January 31, 2024 Email: MLedbetter@cityhs.net

Monty Ledbetter
Utilities Director
City of Hot Springs
P.O. Box 700
Hot Springs, AR 71902

RE: NPDES Permit Number: AR0033880, AFIN: 26-00145
Sanitary Sewer Overflows Manholes #1750 and #1748
Bacteria Sampling and a Communications Plan
Lake Catherine Filamentous Algae Study

Dear Mr. Ledbetter,

The Division of Environmental Quality's Office of Water Quality (DEQ) recently received complaints regarding sanitary sewer overflows (SSOs) at manholes #1750 and #1748. Complaint photographs indicate filter fabric used in the temporary rock berm has become dislodged, dried scum and sludge was covering the ground and rocks surrounding the manholes, and solid waste from these SSOs are entering a water of the state. As such, the City of Hot Springs (Hot Springs) shall take the following immediate actions in accordance with the approved Revised Bacteria Sampling and Communication Plan dated October 26, 2022:

1. **Standard Operating Procedure – Recover/Cleanup – #2 -** Hot Springs shall document methods used to remediate the SSO-affected area. The documentation shall include photographs demonstrating wastewater in the temporary rock berm has been recovered and disposed of properly. Hot Springs shall evaluate and implement additional BMPs to ensure solid waste is not leaving the site during high SSO flows. Hot Springs shall ensure the grounds surrounding the SSO-impacted area are cleaned and free from scum, sludge, and solid waste following each reported SSOs. Copies of the documentation including photographs for each reported SSO shall be included in the monthly reports to DEQ.

2. **Standard Operating Procedure – Recover/Cleanup – #4 -** Hot Springs shall document methods used to evaluate the affected overflow area for appropriate disinfection. The SOP states, "This may include applying lime to absorb liquid and raise the pH to reduce pathogens, applying a nonhazardous bio enzymatic bacteria consuming product to reduce impact of pathogens on receiving waters." Copies of the documentation shall be included in the monthly reports to DEQ.

3. **Standard Operating Procedure – Recover/Cleanup – #5 –** In addition to inspecting and cleaning up the solid waste i.e. solids, toilet paper, and hygiene products at the immediate SSO-

affected area following each reported SSO, Hot Springs shall inspect and clean up any solid waste as a result of the SSOs at the Gulpha Creek banks from manhole #1750 to the confluence at Spencer Bay. Hot Springs shall document these additional inspections with photographs and include them in the monthly reports to DEQ.

4. **Standard Operating Procedure – Public Notification –** Hot Springs shall document the deployed signage (locations #1–#5) for each SSO with photographs and include them in the monthly reports to DEQ.

Additionally, DEQ has received numerous complaints regarding the water quality and filamentous algal growth in Lake Catherine, specifically Spencer Bay. DEQ requests Hot Springs perform a study to delineate the impact the SSOs from manholes #1750 and #1748 have had on water quality in Lake Catherine, which is highly utilized for recreation. As such, Hot Springs shall submit to DEQ, for review and approval, a Workplan that documents and evaluates the filamentous algae in Lake Catherine. The Workplan shall include, at minimum, the sampling methods detailed in DEQ's attached Lake Catherine Filamentous Algae Study, Design Proposal January 2024. DEQ requests the Workplan be submitted by close of business **March 1, 2024**.

Should you have any questions concerning this matter, or if the above listed requests should require further discussion, please do not hesitate to contact Richard Healey at richard.healey@adeq.state.ar.us.

Sincerely,

Digitally signed by Stacie R. Wassell
DN: cn=Stacie R. Wassell, o=ADEQ, ou=Law and Policy, email=wassell@adeq.state.ar.us, c=US
Date: 2024.01.31 10:55:35 -06'00'

Stacie R. Wassell
Associate Director, Office of Water Quality
Division of Environmental Quality

Enclosure: Lake Catherine Filamentous Algae Study, Design Proposal January 2024

cc: Todd Piller TPiller@cityhs.net
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Joe Martin, Planning Branch Manager, DEQ Office of Water Quality

