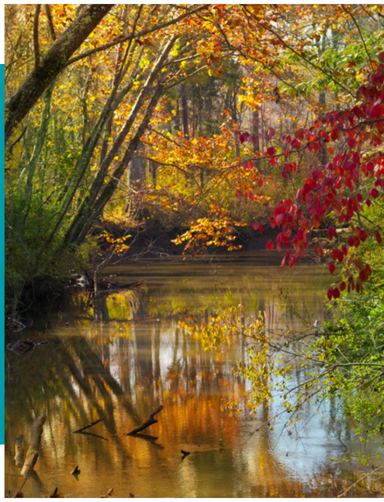
In addition, the organization listed above hold harmless and forever discharge me, the property owner, from any and all liability for any damage, injury, or loss which may be sustained as a result of their entry into the private property described in this agreement.

Property Owner____ Date: _______________
Stream Monitor ____ Date: _______________

When to Monitor

Frequency: Your site should be monitored 2 times a year: spring and fall. You may also choose to monitor your site at other times during the year to measure impacts of a significant event in your watershed, or to host a community outreach event. In general, monitoring stations should have at least two months to recover from a monitoring event. It is very important you do not monitor your site too often – we don't want to negatively impact the macroinvertebrate community in your stream.





Conditions: Volunteers are not to conduct their normal sampling within one week of heavy rainfall if possible (approximately more than 1 inch of rainfall in rural areas or ½ inch of rainfall in urban areas). Rather, monitors should sample the stream during its average conditions for that season.

Do not monitor:

- Alone
- During thunderstorms or heavy rain
- If banks are too steep or slippery
- During posted health warnings
- If a sewage or oil spill is apparent

SOS Biological Datasheet

SAVE OUR STREAMS IZAAK WALTON LEAGUE OF AMERICA

Biological Monitoring Data Form for Stream Monitors

Name of Stream: ____________________ Name of monitoring site: ____________________

Name of Certified Monitor(s): ____________________

Group/Organization: ____________________ Number of participants: ____________

City/State: ____________ Latitude: ____________ Longitude: ____________

Survey Date: ____________ Start time: ____________ End time: ____________

Description of site location: ____________________

Record stream site information here. Be sure to list ALL certified monitors present at each monitoring event.

Record number of nets for Rocky Bottom Protocol

ROCKY BOTTOM SAMPLING

Before sampling, record the riffle composition on the back of this form. Using a kick-seine net, take one 60-second sample in a riffle area (40 seconds to rub rocks, 20 seconds to disturb the streambed). Ensure you sample the entire 3'x3' area in front of the net. If you do not collect at least 100 macroinvertebrates in the first net, take a second sample in the same riffle. Please place a checkmark next to the number of samples collected.

_______ Sample 1 _______ Sample 2

Record scoops in each habitat for Muddy Bottom Protocol

MUDDY BOTTOM SAMPLING

Use the lines below to record the number of scoops taken from each habitat type. The total number of scoops must add up to 20 scoops.

Steep bank/vegetated margin ____________ Woody debris with organic matter ____________

Rock/gravel/sand substrate ____________ Silty bottom with organic matter ____________

Tallying Your Sample

During macroinvertebrate identification, record your results on the biological monitoring form. Once all collected macroinvertebrates have been identified, place a check mark next to each collected species on the Macroinvertebrate Count table. Tally the number of each species you collect and add up the total number of macroinvertebrates collected.

MACROINVERTEBRATE COUNT

Please consult biological monitoring instructions to conduct the macroinvertebrate count. Use the table below to track numbers of each macroinvertebrate found. Once sampling and identification are complete, place a checkmark next to each type of macroinvertebrate identified and list the total number found. Add up the number of checkmarks in each category (sensitive, less sensitive, tolerant) and multiply those numbers by the indicated index value.

Sensitive (Ex: ☑ 10 Caddisflies)	**Less Sensitive** (Ex: ☑ 2 Dobsonflies)		**Tolerant** (Ex: ☑ 3 Leeches)
☐ ________ Caddisflies (except net spinners)	☐ ___ Dobsonflies	☐ ___ Crayfish	☐ ________ Aquatic worms
☐ ________ Mayflies	☐ ___ Fishflies	☐ ___ Scuds	☐ ________ Black flies
☐ ________ Stoneflies	☐ ___ Crane flies	☐ ___ Aquatic sowbugs	☐ ________ Midge flies
☐ ________ Watersnipe flies	☐ ___ Damselflies		☐ ________ Leeches
☐ ________ Riffle beetles	☐ ___ Dragonflies	☐ ___ Clams	☐ ________ Lunged snails
☐ ________ Water pennies	☐ ___ Alderflies	☐ ___ Mussels	
☐ ________ Gilled snails	☐ ___ Common net spinning Caddisflies		
___ # of checkmarks multiplied by 3 = ___	___ # of checkmarks multiplied by 2 = ___		___ # of checkmarks multiplied by 1 = ___

Now add the three totals from each column for your stream's index value. Total index value = ____________________

Total number of macroinvertebrates in sample: ____________

Note: You may find macroinvertebrates that are not part of the SOS count (ex. mosquito larvae, planarians). You may make a note of these macroinvertebrates in the comments section.

Water Quality Rating

Add the number of check marks in each column — Sensitive, Less Sensitive, and Tolerant — and multiply by the index value at the bottom of that column. Add the subtotal for each column to arrive at your total index value, which provides the final water quality rating

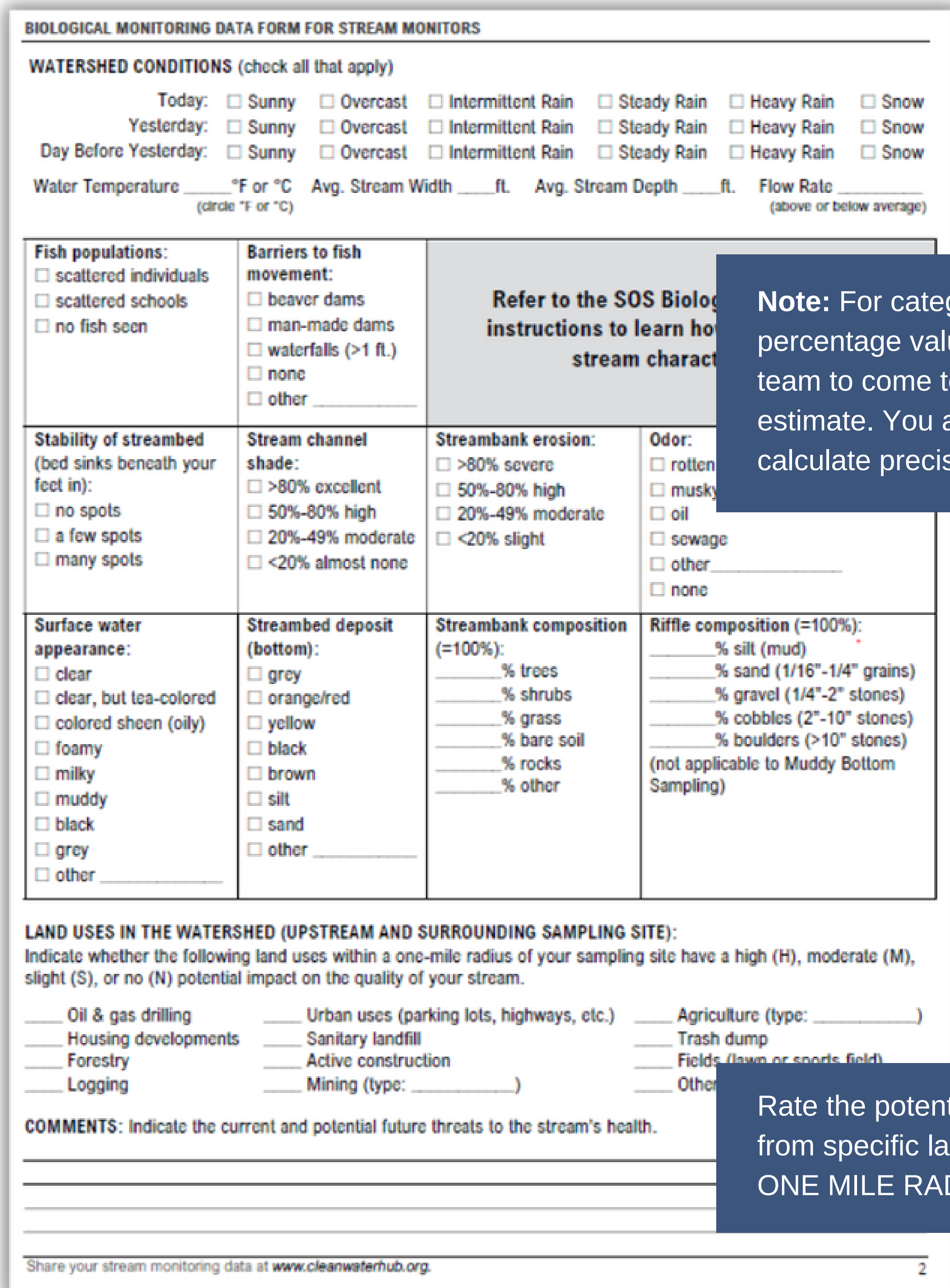
Compare the total index value to the following ranges to determine the water quality of the stream sample site.

