Quality Assurance Project Plan

for

StreamSmart Citizen Science Water-Quality Monitoring Program

Administered by H2Ozarks

Prepared by:

Erin E. Scott
H2Ozarks
1200 W. Walnut Street
Rogers, AR 72758

November 2020
Revision 1, January 2022
Revision 2, January 2025

Table of Contents

Section 1. Program Partners and Participants

The StreamSmart Program is administered by H2Ozarks, with funding from Beaver Water District. Monitoring is conducted and samples are collected by volunteer citizen scientists. Water samples are analyzed by the Arkansas Water Resources Center Water Quality Lab, a State-certified lab. Data will be publicly available on our website. StreamSmart is also registered with the Arkansas Game and Fish Commission Stream Team program, and data will be added to that online data portal as well (https://www.agfc.com/en/education/onthewater/streamteam/citizen-science-tools/). Contact information for each entity is listed below.

H2Ozarks
1200 W. Walnut Street, Box 23
Rogers, AR 72758

Program Coordinator: Ayla Grace, ayla@h2ozarks.org, 479-866-7220

Signature: _____

Senior Policy and Program Director: Erin Scott, erin@h2ozarks.org, 479-841-0235
President: Carin Love, carin@h2ozarks.org, 417-739-5001

Beaver Water District
301 N. Primrose Road
Lowell, AR 72745

Manager of Environmental Quality: James McCarty, JMcCarty@bwdh2o.org
Environmental Specialist: Matthew Rich, MRich@bwdh2o.org

Arkansas Water Resources Center Water Quality Laboratory
1371 W. Altheimer Drive
DTAS 133
Fayetteville, AR 72701

Director: Brian Haggard, haggard@uark.edu

Arkansas Game and Fish Commission Stream Team
2 Natural Resources Drive
Little Rock, AR 72205

State Coordinator: Tim Burnley, tim.burnley@agfc.ar.gov, 877-425-7557

Section 2. Problem Definition/Background

The focus of this program is on the Beaver Lake Watershed in Northwest Arkansas. Beaver Lake is formed by the White River, with headwaters in Winslow, Arkansas and waters moving north towards the Lake before flowing into Missouri. Beaver Lake is the drinking water supply for approximately 500,000 Arkansans and many industries, making it an economic engine for the region.

The watershed is mostly forested (60%), with 27% pasture, 6% urban, 4% water, and 3% other (BWD, 2018). In addition to the White River, Richland Creek and War Eagle Creek are main tributary inflows to the Lake. Many stream reaches in the watershed are on the State's 303(d) list of impaired waterbodies (ADEQ, 2018). The watershed is also a nutrient surplus and State-identified priority watershed (ANRC, 2018).

Northwest Arkansas continues to experience rapid population growth, which impacts land use changes and water quality in the Beaver Lake Watershed. The StreamSmart program contributes to the overall efforts by other agencies and organizations to collect water quality data and information. These data are used to inform watershed management activities and identify changes in water quality over time.

Section 3. Program Description

3.1 Purpose

StreamSmart is the volunteer, citizen-science based water-quality monitoring program for the Beaver Lake Watershed in Northwest Arkansas. This program is administered by H2Ozarks, with funding support from Beaver Water District.

The purpose of the program is to engage citizen scientists, increase public awareness, and inform stakeholders and policy makers about the quality of our waterways. The program is designed to coordinate with and complement the efforts of other groups and organizations that are actively engaged in monitoring and protecting water quality in the streams and rivers of the Beaver Lake Watershed. StreamSmart helps to fill data gaps by monitoring sites that may not otherwise be monitored for water quality. Data collected through this program can be used to inform watershed protection strategies, evaluate water quality, and identify trends in water quality over time.

In addition to the importance of the program for data collection in the Beaver Lake Watershed, StreamSmart recruits and coordinates volunteer citizen scientists who collect water-quality data to develop a long-term database for tributary stream sites in the Beaver Lake Watershed. These volunteers conduct quarterly monitoring activities on their selected stream and report site information to the StreamSmart coordinator. This program provides a valuable outlet for individuals who want to play a role in protecting and improving water quality in the watershed. The program also provides volunteers with the opportunity to share their citizen-science experiences and the importance of their work with their peers and the public. Volunteers in this program are integral in establishing a more robust monitoring plan for the watershed, and in some cases may act as a first line of defense for watershed protection.

The Stream Smart program was developed and is maintained through a strong partnership with Beaver Water District, the Arkansas Water Resources Center, Arkansas Game and Fish Commission Stream Teams, Beaver Watershed Alliance, Northwest Arkansas Master Naturalists, and H2Ozarks.