ENVIRONMENTAL QUALITY

Lake Catherine Filamentous Algae Study

Design Proposal

January 2024

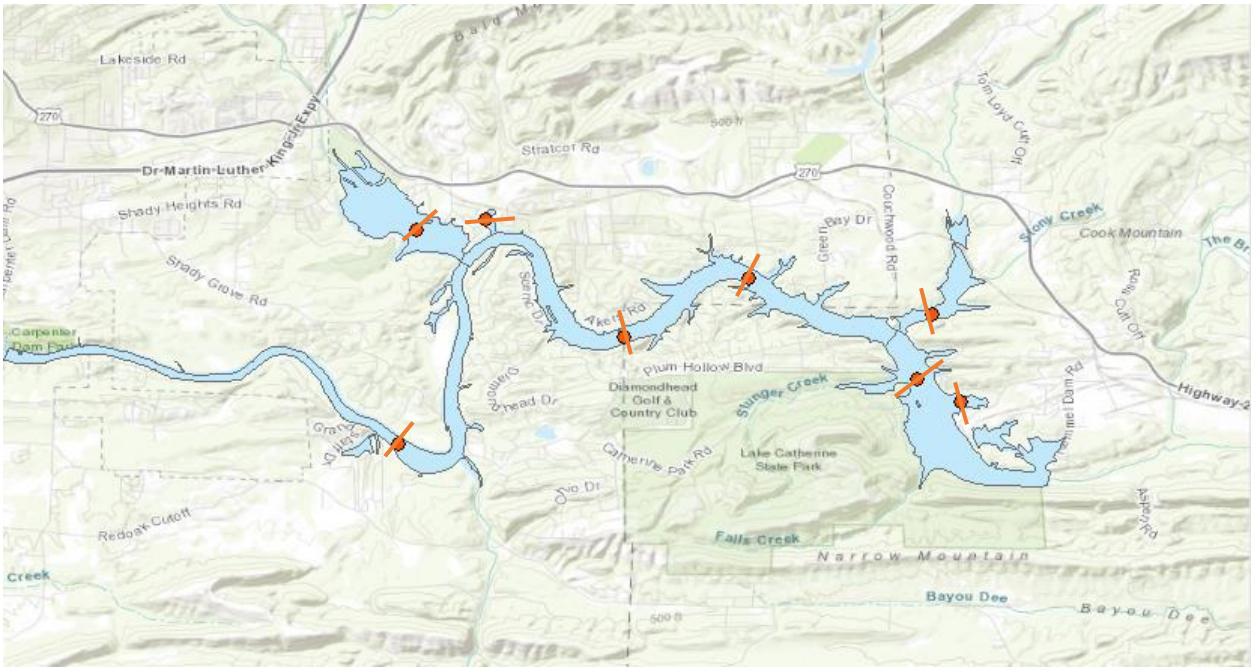
Purpose Statement

Since 2019, the Division of Environmental Quality (DEQ) has received numerous complaints regarding the water quality and filamentous algal growth in Lake Catherine. Both the City of Hot Springs and local citizens have reported sanitary sewer overflows (SSOs), particularly in Spencer Bay. Although the City of Hot Springs is under a Consent Administrative Order, and efforts are underway to correct the failing infrastructure, DEQ feels that a study is needed to understand the effect of the SSOs on water quality in Lake Catherine, which is highly utilized for recreation.

Monitoring Locations

Eight sampling locations have been selected based on reported complaints and historic monitoring sites.

Site Name	Location Description	Latitude	Longitude	Rationale	Established DEQ Monitoring Location
LOUA016N	Lake Catherine 0.5 miles upstream from Camp Couchdale	34.431194	-92.976433	DEQ monitoring site upstream of complaints	Y
LOUA016S	Lake Catherine in Spencer Bay	34.458206	-92.974091	DEQ monitoring site in vicinity of majority complaints	Y
LOUA016W	Lake Catherine in Wilson Creek Cove	34.459652	-92.965332	DEQ monitoring site in vicinity of complaints	Y
LOUA016L	Lake Catherine 0.5 miles downstream of Marina Point	34.444778	-92.947914	DEQ monitoring site in vicinity of complaints	Y
LOUA016K	Lake Catherine off of Springbrook Point	34.452213	-92.932182	DEQ monitoring site in vicinity of complaints	Y
LOUA016T	Lake Catherine in Tigre Bay	34.447697	-92.908844	DEQ monitoring site in bay similar to Spencer Bay where majority of complaints have been received	Y
LOUA016J	Lake Catherine near entrance to State Park Cove	34.439369	-92.910828	DEQ monitoring site in vicinity of complaints	Y
LOUA016D	Lake Catherine Cove near Northbend Dr.	34.436642	-92.905277	Complaint Location	N