WATER QUALITY RATING

________ Excellent (>22) ________ Good (17-22) ________ Fair (11-16) ________ Poor (<11)

Watershed Conditions

The Biological Monitoring Data Form also includes questions about the land and vegetation surrounding the stream. These questions provide extra context to your macroinvertebrate data and help characterize the quality of stream habitat and its ability to support a healthy population of stream organisms. The land use information also paints a picture of the stream for other people who might review your data.



BIOLOGICAL MONITORING DATA FORM FOR STREAM MONITORS

WATERSHED CONDITIONS (check all that apply)

Today:	☐ Sunny	☐ Overcast	☐ Intermittent Rain	☐ Steady Rain	☐ Heavy Rain	☐ Snow
Yesterday:	☐ Sunny	☐ Overcast	☐ Intermittent Rain	☐ Steady Rain	☐ Heavy Rain	☐ Snow
Day Before Yesterday:	☐ Sunny	☐ Overcast	☐ Intermittent Rain	☐ Steady Rain	☐ Heavy Rain	☐ Snow

Water Temperature _____°F or °C (circle °F or °C) Avg. Stream Width ____ft. Avg. Stream Depth ____ft. Flow Rate __________ (above or below average)

Fish populations: ☐ scattered individuals ☐ scattered schools ☐ no fish seen	**Barriers to fish movement:** ☐ beaver dams ☐ man-made dams ☐ waterfalls (>1 ft.) ☐ none ☐ other __________	**Refer to the SOS Biolog instructions to learn ho stream charact**	
Stability of streambed (bed sinks beneath your feet in): ☐ no spots ☐ a few spots ☐ many spots	**Stream channel shade:** ☐ >80% excellent ☐ 50%-80% high ☐ 20%-49% moderate ☐ <20% almost none	**Streambank erosion:** ☐ >80% severe ☐ 50%-80% high ☐ 20%-49% moderate ☐ <20% slight	**Odor:** ☐ rotten ☐ musky ☐ oil ☐ sewage ☐ other__________ ☐ none
Surface water appearance: ☐ clear ☐ clear, but tea-colored ☐ colored sheen (oily) ☐ foamy ☐ milky ☐ muddy ☐ black ☐ grey ☐ other __________	**Streambed deposit (bottom):** ☐ grey ☐ orange/red ☐ yellow ☐ black ☐ brown ☐ silt ☐ sand ☐ other __________	**Streambank composition** (=100%): _______% trees _______% shrubs _______% grass _______% bare soil _______% rocks _______% other	**Riffle composition** (=100%): _______% silt (mud) _______% sand (1/16"-1/4" grains) _______% gravel (1/4"-2" stones) _______% cobbles (2"-10" stones) _______% boulders (>10" stones) (not applicable to Muddy Bottom Sampling)

LAND USES IN THE WATERSHED (UPSTREAM AND SURROUNDING SAMPLING SITE):
Indicate whether the following land uses within a one-mile radius of your sampling site have a high (H), moderate (M), slight (S), or no (N) potential impact on the quality of your stream.

____ Oil & gas drilling	____ Urban uses (parking lots, highways, etc.)	____ Agriculture (type: __________)
____ Housing developments	____ Sanitary landfill	____ Trash dump
____ Forestry	____ Active construction	____ Fields (lawn or sports field)
____ Logging	____ Mining (type: __________)	____ Other

COMMENTS: Indicate the current and potential future threats to the stream's health.

Share your stream monitoring data at ***www.cleanwaterhub.org*** 2

Note: For categories asking for percentage values, work with your team to come to a reasonable estimate. You are not expected to calculate precise percentages.

Rate the potential level of impact from specific land uses within a ONE MILE RADIUS of your site.

SOS Chemical Datasheet

SAVE OUR STREAMS IZAAK WALTON LEAGUE OF AMERICA

Chemical Monitoring Data Form for Stream Monitors

Name of Stream: ____________ Name of monitoring site: ____________

Name of Certified Monitor(s): ____________

Group/Organization: ____________ Number of participants: ____________

City/State: ____________ Latitude: ____________ Longitude: ____________

Survey Date: ____________ Start time: ____________ End time: ____________

Description of site location: ____________

Record stream site information here. Be sure to list ALL certified monitors present at each monitoring event.

WEATHER CONDITIONS (check all that apply)

Today:	☐ Sunny	☐ Overcast	☐ Intermittent Rain	☐ Steady Rain	☐ Heavy Rain	☐ Snow
Yesterday:	☐ Sunny	☐ Overcast	☐ Intermittent Rain	☐ Steady Rain	☐ Heavy Rain	☐ Snow
Day Before Yesterday:	☐ Sunny	☐ Overcast	☐ Intermittent Rain	☐ Steady Rain	☐ Heavy Rain	☐ Snow

COLLECTED DATA

Dissolved Oxygen: ____________ mg/L ____________ % saturation (*See page 2 of this form to calculate % saturation)*

pH: ____________ pH units

Chloride: ______ Quantab Units ______ mg/L *(Convert Quantab Units to mg/L using the chart provided on the bottle)*

Phosphate: ____________ mg/L

Nitrate-N: ____________ mg/L

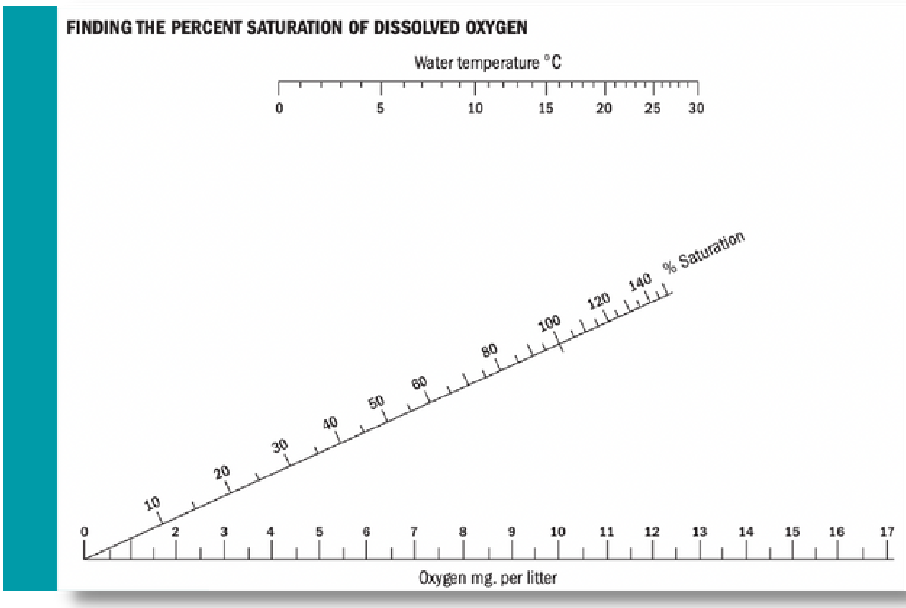
Transparency (record whole numbers only): ____________ centimeters

Water temperature: ____________ °C

Other Stream Assessment Observations and Notes: ____________

Determining Dissolved Oxygen Percent Saturation

Use the chart on the back side of the Chemical Monitoring Data Form to determine dissolved oxygen percent saturation. Place a straight edge on the concentration (mg/L) of dissolved oxygen you measured at your site, then place the other end of the straight edge on the water temperature. The point where the straight edge passes through the line labeled "% Saturation" is your dissolved oxygen percent saturation.



Water Quality Summation

Compare your chemical readings to the values on the Water Quality Summation table on the back side of the Chemical Monitoring Data Form.

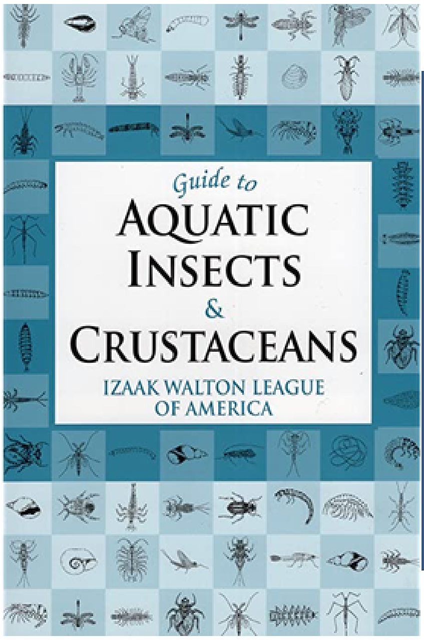
WATER QUALITY SUMMATION for Chemical Tests				
	Excellent	**Good**	**Fair**	**Poor**
Dissolved Oxygen (% saturation)	80-120	70-79 121-140	50-69 >140	<50
pH (units)	7.0-7.5	6.5-6.9 7.6-8.5	5.5-6.4 8.6-9.0	<5.5 >9.0
Chloride (Cl) (mg/L)	0-20	21-50	51-250	>250
Reactive Phosphate (PO_4X^3) (mg/L)	0-0.2	0.3-0.5	0.6-2.0	>2.0
Nitrate (NO_3) (mg/L)	0-3	>3-5	>5-10	>10
Transparency (cm)	≥65.0	64.9-35.0	34.9-15.5	<15.5

Macroinvertberate Identification

Sorting Your Sample

When you first get started monitoring, it may be easiest to start by simply sorting critters by similar appearances. Place organisms that share similar characteristics in your sorting tray together. After picking your sample, go through the sorting tray and spend more time magnifying, identifying, and recording your organisms.