3.2 Site Selection and Locations

Table 1. StreamSmart site locations and information.

Site Number	Site description	Begin Monitoring Period	Lattitude	Longitude	Subwatershed
101	West Fork at Baptist Ford Bridge	2014 November	35.982714	-94.173129	West Fork
102	West Fork (Brentwood Park)	2014 May	35.865723	-94.117257	West Fork
103	Baldwin Creek Near St. Paul	2015 August	35.822256	-93.758937	Headwaters
104	White River Near St. Paul	2015 August	35.819376	-93.781475	Headwater
109	War Eagle Creek near CR6129	2018 November	36.041958	-93.703225	War Eagle
110	White River at CR 6578	2021 August	35.923194	-93.938147	Lake Sequoya-White River
201	Middle Fork of W.R. at Harris Rd	2014 February	35.99622	-94.073197	Middle Fork
205	Hock Creek	2016 November	36.022364	-93.859988	Richland Creek
210	Town Branch (White River Ball fields)	2014 August	36.042974	-94.135464	West Fork
300	Brush Creek	2013 February	36.131947	-93.947956	Beaver Reservoir
302	Glade Creek	2013 February	36.159851	-93.81169	War Eagle
303	Clear Creek	2012 August	36.195153	-93.789276	War Eagle
304	Clifty Creek	2012 August	36.239525	-93.907125	War Eagle
307	Holman Creek Upstream of Huntsville	2014 November	36.104418	-93.75675	War Eagle
308	Holman Creek Downstream of Huntsville	2014 November	36.124453	-93.734211	War Eagle

All sites are located in the Beaver Lake Watershed, a nutrient surplus and State-identified priority watershed (ANRC, 2018). Site selection for this program was determined by identifying the gaps in monitoring locations from other agencies and organizations. Selection also considered potential subwatersheds or streams that may be important to understanding the influence of these waterways to the main stem and ultimately Beaver Lake. See Table 1 for site locations and information.

Section 4. Water Sample Collection for Chemistry Analysis and Temperature Measurement

4.1 Monitoring Conditions and Time Frame

Volunteer citizen scientists conduct quarterly monitoring (February, May, August, November) during base-flow conditions on their selected stream site and submit water samples to the AWRC WQL. There may be rare cases where samples are collected outside of these

months, for example where weather or other logistical issues require monitoring at a site to be delayed. Sample collection is targeted to base-flow conditions for purposes of data analysis and interpretation, and volunteer safety. Base-flow for this program is assessed by visually evaluating stage and discharge data from U.S. Geological Survey (USGS) monitoring sites which are geographically close to the StreamSmart site of interest. Monitoring sites for this program tend to be located in smaller tributaries or upstream reaches of main stems, so typically teams allow 1-3 days after a rain event to monitor their site and collect the water sample. Samples are collected by filling two bottles – a 125-mL and a 1-L – from their stream site. Water sample collection must be done according to the standard protocol in the following subsections.

4.2 Standard Operating Procedures for Collecting the Water Sample and Measuring Temperature

This section details the instructions for sample collection and temperature measurements that are used to train volunteers and provided to volunteers in their guidance document. During each monitoring period, one field duplicate and one field blank are collected from different sites, selected at random.

Clean sample bottles are provided by the AWRC WQL. To avoid contamination, please do not open the bottles until it is time to collect the sample and keep hands, fingers, mouth, etc. away from the bottle opening when collecting the sample.

Example of how to label your sample bottle.

Step 1. **Measure air temperature.** When you get to your site, hang the thermometer on a tree or bush, out of the direct sunlight and wind. Wait at least 3 minutes and record the air temperature on your field sheet.

Step 2. **Label bottles.** Using a permanent marker, write the site number, site name, and the date of collection on both sample bottles (see example to the right).

Step 3. **Identify collection location.** Visually identify where you will collect your water sample. This location should be where the water is moving fastest, generally near the middle of the stream, and where the water is deep enough not to scrape the streambed with the sample bottle. You should also collect from this same area every time you monitor.

Step 4. **Wade into the water.** With sample bottles in hand, wade into the stream to the identified location. Be careful not to kick up or disturb the streambed; if you do see kicked up sediment, wait until it flows away or settles down before proceeding.

Step 5. **Triple rinse.** Facing upstream (so the water is moving toward you), open the lid of one of the sample bottles and fill with water about ¼ of the way full. Put on lid and shake, then open and dump the water out downstream (behind you). Again, try not to move your feet so you avoid kicking up sediment. Repeat this rinsing

process two more times, for a total of three rinses.