Sampling Method

Water chemistry parameters should be collected monthly at each site for pH, dissolved oxygen, conductivity, temperature, chlorophyll a, total nitrogen, total phosphorous, depth, and Secchi depth. Filamentous algae estimates will be collected monthly in congruence with water samples. During stratification (generally April – October), collect in situ profiles at each site and water samples in the epilimnion and hypolimnion. During mixing, collect one discrete epilimnion water sample and in situ reading. Profiles may need to be taken in March to determine if the lake has stratified. Water collection procedures are modified from the DEQ Lake Sampling Standard Operating Procedures and Work Plan.

Secchi Depth Collection

Measure Secchi depth directly in the water. The Secchi disk should be clean, weighted, and suspended on a metric-calibrated chain, wire, or a non-stretch rope. Collect Secchi depth before any water collection as it will determine depth of sample. Follow these procedures for measuring Secchi disk transparency under normal conditions:

a) Remove sunglasses and hat.
b) On the shaded side of the boat, slowly lower the Secchi disk vertically into the waterbody until it disappears. The viewer should maintain an eye level of less than 2 meters above the water's surface. Note the depth at which the Secchi disk disappears.
c) Slowly raise the Secchi disk until it becomes visible again. Take a mental note of the depth at which the disk becomes visible again.
d) Compute the average (mean) of the two depths noted and record the value. The recorded average value is the Secchi disk transparency.
e) If the disk is still visible on the lake bottom, place a "B" on the field sheet.

Depth Collection

Measure lake depth at the site using a sounding line, depth finder, or other applicable method.

Water Sample Collection

Water samples at each site are paired with *in situ* water quality data. Epilimion samples shall be taken between 0.5 and 2 meters below the surface. Hypolimnion samples shall be taken 1 meter above the bottom. Before sampling, triple-rinse the collection vessels and put on gloves to avoid contamination. Avoid submerging bare skin in the water at sampling locations. Collect water samples as far from the motor as is possible. All water samples must be analyzed in a State accredited laboratory.

Grab Sample Collection Using a Van Dorn or Kemmerer Sampler

A Van Dorn sampler is a horizontal cylinder used to collect water samples at specified depths, and a Kemmerer sampler is a vertical cylinder. Use of a Van Dorn or Kemmerer sampler is an accepted method for collecting water samples. Follow these procedures to collect a water sample using a Van Dorn or Kemmerer sampler:

a) Record "Van D." or "Kem." in the "Collection Method" column of the field sheet.
b) Triple rinse the inside and outside of the Van Dorn or Kemmerer sampler. Expel the rinsate water away from the work area, ensuring that none of the rinsate water is included in the sample.
c) Close all discharge valves.
d) Lock end seals in the open position.
e) Using a marked rope, lower to the appropriate depth. Be sure to hold on to the messenger apparatus while lowering the instrument.
f) Once the desired depth is reached, release the messenger apparatus to close both ends of the instrument and collect a water sample.
g) Return instrument to boat.
h) Deposit the sample into the plastic bucket.
i) Repeat until the needed amount of water is collected.
j) Aliquot sample water to the sample containers as described.

Sample Aliquoting

Prior to aliquoting, label all sample containers with the Site Code. Labels must be written directly on the side of the container with permanent, waterproof ink. Do not label lids.

One duplicate sample is taken for every 10 samples collected and once per calendar day. The sampler can choose which site will be the duplicate. Refer to the section entitled "Duplicate Sample Collection below for more information regarding duplicative samples.

Aliquot water sample into containers as outlined below.

If you do not have enough volume in the sample container to aliquot all samples, repeat the water collection procedure to acquire more sample water. Keep in mind that duplicates should be aliquoted from the same container of sample water. To ensure data quality, follow all procedures described in these procedures regarding sample container preparation.