As you get more practice and your macroinvertebrate identification skills improve, you may be able to identify macroinvertebrates as you pick them off of the net and call your organisms out to another monitor as they record your findings.




Identifying Macroinvertebrates

We identify to the Order level in the SOS program. The accuracy of SOS stream health score data relies on the accuracy of macroinvertebrate identification. Monitors should take care to identify all macroinvertebrates correctly. Utilize identification resources and magnification tools to ensure that your identifications are correct. When in doubt, put the critter under the microscope to be sure! **Many macroinvertebrates share similar characteristics to others, so monitors should take the time to <u>identify multiple characteristics</u> on each bug that confirm your identification.**

Returning Your Sample

When you've finished identifying and tallying macroinvertebrates, return them to the stream. Rinse all of your supplies and check them carefully to be sure all organisms are returned.

REMEMBER: To increase the chance of survival, return the macroinvertebrates to the stream as soon as possible after identification.

Handling Unknown Specimens

If you find that you and your monitoring group cannot identify an organism, you will need to do the following to secure an accurate identification;

1. Take a photograph of the organism (including an item to represent scale, if possible)
2. Write down a detailed description of the organism
3. Send the information to SOS Staff at **SOS@iwla.org**

You may also choose to preserve the organism in a vial of ethanol and mail the sample to the Izaak Walton League of America headquarters for identification.

Izaak Walton League of America
ATTN: SOS Coordinator
707 Conservation Lane
Gaithersburg, MD 20878

Unusual Results

Use this flow chart to determine what to do if your SOS sampling yields unusal results.

I found some strange results at my site. What do I do?

Is there any evidence of criminal activity?

YES → Leave the area immediately and contact local law enforcement.

NO → Is there evidence of dangerous pollution discharges, fish kills, or public health hazards?

- **YES** → Immediately report to your state's conservation or environmental department. Take photos and note the location, but do not disturb the area or evidence.
- **NO** → Have you observed abnormal benthic macroinvertebrate results?
  - **YES** → Contact your state's conservation or environmental department during regular business hours with results and concerns.
  - **NO** → Continue collecting data and tracking long-term trends.

When in doubt, contact Save Our Streams: sos@iwla.org

Clean Water Hub

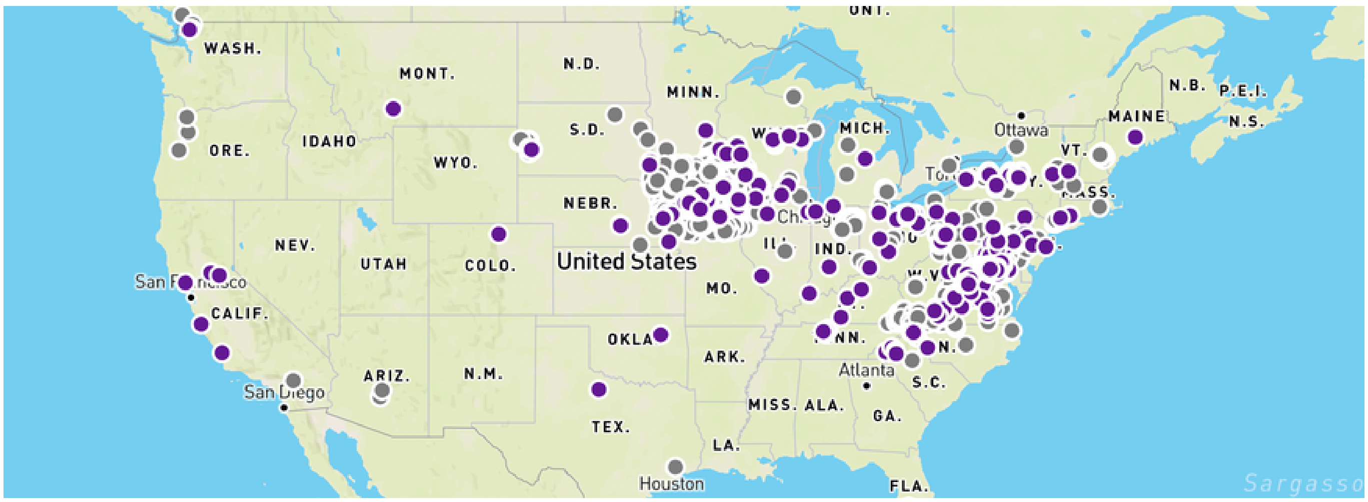
What is the Clean Water Hub?

The Clean Water Hub is a collaborative data visualization tool to help water quality monitors and communities track water quality in local creeks and streams.

The Clean Water Hub currently hosts the following types of water quality data;

- National SOS benthic macroinvertebrate data
- Virginia SOS (VA SOS) benthic macroinvertebrate data
- Chemical water quality data
- Salt Watch & Nitrate Watch results
- Macroinvertebrate data collected by the Creek Critters app

Visit **www.cleanwaterhub.org** to explore the map, create an account, and add your data.



Request a Clean Water Hub Group/Organization Profile

To see all of your sites in one place and access downloads of your data, you can request an organization profile be made for your monitoring group/chapter/organization. This profile is a great way to manage data for multiple sites, and can serve as a communication tool for you to share your results with your community.

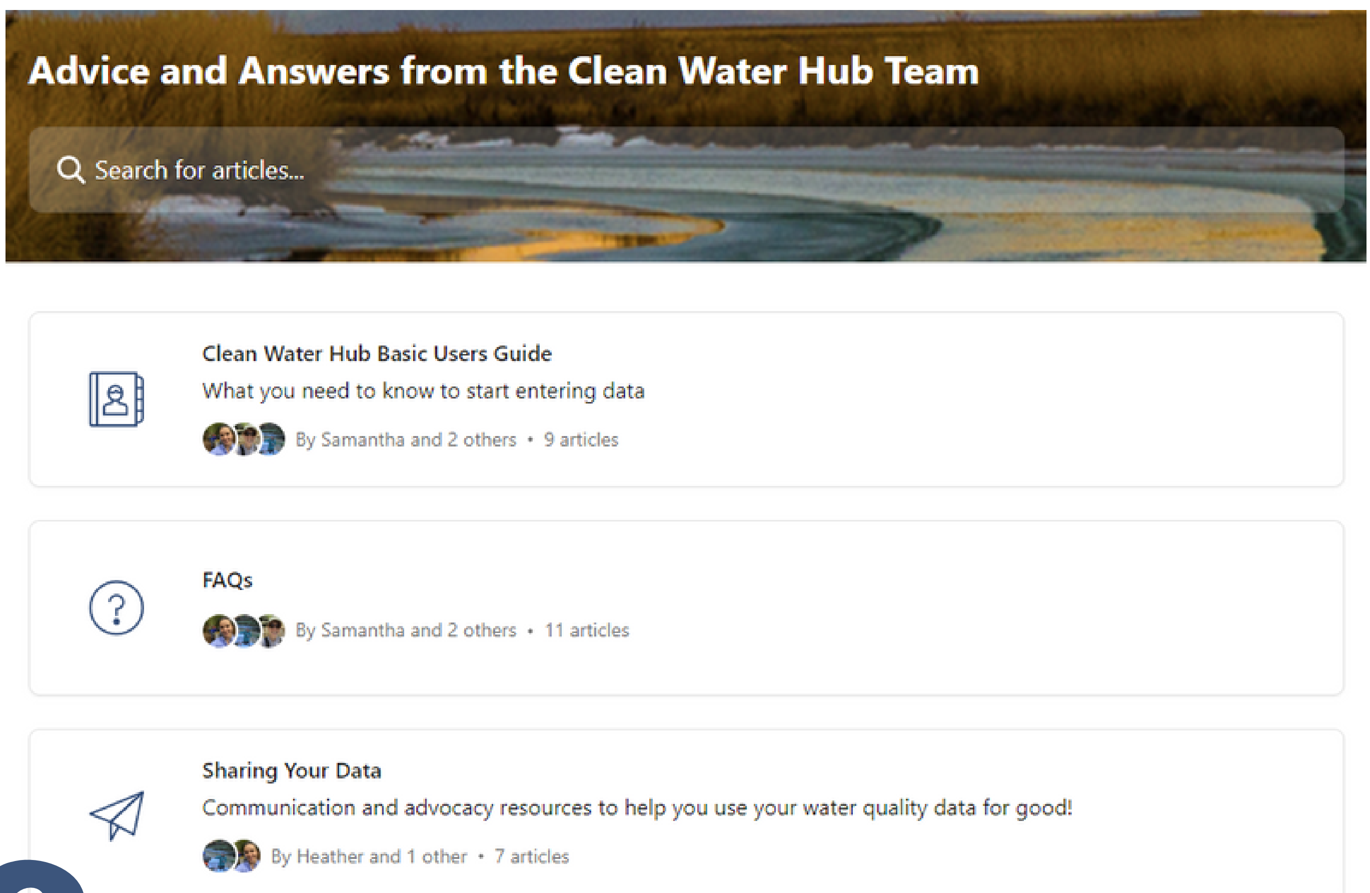
Request a profile using this online form, or by emailing **sos@iwla.org**.