Step 6. **Collect the sample.** After the final rinse, turn the bottle upside down and dip it into the water to about halfway to the bottom of the stream. It is important not to touch or scrape the streambed to avoid contaminating the water sample with streambed sediment. Fill the bottle, turn right-side up, and pull it out of the water. Be sure that there is a small amount of headspace, then cap tightly.

Step 7. **Repeat with 2nd bottle.** Repeat Step 5 and 6 with the other sample bottle.

Step 8. **Place sample on ice.** Carefully exit the stream and immediately put the sample bottles in a cooler with ice or ice packs. It is important to keep samples in a cold (but not freezing) and dark place to keep samples stable during storage and delivery to the lab.

Step 9. **Measure Water Temperature.** Place the thermometer in the water, away from the streambank, by lowering the thermometer so the tip is a few inches below the water surface. This should be done at a location with moving water and out of direct sunlight if possible. Record the water temperature on your field sheet. **Note:** The thermometer is a liquid-in-glass laboratory thermometer with a window plastic case, and does not go through calibration procedures.

Step 10. **Fill out field sheet.** Fill out the field sheet with the **date** and **time** that the sample was collected, as well as the names of volunteers who monitored, and the name of the person who filled the sample bottles. Verify that the site number, waterbody, and site description are correct. Write down any site observations that may be important (see Section 5 for details).

You can view a video produced by AWRC that provides instructions for collecting a stream water sample (https://www.youtube.com/watch?v=5RERGib1IVM&feature=youtu.be). Note that there may be differences between the StreamSmart protocol and what is provided in the video – in these cases, adhere to the StreamSmart protocol.

4.3 Sample Analysis at the Arkansas Water Resources Center Water Quality Lab

All water samples will be promptly delivered to the State-certified AWRC WQL for analysis of the following parameters:

	Parameter	Unit of Measure
1.	Alkalinity	mg/L as $CaCO_3$
2.	pH	Unitless
3.	Conductivity	µS/cm
4.	Total dissolved solids (TDS)	mg/L
5.	Total suspended solids (TSS)	mg/L
6.	Turbidity	NTU
7.	Total nitrogen (TN)	mg/L
8.	Total phosphorus (TP)	mg/L

Certification and quality assurance information for the Lab can be found on their website (https://awrc.uark.edu/water-quality-lab/certification-and-quality-assurance/), or by contacting Center Director (see Section 1 for contact information).

Section 5. In-situ Analysis of Dissolved Oxygen

5.1 Standard Operating Procedure for Dissolved Oxygen Measurement with Membrane Electrode

I. Equipment and Materials

a. Dissolved oxygen (DO) membrane probe (YSI EcoSense DO 200M)
b. Membrane replacements
c. Electrolyte solution, Na_2SO_4, KCl
d. Data sheet for recording results

II. Storage of the Probe

a. The DO probe must be stored in a water-saturated environment by wetting the sponge with 5-6 drops of water (tap, distilled, or deionized) and placing probe into bottle with sponge.
    a. The sponge should not touch the membrane.
b. The moisture level of the stored probe should be checked periodically, at least monthly.

III. Calibration and Quality Control

All DO units are initially set up, calibrated, and tested by the H2Ozarks project coordinator. Citizen scientists will calibrate the equipment and do the quality control (QC) check before each use. The project coordinator will collect units at least one time per year to replace the membrane.

Quality Control:

1. Before units are distributed to citizen scientists, the project coordinator will run the QC check as outlined below. The project coordinator also will test the probes for consistency in measurements by inserting all probes into the same well-mixed water source and measuring DO with each unit. Any unit that has a reading inconsistent with others will be recalibrated and any issues will be addressed.
2. **Before each usage**, the following QC check will be performed.
    a. Turn the DO probe on and let warm up for 10-15 minutes.
    b. After the unit is warmed up, and before calibrating the probe, remove the probe from the storage container.
    c. Gently swirl the container in the air to refresh oxygen in the container.
    d. Place probe back into container.
    e. Let reading stabilize, then record DO % saturation on the field sheet for “Pre-calibration DO” (press Mode to scroll through units for “%”).

    PROCEED TO CALIBRATION SECTION

    f. Once unit is calibrated, let the reading stabilize again, then record DO % saturation on the field sheet for “Post-calibration DO”.
    g. If the post-calibration DO % saturation is less than 90% or greater than 110%, contact the project coordinator and do not use the probe.