Nutrients

A 946 mL (quart) plastic container.*†

1. Gently swirl sample in collection vessel to homogenize.
2. Fill labeled 946 mL (quart) plastic container with sample water.
3. Tightly secure the lid back on the sample container so that it does not leak.
4. Refer to the Duplicate Sample Collection Section below for instructions on taking a duplicate sample.
5. Immediately place sample container(s) on ice and store at ≤ 6.0 °C until relinquished to the lab.

   *If holding times cannot be met, bring an additional labeled 946 mL plastic container with H_2SO_4 preservative for each sample (and duplicate) and follow procedures above. Take care to not spill contents.

   † Sample containers may vary depending on lab used for analysis

Sestonic Chlorophyll *a* Sampling

A 1,000 mL brown plastic bottle.

The following methodology described is for sestonic chlorophyll *a* only.

1. Swirl sample in collection vessel to homogenize. Do not aerate the sample.
2. Fill labeled container with sample water, leaving a little head space.
3. Close the sample container, ensuring that the lid is properly threaded and tightened so that the sample does not leak or get contaminated.
4. Immediately place sample container(s) on ice and store at ≤ 6.0 °C.

Duplicate Sample Collection

Duplicate collection procedures may differ depending on laboratory requirements. At DEQ, duplicate samples are taken for all parameters at a rate of 10% (1 duplicate per 10 samples and 1 duplicate per day). Take all duplicates at a single selected site. Duplicate sites are selected at the discretion of the sampler and are usually selected based on ease of collection and distance of sample processing location from the road.

To collect a duplicate sample, fill one additional container with sample water. Label all applicable containers with their sample ID and "dup". If holding times cannot be met, collect a duplicate 946 mL plastic container with H_2SO_4 preservative. Record the duplicate sample on the datasheet by indicating the WQMS-dup (i.e. LOUA016N – dup). Ensure that the time of duplicate sample collection is recorded.

If the study requires sestonic chlorophyll *a* collection, collect a sestonic chlorophyll *a* duplicate at the same location as the other duplicates.

In Situ Meter Calibration

Record calibration data on a calibration datasheet or lab notebook. Each meter should have its own calibration logbook. Scan and save all calibration datasheets during calibration checks.

Before each calibration, clean probes using the central wiper (if available) and a lint-free cloth such as lab-tissue. Use care while cleaning sensors.

Prior to meter use, calibrate according to methods outlined in the user manual/manufacturer's guidelines. Perform proper maintenance if any sensor is not reading or calibrating correctly. Calibrate probes in the following order (as applicable). Rinse probes with Type I DI water between standards. Record both the pre-calibration and post-calibration values:

- Temperature
    - Check temperature quarterly during use.
    - Place a NIST thermometer and the meter in the same bucket of water (can be Type 1 DI, tap, or sample water).
    - For meters used at only certain times of year (unattended deployments), check temperature quarterly during use and before deployment.
    - Record in the calibration book.
- Conductivity
    - If collecting *in situ* conductivity, calibrate conductivity before each sampling event.
    - Calibrate using specific conductance with one calibration standard greater than 1000 µs/cm. Ensure that there are no air bubbles in the sensor and that the meter is reading in the correct units.
    - Record pre and post-calibration values in the calibration book.
    - Check calibration standard against a second source, monthly.
    - Record monthly checks in the calibration book.
- pH
    - Calibrate pH before each sampling event.
    - Conduct a 3-point calibration using pH 7 and pH 4 and pH 10.
    - Record pre and post-calibration values in the calibration book.
    - During calibration for each standard, write down the millivolts (mV) (mVs will not have a pre- and post-calibration value).
        - mVs can provide information about the effectiveness of the pH sensor.
            - While calibrating at ~25^{o}C, the mV range between standards should fall between 165 and 180. If the range falls outside of these values, the pH sensor needs replacement.
            - mVs for pH 7 should be 0 ± 50
            - mVs for pH 4 should be 177 ± 50
            - mVs for pH 10 should be -177 ± 50.
                - E.g. mV for pH 4 = 173
                    - mV for pH 7 = -30
                    - 173 – (-30) = 203
                    - mV range = 203 pH sensor needs replacement
                - E.g. mV for pH 4 = 147