Using the Clean Water Hub

Looking for help getting started on the Clean Water Hub? Visit help.cleanwaterhub.org/ to find the following resources:

- **Clean Water Hub Basic Users Guide** - all the information you need to get started entering data into the Hub
- **FAQs** - answers to frequently asked questions from Hub users
- **Sharing Your Data** - Communication and advocacy resources to help you use your water quality data for good!

help.cleanwaterhub.org/

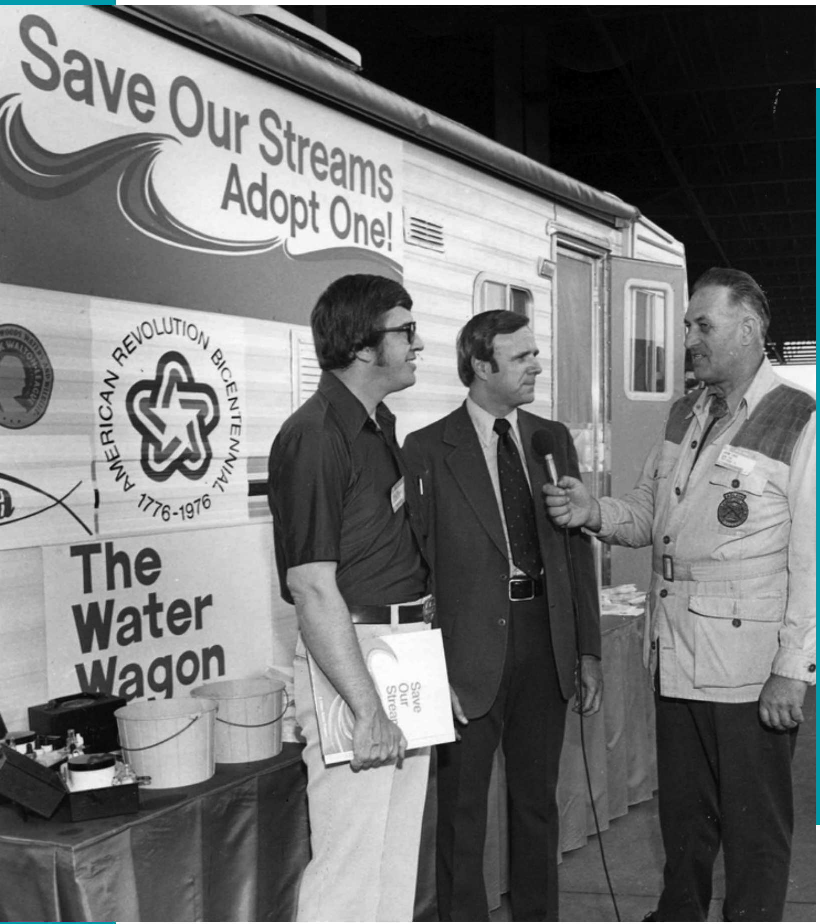


Still stuck? Email support@cleanwaterhub.org and we will get back to you!

Advocacy Guide

Use Your Data!

Stream monitoring is one step of many that you can take to protect your waterways. The **Save Our Streams Advocacy Guide** shows you how to take action at the local, state or federal level to protect the waterways you monitor. You'll find valuable tips and advice on how to organize your community, influence policymakers and create positive change for your streams. Plus, read inspiring success stories from fellow monitors and other League members.



SAVE OUR STREAMS
IZAAK WALTON LEAGUE OF AMERICA
ADVOCACY GUIDE

Other Monitoring Opportunities

Salt Watch

IWLA sends **free kits** to volunteers to track levels of road salt (chloride) in their local streams throughout the year and submit their data to a national database. Volunteers can share and use these data with their local watershed groups, neighbors, and local government. Interested in partnering? We can send you bulk kits for your monitoring or education groups.

Creek Critters

Perfect for classes, families, public programs, and even as a solo activity, Creek Critters is easy and fun. Collect bugs by following simple step-by-step instructions, and identify your bugs with an interactive identification key. The app automatically calculates your Stream Health Score based on your findings. The score tells you how healthy your stream is – plus your results are added to the Clean Water Hub, our public database of water quality in America.

Nitrate Watch

Nitrate Watch is the newest community science program from the IWLA Clean Water team. It mobilizes volunteers across the country to track nitrate levels in surface water and drinking water. Request your Nitrate Watch kit and find educational resources and advocacy actions at **www.NitrateWatch.org**.

Become an IWLA Member

National Membership

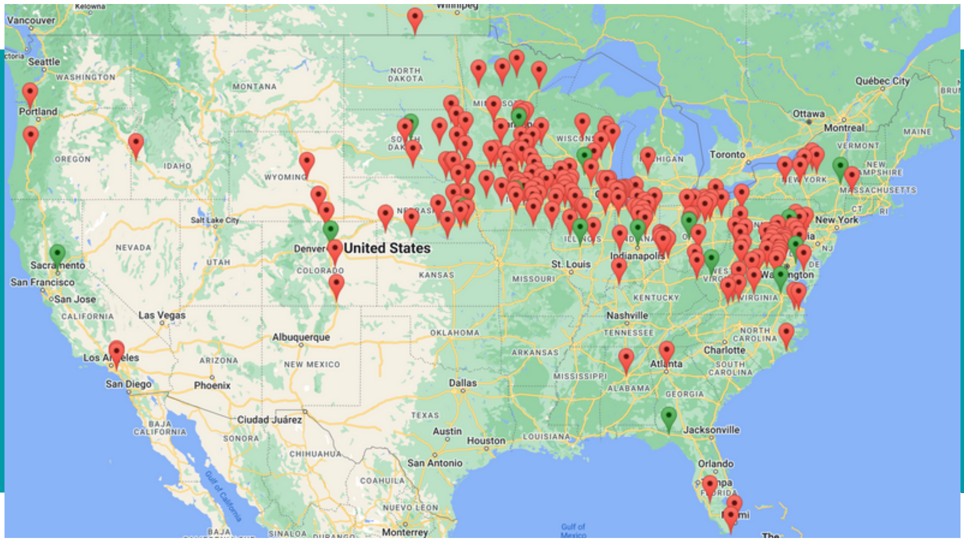
The Izaak Walton League doesn't take a "doom and gloom" approach to conservation. We work for practical solutions that balance conservation with sustainable use of natural resources. Want to help find common-sense solutions to today's environmental problems? Join the League as a national member to support our conservation and advocacy work.

Become a National Member and receive:

- Outdoor America magazine, the League's award-winning quarterly magazine
- E-news you can use each month to defend America's outdoors
- Advocacy on your behalf to protect clean water, fish and wildlife, and outdoor recreation
- Networking with League members
- Scholarships that are only open to League members and their families
- Supporting the only organization training volunteers to protect clean water nationwide

Join a Local Chapter

Volunteers are the heart and soul of the League's brand of community-based conservation. Much of that volunteer work happens at our more than 200 chapters, where you can find opportunities to enjoy outdoor America – and protect it for the enjoyment of others. Some chapters offer hiking trails, fishing ponds, and shooting sports facilities. Many chapters organize stream clean-ups, youth programs, and conservation education events.



[Find a Chapter Near You](#)

APPENDIX A

SOS Biological Protocol

Rocky Bottom Protocol

Objective:

Sampling up to two riffles, use a kick net to collect at least 100 macroinvertebrates. Use the SOS Biological datasheet to tally macroinvertebrates and to calculate a stream health score.

Step 1: Identify Riffles

Identify which riffle you will sample during your collection. A riffle is a fast-moving area of water with a depth of 3 to 12 inches and cobble-sized stones (2 to 10 inches) or larger.

Look for riffles where maximum bubbling action occurs and there are plenty of cobble sized rocks. Riffles can be aligned vertically moving upstream, horizontally across a wide stream, or both!

Note: You will be sampling a 3'x3' area. Your kick net is 3'x3' in size, so use the net to approximate the size of your sample area.

Step 2: Approach From Downstream

Start with the most downstream riffle and approach from downstream. Avoid disturbing riffle areas before your sample collection begins to avoid disrupting or double counting bugs.

Step 3: Place Kick Net Below Riffle

Place your kick net downstream of the riffle you aim to sample. Kick net should be placed perpendicular to water flow and held at approximately a 45 degree angle. Be sure that water is flowing *through* the net, and not over the top. Spread net as widely as possible and allow direct flow of water into the center of the net.

Step 4: Line Net Edge with Rocks

To avoid losing any macroinvertebrates beneath the net, place anchor rocks along the bottom edge of the net. Anchor rocks should be taken from INSIDE the sample area.

A **Rocky Bottom** sample lasts 60 seconds:

40 seconds to rub rocks

20 seconds to disturb substrate

Step 5: Rub Stream Rocks

Spend 40 seconds rubbing rocks. Pick up cobbles in your 3'x3' sample area and rub them quickly and thoroughly underwater. Get to as many rocks as possible during your allotted time. The aim is to dislodge any macros that are clinging to the rocks and capture them in the net.

Step 6: Disturb the Substrate

Spend 20 seconds disturbing the substrate of the stream within your 3'x3' sampling area. Use the toe of your shoe or a clean rock, hand rake, or trowel to rigorously jab the streambed in a shuffling motion, moving towards the net. Disturb the first few inches of sediment to dislodge burrowing organisms.

Step 7: Clean and Remove Anchor Rocks

Before removing the kick net, rub the rocks that you used to anchor the net to the stream bottom to collect any macroinvertebrates clinging to those rocks.

Step 8: Take Net to Table to Process

Take net back to your table to sort and identify your macroinvertebrates. To avoid losing any of your sample, firmly grab the bottom of the net , and then remove it from the water with a forward-scooping motion.