Calibration:

a. **Before each usage**, the following calibration procedure will be performed.
b. The DO probe is stored and calibrated in a 100% water saturated environment using a small sponge disk. Care is taken to ensure the membrane does not touch the sponge.
c. Look up the current local barometric pressure using a reliable resource. Pressure must be in mBar, so convert units as described below if needed.
    a. If the pressure was obtained in inches (inHg), multiply by 33.86, such that:
        Pressure in inches x 33.86 = pressure in mBar
        Example: 30.67 inHg x 33.86 = 1,038 mBar
    b. If the pressure was obtained in millimeters (mmHg), multiply by 1.33, such that:
        Pressure in millimeters x 1.33 = pressure in mBar
        Example: 778.3 mmHg x 1.33 = 1,035 mBar
c. Push the CAL button.
d. Using the arrow keys, enter the barometric pressure in **mBar.**
e. Press ENTER.
f. When the value in the main display stabilizes, press ENTER again.
g. The expected salinity is shown and should always be 0.0. Leave this as is and press ENTER.
h. Calibration is complete. Proceed to step "f" of the Quality Control section.

IV. Operational Procedures

1. If calibration was done on-site immediately before use, go to step 5. If you calibrated off-site and the unit is currently off, go to step 2.
2. Press the POWER button to turn unit on.
3. As the unit performs a self-diagnostic test, an "ovEr" message may appear (this is normal), and will disappear after the warm up is complete.
4. Once the unit is warmed up, the temperature reading will display in the lower right of the display, signaling that the unit is ready for operation.
5. Submerge the probe halfway and directly into the waterbody being analyzed, in an area where water is flowing.
    a. DO NOT allow probe to touch any solid object.
    b. DO NOT allow air bubbles around the probe.
    c. Note that the probe is consumptive – meaning that oxygen is consumed by the sensor. If a sample is ever analyzed from a sample bottle rather than in situ, gently swirl the probe to overcome this oxygen consumption.
5. Take the reading in % saturation and mg/L and record on field sheet. (Press Mode to change units.)
6. Also record the temperature.
7. Turn unit off and replace the probe into the storage bottle with moist sponge.

V. References

1. YSI EcoSense DO200M User Manual, document # 606035REF.

Section 6. Sample Handling and Delivery to Lab

As soon as water samples are collected in the field, citizen scientists will place them in a cooler with ice or ice packs. Citizen scientists will deliver samples and field sheets to the Lab as

soon as possible after the time of collection, or at least with enough time to allow analysis before holding time elapses. If he or she is unable to transport to the Lab, the sample will be transferred to the StreamSmart coordinator who will promptly submit the sample to the Lab.

The date and time of sample collection is recorded on the field sheet. In cases where the sample is transferred to the StreamSmart coordinator, the Chain of Custody section at the bottom of the field sheet is signed and dated by the volunteer and the coordinator. When the sample is dropped off at the Lab (whether by the volunteer or by the coordinator) a chain of custody form is filled out with the Lab as well. Therefore, there is a comprehensive chain of custody where date, time, and personnel are listed at any point of sample transition.

Section 7. Training and Record-Keeping

The StreamSmart coordinator keeps detailed records of training activities in an Excel document. Information includes the date of the training activity, names of volunteers who were trained, site information associated with the volunteer being trained, the name of the person(s) who conducted the training, and the topics covered during the training.

Training will generally be conducted by the StreamSmart coordinator, Erin Scott. Erin has a master's degree in environmental science with an emphasis on water quality from the University of Arkansas. After completion of her degree, she began working at the Arkansas Water Resources Center, where she spent over 6 years conducting water quality monitoring work. This work included development of quality assurance project plans, water sample collection from regional streams and lakes, and data analysis. In some cases, other qualified water professionals may assist in training, which will be overseen by the StreamSmart coordinator.

The citizen scientists populate field sheets prepared by the coordinator to keep record of on-site activities and observations. This includes the names of the citizen scientists present, the name of the person who collects the sample, the date and time of sample collection, and site observations.

Section 8. Data Management

Water-quality data are approved by the Lab according to their QAP, and then data and QAQC reports are sent to the StreamSmart coordinator. The coordinator reviews data for reliability and stores results in Excel and on the H2Ozarks website. Data will also be submitted to the Division of Environmental Quality - Office of Water Quality in the Arkansas Department of Energy and Environment during their call for water quality data.

Section 9. References

ADEQ (Arkansas Division of Environmental Quality). 2018. 2018 Impaired Waterbodies – 303(d) List, https://www.adeq.state.ar.us/water/planning/integrated/303d/list.aspx.

ANRC (Arkansas Natural Resources Commission). 2018. 2018-2023 Nonpoint Source Pollution Management Plan. 100 pp.

BWD (Beaver Water District). 2018. Source Water Protection Plan 2018 Update. 452 pp.