Once you've finished taking your sample, carefully return all rocks to the riffle that were removed in the sampling process.

Note: You may catch vertebrates like minnows and salamanders in your net. You can make a note of their presence on your datasheet, but you will not count them as part of the SOS calculation. Return them to the stream promptly.

Step 9: Processing Your Sample

Using forceps, spoons, or pipettes, pick ALL macroinvertebrates off of the net and place into sorting trays (we recommend white ice cube trays). Switch positions around the table to double check for bugs not yet sorted.

When picking your net, start by completely picking bugs off of the top. Then roll the net away and pick any bugs stuck on the underside of the net. Once all bugs are off of the net, examine the table for any bugs that crawled through.

As organisms on the net start to dry out, use a spray bottle filled with stream water to moisten them. This makes them easier to see.

TIP: Use the 5 minute rule! If 5 minutes pass without finding a bug, the net is fully picked.

Note: You must FULLY pick every net. Do not stop picking when you reach 100 organisms if there are still bugs on net. Picking every bug ensures that the composition of the stream is accurately reflected when calculating a stream health score.

Step 10: Count and Identify Macroinvertebrates

If your first net yields 100 or more bugs, you are done! If not, complete a second sampling at a different riffle. You should only take a maximum of 2 samples in an attempt to get 100 macroinvertebrates.

Step 11: Return Your Sample

When you've finished identifying and tallying macroinvertebrates, return them to the stream. Rinse all of your supplies and check them carefully to be sure all organisms are returned. To increase the chance of survival, return the macroinvertebrates to the stream as soon as possible after identification.

Muddy Bottom Protocol

Objective:

Use a D-Net to take 20 scoops from muddy bottom habitats present at your site. Use the SOS Biological datasheet to tally macroinvertebrates and to calculate a stream health score.

Step 1: Identify Habitat Composition

Identify which of the four Muddy Bottom habitats are available within the 50-foot site you have selected. The habitat areas are: steep banks/vegetated margins, silty bottom with organic matter, woody debris with organic matter, and sand/rock/gravel substrate.

Ideally, you should take:

- 10 scoops from steep banks/vegetated margins
- 3 scoops from silty bottom with organic matter
- 4 scoops from woody debris
- 3 scoops from sand/rock/gravel substrate

However, not all four habitats will always be present at every Muddy Bottom site. If one of the habitat types is not present, divide the number of assigned scoops from that habitat between the other habitats present. **You should always take 20 scoops total.**

Steep Banks/ Vegetated Margins

Woody Debris with Organic Matter

Silty Bottom with Organic Matter

Sand/Rock/Gravel Substrate

Note: Riffle areas are the areas of highest oxygenation in a stream. When riffles are present, the highest concentration of macroinvertebrates will be found there. If you have two riffles at a site, you should use the Rocky Bottom protocol to get the most accurate and representative score. Use the Muddy Bottom protocol when less than two riffles are available.

Step 2: Take 20 scoops within your site

A single scoop consists of aggressively thrusting the net into the target habitat for a distance of approximately 1 foot. This initial "jab" is followed by sweeping the net through the water in an upstream motion to collect dislodged organisms. Be sure to mark on your datasheet how many jabs were taken in each habitat.

The following techniques are recommended for sampling the four major productive habitats in muddy bottom streams.

- **Steep banks/vegetated margins:** This habitat along the edge of the stream consists of overhanging bank vegetation, plants living along the shoreline, and submerged root mats. Move the dip net in a bottom-to-surface motion, jabbing at the bank to loosen organisms. Each scoop of the net should cover one foot of submerged area.

- **Woody debris with organic matter:** To sample woody debris, approach the area from downstream and hold the net under the section of wood you wish to sample, such as a submerged log. Rub the bottom of the net frame along the surface of the log for a total surface area of one foot. It also is good to dislodge some of the bark, as organisms may be hiding underneath. You can also collect sticks and leaf litter and rub roots attached to submerged logs.

- **Silty bottom with organic matter:** Silty substrates with organic matter can be found where the water is slow-moving and where there is overhanging vegetation or other sources of organic matter. Collect samples by pushing the net upstream with a jabbing motion to dislodge the first few inches of organic layer

- **Sand/rock/gravel substrate:** Sand/gravel substrates are sampled by jabbing the net upstream to dislodge the first few inches of sediment. If you have large rocks (greater than two inches in diameter), hold the net on the downstream side of the rocks. In a one-square-foot area in front of the net, gently kick up the rocks with your toes or push them free with your fingers. This should dislodge burrowing organisms and allow them to wash into your net.

Note: As you are sampling, sweep the mesh bottom of the D-frame net back and forth through the water (not allowing water to run over the top of the net) to rinse fine sediment from the net. This will avoid a large amount of sand and silt from collecting in the pan and clouding the water.

Step 3: Processing Your Sample

As you are collecting your scoops, place the contents of each net into a shallow light-colored pan filled with a few inches of water. You may choose to run the sample through a sieve bucket or the mesh of your D-frame net to remove excess sediment.

Empty the contents of your sieve bucket or light-colored pan onto a flat, light colored surface, such as a white sheet, or table. Use a spray bottle filled with stream water to remove all organisms from the bucket. Spread the sample across your surface (as large an area as needed so that the material is not clumped into piles). Using forceps, spoons, or pipettes, pick ALL macroinvertebrates from the sample and place into ice cube trays.

As organisms on the net start to dry out, use a spray bottle filled with stream water to moisten them. This makes them easier to see.

TIP: Use the 5 minute rule! If 5 minutes pass without finding a bug, the net is fully picked.

Step 4: Count and Identify Macroinvertebrates

Count and identify all macroinvertebrates found in the sample. Unlike Rocky Bottom sampling, there is no minimum required number of macroinvertebrates for a Muddy Bottom sample.

Step 5: Return Your Sample

When you've finished identifying and tallying macroinvertebrates, return them to the stream. Rinse all of your supplies and check them carefully to be sure all organisms are returned.

APPENDIX B

Explanation of Chemical Parameters

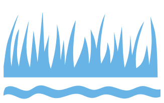
Explanation of Chemical Parameters

In this section, find additional information about the parameters measured in Save Our Streams Chemical Monitoring.

Streamside Observations

Sometimes just observing your stream before you ever step into the water can tell you about the water quality. When you first reach your stream site, spend a few minutes observing the habitat. Here are a few things you can look for:

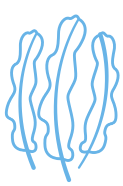
Smell. A healthy stream shouldn't have a strong smell – wet soil, decomposing leaves, and other natural smells are normally mild. If you smell sewage, chemicals like oil or gasoline, or other unnatural smells, these could be a sign of a pollution problem.



Vegetation. Most streams are bordered by some kind of vegetation, including grasses, shrubs, or trees. These plants help stabilize the banks, keep the water shaded and cool, and catch pollution before it flows into the stream. Streams without vegetation are vulnerable to bank collapse and pollution.

Erosion. Many urban streams suffer from severe erosion due to sudden changes in water level. Look for signs of erosion by comparing the high water mark with the level of the stream itself. Observe any trees with exposed roots and note if soil is actively collapsing into the stream.

Weather. Recent weather can affect stream conditions. Has it been very rainy recently? Lots of rain may make the water murky and wash in pollutants via runoff. Hot and dry? The water may be lower and warmer than usual.



Algae. Algae is a natural part of a stream habitat and can be many different colors from green to brown to orange. Excessive algae on the water's surface or covering the stream bottom can indicate excessive nutrients in the water. Check for algae by looking at the streambed and stones or even by feeling cobbles in the water.

Chemical Parameters

Save Our Streams chemical monitoring can help pinpoint the cause of a water quality problem. By combining chemical monitoring with biological monitoring, you can start to put together a full picture of your stream's health.

Dissolved Oxygen

Dissolved Oxygen (DO) is the measurement of oxygen present in a body of water and available to aquatic organisms. It is measured as a concentration in milligrams per liter or a percent-saturation. Certain processes add oxygen to a stream, while others remove or consume oxygen.

What Affects Dissolved Oxygen?

Water Temperature: Cold water holds more oxygen than warm water.

Time of Day: DO levels are highest during sunny days, when aquatic plants create oxygen.

Stream Flow: DO will vary with the volume and speed of water in a stream. Faster moving water mixes with oxygen from the air, thus increasing DO.

Sediments: Oxygen dissolves more easily in water without high amounts of salts or sediments. Sediment also blocks sunlight from reaching aquatic plants, making it difficult for these plants to produce oxygen.

Human Impacts: Human impacts that increase stream temperature or create pollution can reduce DO, like stormwater runoff, riparian habitat removal, and dams.

Algae blooms: Excess nutrients in water can cause algae to grow in thick mats or "blooms," which block sunlight to aquatic plants. Decomposing algae also releases carbon dioxide into the water.

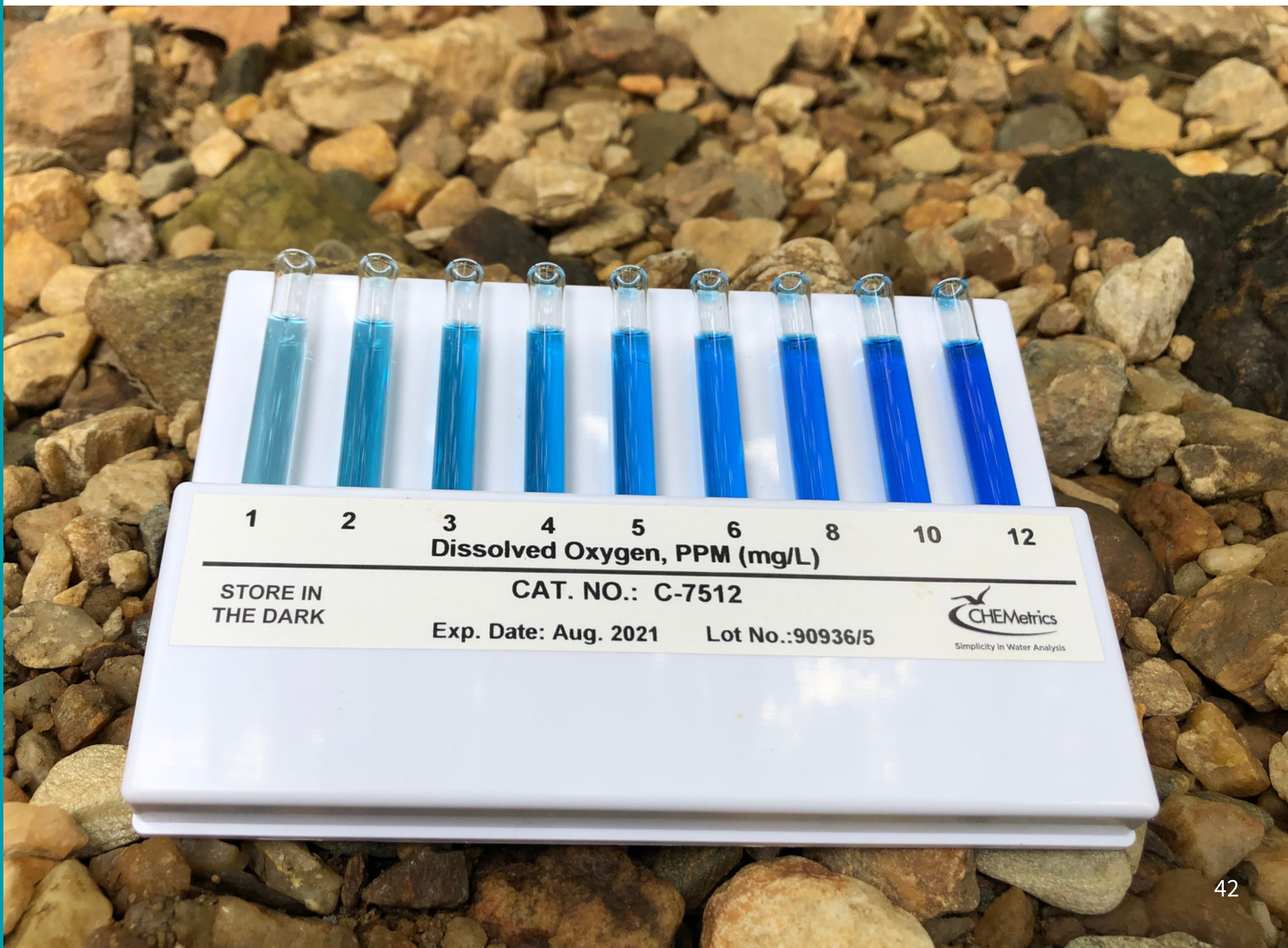
Dissolved Oxygen - continued

What's a Normal DO Reading?

The typical range for dissolved oxygen for rivers and streams is 8.7 to 12.9 mg/L. DO levels can be lower in stagnant or still water, like in marshes, lakes, or the bottoms of large, deep rivers. Low DO in a stream, however, can indicate a pollution problem.

Combining a DO test with other chemical measurements can help pinpoint potential water quality threats. Habitat assessments are also a good tool for identify potential causes of DO. Little riparian vegetation or lots of algae can both cause low levels of DO in a stream.

Finally, monitoring for macroinvertebrates will help provide a full picture of stream health. If the DO levels have been chronically low in a stream, only pollution tolerant macroinvertebrates will be present. If the DO dropped recently or for a short period of time, sensitive macroinvertebrates may still be present.



pH

pH is a measure of a water's acid/base content and is measured in pH units on a scale of 0 to 14. A pH of seven is neutral, a pH greater than seven is basic/alkaline, and a pH less than seven is acidic. The pH level of stream water is influenced by the concentration of acids in rain and the types of soils and bedrock in the state.

What Affects pH?

Rainfall: The typical pH of rainfall in the United States is slightly acidic, ranging from 5.0 to 5.6. Rainwater pH is determined by natural atmospheric processes and air pollution.

Soil: The pH of soil varies depending on both geology and vegetation. Fallen pine needles make neighboring soil and water slightly acidic, while limestone make them basic.

Human Impacts: Runoff of chemical pollutants, air pollution, wastewater from mining operations.

What's a Normal pH Reading?

Most aquatic organisms can only survive in habitats with a pH of 6.5 to 9.0. Too high or too low, and most aquatic species will die out.

Combining a pH test with other chemical measurements can help pinpoint potential causes of low of high readings. Habitat assessments are also a good tool for identify potential causes of low or high pH. Visible pollution, runoff, or vegetation types may help explain an abnormal reading.

Finally, monitoring for macroinvertebrates will help provide a full picture of stream health. If the pH levels have been chronically abnormal, only pollution tolerant macroinvertebrates will be present. If the pH recently changed or changed for a short period of time, sensitive macroinvertebrates may still be present.

Water Temperature

Many of the chemical, physical, and biological characteristics of a stream are directly affected by water temperature. Some animals, such as trout, are quite sensitive to temperature changes. Water temperatures can fluctuate seasonally, daily, and even hourly.

What Affects Water Temperature?

Air temperature: Water temperature is cooler in winter and warmer in summer. Warming air temperatures driven by climate change are also increasing average stream temperature.

Groundwater: Although groundwater springs are often cold, the temperature of groundwater feeding streams can vary.

Riparian vegetation: Plants that live along streams provide shade and keep the water cool. Removing this vegetation increases the temperature of water flowing through that section of stream.

Erosion: Natural and human-caused soil erosion fills streams with soil, making water cloudier and darker. Darker water absorbs more sunlight and is thus warmer.

Human activities: Runoff from warm pavement and industrial discharge brings warm water into a stream.

Changes in water temperature affect water quality. Cool water holds more oxygen than warm water, so the amount of dissolved oxygen decreases as temperature rises. The rate of photosynthesis by algae increases in warmer waters, encouraging blooms. The metabolic rate of aquatic animals increases with higher temperatures, meaning they require more oxygen and food to survive. The sensitivity of aquatic organisms to diseases, parasites, and toxic wastes also increases with rising water temperatures, putting them at greater risk.

Water Temperature - continued

What's a Normal Water Temperature Reading?

Combining a temperature reading with other chemical measurements can help pinpoint potential causes of low or high temperatures. Habitat assessments are also a good tool for identify potential causes for temperature readings: the presence of vegetation, nearby parking lots, or erosion can all influence water temperature.

Finally, monitoring for macroinvertebrates will help provide a full picture of stream health. If the temperature has been chronically abnormal, only pollution tolerant macroinvertebrates will be present. If the temperature changed recently or changed for a short period of time, sensitive macroinvertebrates may still be present.

Nitrate

Nitrate is a naturally occurring compound made up of nitrogen and oxygen. Nitrogen is an essential nutrient for plant growth, but human activities produce more nitrogen than natural systems can use. Fertilizers, manure and sewage all add extra nitrogen to the landscape. As this nitrogen moves through the environment, it becomes nitrate. The nitrate can then make its way to streams and sources of drinking water via surface runoff or groundwater saturation. Excess nitrate in water can pose serious problems for the health of humans and the environment.

What Affects Nitrate?

Natural Sources: Natural sources can contribute small amounts of nitrate to water. Wildlife waste, decaying organic matter, and nitrogen-fixing plants can contribute to nitrate concentrations.

Human Sources: Nitrogen is an abundant ingredient in chemical fertilizers used on lawns, farm fields, golf courses, and gardens. Sewage, faulty septic systems, and animal feedlots can also be big contributors of nitrate. Some additional potential sources include industrial or food processing waste.

Rain Events: During and immediately following precipitation, there can be a higher volume of nitrate in waterways. However, because the volume of water has also increased, the change in nitrate concentration (parts per million or mg/L) may not accurately reflect the increased nitrate load.

Natural Filters: Because nitrate is an essential nutrient in nature, there are ways for nature to filter nitrates. Plants can slow down and extract nitrate from water. Some natural nitrate filters include wetlands, vegetated buffers around waterways, and rain gardens. Some specific bacteria also consume nitrate in conditions with low or no oxygen.

What's a Normal Nitrate Reading?

Nitrate concentration measures the volume of nitrate per volume of water as milligrams per liter (mg/L) or parts per million (ppm). When comparing a small stream and a large river with an equal concentration, the larger river will actually be carrying a higher volume of nitrate. A typical range for nitrate in a stream is 0.1 - 3 mg/L. The EPA mandates that the maximum nitrate concentration for drinking water is 10 mg/L.

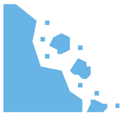
Phosphate

Phosphates are chemical compounds made up of phosphorus and other elements, which plants and animals need to grow. The most common source of phosphates in waterways are artificial fertilizers used by farmers and homeowners for crops, lawns, and landscaping. Although a small amount of phosphate is important for a healthy stream, too much phosphate can cause serious problems.

What Affects Phosphate?

Natural Sources: Decomposing rocks and minerals, deposits from the air, decaying organic matter, and wildlife feces can all contribute small amounts of phosphate that are usually within healthy and necessary levels for the ecosystem.

Human Sources: Phosphates can become problematic when humans contribute more than the system is naturally meant to handle. Human sources can include the following: fertilizer, detergents, erosion and sedimentation, livestock manure, wastewater treatment plants, sewage, and industrial discharges.



Erosion and Sedimentation Control: Because phosphate and soil particles are attracted to each other, practices carried out to keep soil in place should help lower the amount of phosphate that is added to water through erosion and sedimentation.

What's a Normal Phosphate Reading?

Concentration measures the volume of phosphate per volume of water as milligrams per liter (mg/L) or parts per million (ppm). When comparing a small stream and a large river with an equal concentration, the larger river will actually be carrying a higher volume of phosphate. A typical range for phosphate concentration should be between 0.11 to 0.34 mg/L.

Transparency

Transparency is a measure of water clarity and is affected by the amount of material suspended in water. As more material is suspended, less light can pass through, making it less transparent. Suspended materials may include soil, algae, microbes, and more.

Low transparency harms aquatic animals by clogging gills, destroying habitat, and reducing the availability of food. Suspended materials in streams also promote solar heating, which can increase water temperature and reduce light penetration, both of which contribute to lower dissolved oxygen. Sediment also can carry chemical pollutants, such as phosphates or heavy metals, which can have harmful environmental effects.

What Affects Transparency?

Precipitation: Precipitation events can reduce stream transparency, as sediment, organic materials, and pollution are washed into the stream. Heavy rain events can also trigger streambank erosion, decreasing transparency.

Natural Causes: Bottom-feeding fish or other animals walking through the stream can disturb the streambed and decrease transparency. Algae growth is natural and can lower transparency, though human-caused nutrient enrichment can cause algae growth to spike above normal levels.

Human Activity: Human activities on the land, such as construction, agriculture, waste discharge, storm water runoff, industrial discharge, and more can result in decreased water transparency.

Impermeable Surfaces: Impermeable surfaces are those surfaces that do not allow water to saturate down into the soil. They include roads, parking lots, roofs, sidewalks, or even heavily-compacted dense soils. These impermeable surfaces can rush water into streams very rapidly during precipitation events, which can contribute greatly to erosion within the watershed. This erosion creates cloudy water.

What's a Normal Transparency Reading?

Transparency can fluctuate greatly based on land use, land cover, and recent precipitation. However, mostly clear water is the ideal. A result of less than 15.5 cm would be considered “poor”, and greater than 60 cm would be considered “excellent.” A transparency reading between 15.5-35 cm is “fair,” and 35-60 cm is “good.”

APPENDIX C

SOS Chemical Protocol

Chemical Monitoring Protocol

Objective:

Perform chemical tests on a water source to determine if environmental conditions are influencing the water chemistry. Use the SOS chemical datasheet to record your results and determine water quality.

Dissolved Oxygen

For use with the CHEMetrics dissolved oxygen test kit

1. Remove the 25 ml sample cup from the kit and rinse it three times with stream water.
2. Wade out to the spot with the greatest flow of water.
3. Lower the sample cup down to wrist depth while holding it upside down. Turn the opening downstream so that the cup backfills with water, then turn the cup upstream and carefully remove cup and water sample from stream.
4. Place a glass ampoule in the sample cup, tilting it so the tip is wedged in one of the spaces along the side of the sample cup.
5. Snap off the tip of the ampoule by pressing it against the side of the cup, allowing it to fill with water.
6. Remove the ampoule from the cup and mix the water by inverting the ampoule several times. Be careful not to touch the broken end, as it will be sharp.
7. **Two minutes** after you break off the ampoule tip, compare the ampoule to the color standards provided in the kit. Remove sunglasses before making a color determination. NOTE: It's important to read the ampoule exactly at two minutes – it will continue to change color.
8. Hold the comparator nearly flat while standing directly beneath a bright source of light. Place your ampoule between the color standards moving it from left to right until the best color match is found. Record your result on the Chemical Data Form.

Note: For each chemical test, check the expiration dates on all test strips, ampoules, etc. If materials have expired, DO NOT USE them.

pH

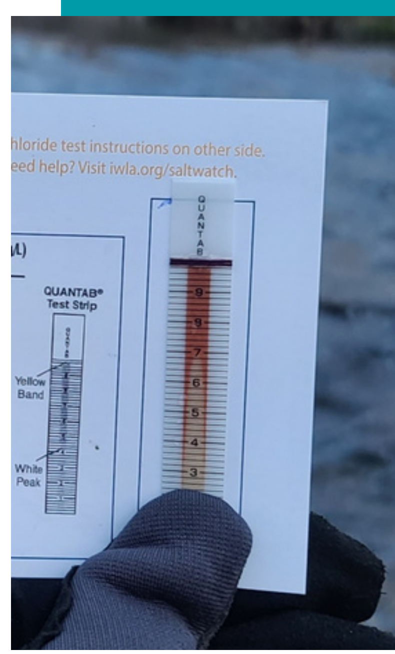
For use with Hach® pH test strips

1. From your monitoring station, wade straight out to the spot with the greatest flow of water and, facing upstream, dip the test strip in the water and remove it immediately.
2. Hold the test strip level for **15 seconds**. DO NOT SHAKE excess water from the test strip.
3. Estimate pH by comparing the test strip to the color chart on the test strip bottle. Remove sunglasses before reading the strip. The strip will continue to change color, so it is important to make a color determination immediately after 15 seconds.
4. Record results on the Chemical Data Form.

Chloride

For use with Hach Chloride QuanTab® titration strips

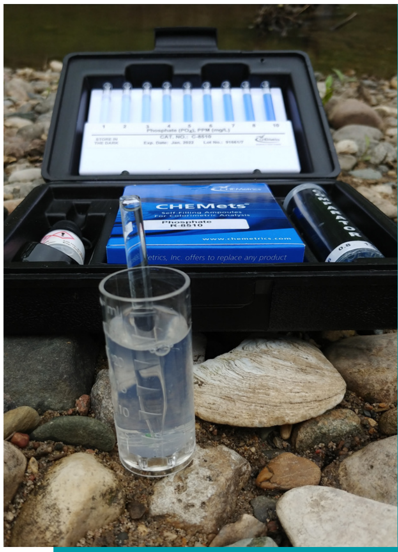
1. Rinse a sample cup three times with stream water.
2. From your monitoring station, wade straight out to the spot with the greatest flow of water and, facing upstream, fill the sample cup with approximately 1 inch of water.
3. Remove a test strip from bottle and replace the cap immediately.
4. Insert the lower end of the test strip into the sample cup filled with water. Do not submerge past the yellow line at the top of the titrator.
5. Allow the sample water to completely saturate the wick of the titrator. There is no time limit for this test – the reaction is complete when the yellow line turns dark (this will take a few minutes).
6. Note where the tip of the white chloride peak falls on the numbered QuanTab scale. This represents the QuanTab unit value.
7. Refer to the table on the QuanTab test strip bottle to convert the QuanTab units into a chloride concentration (units of ppm or mg/L). Record the result on the Chemical Data Form.
8. If the QuanTab unit value is below the smallest value on your test strip bottle, report the chloride concentration as the lowest concentration listed on the test strip bottle and make a note in the comments section.

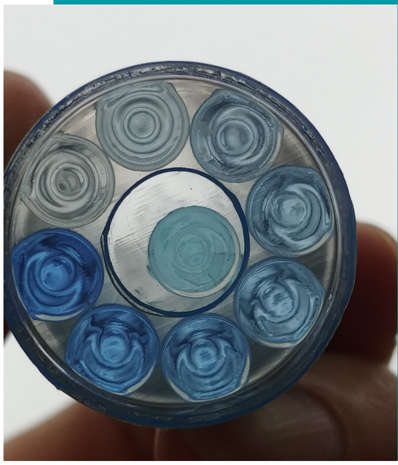


Phosphate

For use with CHEMetrics phosphate test kit

1. Remove the 25 ml sample cup and black lid from the kit and rinse them three times with stream water.
2. Wade out to the spot with the greatest flow of water.
3. Lower the sample cup down to wrist depth while holding it upside down. Turn the opening downstream so that the cup backfills with water, then turn the cup upstream and carefully remove the cup and water sample from the stream.
4. Gently tip the sample cup to pour off excess water. The cup should be filled to the 25 mL mark.
5. Add 2 drops of A-8500 Activator Solution, place the black cap on the sample cup, and shake to mix the contents.
6. Place a glass ampoule in the sample cup, tilting it so the tip is wedged in one of the spaces along the side of the sample cup.
7. Snap off the tip of the ampoule by pressing it against the side of the cup, allowing it to fill with water.
8. Remove the ampoule from the cup and mix the water in the ampoule by inverting it slowly several times. Be careful not to touch the broken end, as it will be sharp.
9. **Two minute**s after you break off the ampoule tip, compare the ampoule to the color standards provided in the kit. Remove your sunglasses before making a color determination. NOTE: It’s important to read the ampoule exactly at two minutes – it will continue to change color.
10. Based on the color of your ampoule, use the appropriate color comparator to estimate the phosphate concentration.
    a. The low-range circular comparator measures concentrations ranging from 0 to 1 mg/L. To use the circular comparator, place your ampoule, flat end downward, into the center tube. Direct the top of the comparator up toward a good light source while viewing from the bottom. Rotate the comparator to match your ampoule to the standards and record your results on the Chemical Data Form.
    b. The high-range comparator in the lid of the kit measures concentrations ranging from 1 to 10 mg/L. Hold the high range comparator nearly flat while standing directly beneath a bright source of light. Place your ampoule between the color standards moving it from left to right until the best color match is found. Record result on the Chemical Data Form.





Nitrate

For use with Hach® nitrate-N/nitrite-N test strips

1. Dip the test strip into the water for one second and remove. DO NOT SHAKE excess water from the test strip.
2. Hold the strip level, with pad side up, for 30 seconds.
3. At exactly **30 seconds**, compare the NITRATE (upper) test pad to the nitrate-nitrogen color chart on test strip bottle, estimate the nitrate concentration in mg/L, and record your reading on the Chemical Data Form. (Remove sunglasses before reading the strip.) The pad will continue to change color, so make a determination immediately after 30 seconds.

Note: Each nitrate-N/nitrite-N test strip also has a second tab for measuring nitrite-N. Save Our Streams chemical monitoring does not collect nitrite-N data, so you may disregard this test pad.

Transparency

For use with transparency tube

1. Make sure the finger clamp on the hose is closed.
2. From your monitoring station, wade straight out to the spot with the greatest flow of water and, facing upstream, fill the transparency tube.
3. Hold the tube upright and in the shade. Use your body to shade the tube if nothing else is available.
4. With your back to the sun, look directly into the tube from the open top and release water through the small hose, regulating the flow with the finger clamp until you are able to distinguish the black and white pattern (Secchi pattern) on the bottom of the tube. Close the finger clamp.
5. Read the number on the outside of the tube that is closest to the water line. Record your reading in centimeters (cm).
6. If the Secchi pattern is visible when the transparency tube is completely full of water, record a transparency reading of 65.0 cm and make a note in the comments section.
7. Rinse the tube after each use so that the bottom Secchi pattern does not become dirty and clouded.

Water Temperature

For use with an aquatic thermometer

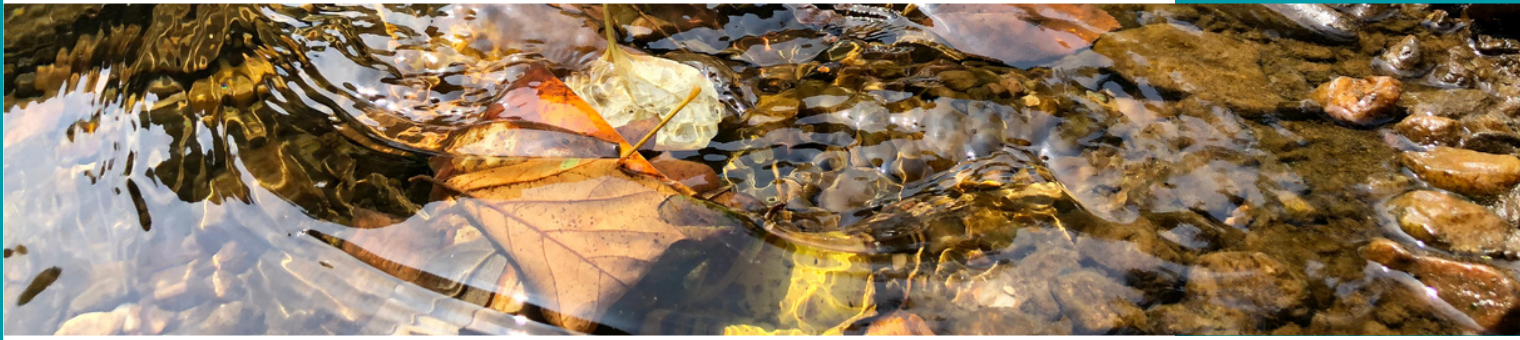
1. From your monitoring station, wade straight out to the spot with the greatest flow of water and place the thermometer or probe directly into the stream
2. Hold the thermometer underwater for at least **two minutes** so the reading can stabilize.
3. Record the temperature on your Chemical Data Form in degrees Celsius (°C).

Use and Storage of Chemical Testing Materials

Chemicals in test kits, though not dangerous, can cause mild skin and eye irritation and should be handled with care. Ampules are made of glass and can be very sharp. Test strips along with waste materials can be disposed of as you would any household item.

Store all chemical testing materials at room temperature. Dissolved oxygen and phosphate testing kits must be stored in the dark. Check expiration dates and avoid using expired materials (which could provide inaccurate results).

You can find links to purchase stream monitoring test kits and equipment on the Izaak Walton League website at **iwla.org/water/resources-for-monitors.**



APPENDIX D

Iowa Equipment Loan Stations

Iowa Equipment Loan Stations

Save Our Streams volunteers in Iowa can utilize a network of equipment loan stations. Find an SOS equipment loan station near you and reach out to borrow SOS biological and chemical monitoring supplies.

As the equipment loan program grows, new sites will be added to this map.
Visit **www.iwla.org/water/resources-for-monitors** to view the most up-to-date version of this map and to contact equipment loan sites to check out equipment.

SAVE OUR STREAMS

Iowa Equipment Loan Stations

1 **Hitchcock Nature Center**
27792 Ski Hill Loop, Honey Creek, IA 51542
Contact: Rene Stroud,
rene.stroud@pottcounty-ia.gov, 712-828-2112

2 **Whiterock Conservancy**
1436 IA-141, Coon Rapids, IA 50058
Contact:
volunteer@whiterockconservancy.org

3 **Raccoon River Watershed Association**
Greene County, IA
Contact: Bob Rye, justrt@gmail.com

4 **Forest Park Museum and Arboretum**
14581 K Ave, Perry, IA 50220
Contact: Zach Moss,
zach.moss@dallascountyiowa.gov
515-465-3577

5 **Madison County Conservation**
2508 Pammel Park Trail, Winterset, IA 50273
Contact: naturalist@madisoncountyparks.org,
515-462-3536

6 **Izaak Walton League - Des Moines Chapter**
4343 George Flagg Pkwy, Des Moines, IA 50321
Contact: Christine Curry,
christineanncurry@gmail.com

7 **Polk County Conservation**
11204 NE 118th Ave, Maxwell, IA 50161
Contact: Ginny Malcomson,
Ginny.Malcomson@polkcountyiowa.gov,
515-323-5300

8 **Lake Red Rock Visitor Center**
1105 Hwy T15, Knoxville, IA 50138
Contact: Tracy Spry,
tracy.j.spry@usace.army.mil,
641-628-8690 ext. 6430

9 **Center for Energy and Environmental Education - Green Iowa Americorps**
8106 Jennings Dr, Cedar Falls, IA 50613
Contact: LWSAmeriCorps@gmail.com

10 **Lake Iowa Park**
2550 G Ave, Ladora, IA 52251
Contact: Mary Bulger,
mbulger@iowacounty.iowa.gov,
319-655-8466

11 **Izaak Walton League - Linn County Chapter**
5401 42nd St NE, Cedar Rapids, IA 52411
Contact: Dale Braun (dakotadb@mchsi.com) or
Neil Mittelberg (nmittel@gmail.com)

12 **Hurstville Interpretive Center**
18670 63rd St, Maquoketa, IA 52060
Contact: Jessica Wagner,
jwagner@jacksoncounty.iowa.gov

13 **National Mississippi River Museum & Aquarium**
350 E 3rd St, Dubuque, IA 52001
Contact: Codi Sharkey,
csharkey@rivermuseum.com

APPENDIX E

Iowa DNR Permits and Licenses

Iowa DNR Permits and Licenses

As a trained volunteer in the Save Our Streams program, you are not required to obtain a permit or license to perform the standard SOS macroinvertebrate monitoring protocol. The SOS protocol requires you to return organisms to the stream alive as quickly as possible after identification and counting. You may not remove specimens from the monitoring site.

Mussels: Mussels should be treated differently than most other invertebrates you will encounter. It is possible that mussels you encounter are on state or federal endangered lists. If you do happen to have an incidental catch of a mussel, it is recommended that you return it to the exact place it came from as soon as possible and mark it on your data sheet.

Fish: Fish are not a target of the Save Our Streams monitoring protocol. It is recommended that any fish that are incidentally captured in your net be returned to the water immediately. If you are found in possession of a fish, it is possible that you may be prosecuted under state fishing laws.

Other monitoring protocols

If you are using a monitoring protocol other than that which is taught in the Save Our Streams program, it is possible that you may need a scientific collector permit and a fishing license before going out to monitor. Some examples could include fish surveys, mussel surveys, macroinvertebrate identification down to a species level, and/or removal of any specimen from the monitoring site, whether dead or alive.

Scientific Collector Permit Application:
https://www.iowadnr.gov/conservation/scientific-collectors-permits
Iowa Fishing License: https://www.iowadnr.gov/fishing/buy-your-license

Contact Us

Email us at SOS@iwla.org

Find us online at www.iwla.org/sos

Call us at 301-548-0150

Follow us on Social Media

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- instagram.com/saveourstreams

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