        - mV for pH 7 = -20
        - 147 – (-20) = 167
        - mV range = 167 pH sensor is OK

- Dissolved Oxygen (DO)
    - Calibrate DO before each sampling event.
    - Ensure there are no water droplets on the DO or temperature probe.
    - Record the barometric pressure using an internal barometer, a local barometer or an online resource. If not done automatically in the instrument's programming, adjust the reading for elevation. Refer to a solubility table to check appropriate calibration values.
    - Calibrate DO using percent saturation. Put a small amount (~1/8 inch) of water into the calibration cup. Loosely thread the calibration cup (do not seal) to the meter. Wait for the % DO and temperature to equilibrate.
    - Record pre- and post-calibration values in the calibration book.
- Depth
    - Calibrate depth before each sampling event.
    - Record pre- and post-calibration values in the calibration book

To ensure accuracy of measurements, calibrate specific conductance, DO, and pH within 12 hours of each deployment. If temperature is not accurate, send the instrument in for servicing.

Post Sampling Quality Assurance Check

When sampling is complete for the day, perform a post-field QA check in the lab or other controlled environment by checking readings against calibrations standards. Place standards in the calibration cup in the same order as calibration (pH, specific conductance, DO) and record readings in the calibration book. See Table 3 for maximum allowable deviations from calibration standards for post-field checks. If a value falls outside of the maximum allowable limit ranges (Table 3), flag the data recorded from whichever probe malfunctioned as unusable.

Table 3. Acceptable value ranges for post-field QA check (TCEQ, 2012)

Measured Field Parameter	**Maximum allowable limits for water-quality sensor values**
Temperature	±0.2 °C (pursue factory maintenance) **±0.5 °C (flag data)**
Specific conductance	±5%
Dissolved Oxygen	±6% saturation, ±0.5 mg/L
pH	±0.5 pH units

In situ Data Collection

Discrete sample

At a minimum, during each sampling event, paired *in situ* data should be collected in real time using a calibrated multisensor meter or equivalent instrument(s). Collect and record discrete *in situ* data when the lake is mixed (typically November – March) at approximately the same depth as the water sample collection (not to exceed 2 m for epilimnetic samples). Collect dissolved oxygen (DO), temperature, conductivity, and pH readings in a manner that won't disturb or be disturbed by water sample collection.

Take a duplicate *in situ* reading where duplicate water chemistry samples are collected by lifting the meter out of the water for several moments and lowering back into the water at the depth of the previous reading. Record results and ensure that DO readings are within 0.5 mg/L of one another. If not, flag the data.

Vertical Profile

Collect a vertical profile at the sample site when the lake is stratified (typically April – October). Profiles may need to be taken March and November to determine if the lake has stratified or mixed.

Meters that can internally store profile information should be programmed to collect the profile under a unique file name with the following naming convention:

Site_mmddyyyy.ext (Example: LOUA016N_01062023.ext)

Ensure that the meter is logging information. Slowly lower the meter into the lake at a consistent rate. Recall the depth of the lake and do not lower more than 1 m above the lake bed. Stop logging information on the meter and pull the meter back into the boat. Bring the meter back to the surface where the discrete measurement was taken and note the DO. If DO is within 0.5 mg/L of initial reading, indicate that the profile has passed QC on the datasheet. Verify that the file was accurately recorded. Refer to the instrument's user manual for logging and verification procedures.

Meters that do not have the ability to internally store profile data should follow EPA's National Lakes Assessment method:

- Determine Measurement Intervals:
  a) The number of readings and the depth intervals taken depends on the site depth. Below is a list of rules for determining the intervals:
     i. The profile will always begin with a measurement just below the surface (e.g., approximately 10 cm or the minimum depth required to keep all probes submerged).
     ii. The last (deepest) measurements will always be at 0.5 m above the bottom.
     iii. If the site is < 2.0 m deep, record measurements beginning just below the surface and at 0.5 m intervals, until 0.5 m above the bottom.
     iv. If the depth is between 2.0-20 m (inclusive), record measurements beginning just below the surface and then at 1.0 m intervals until reaching 0.5 m above the bottom.

v. If the depth exceeds 20 m, record measurements beginning just below the surface, then at 1.0 m intervals until you reach 20 m, then at 2.0 m intervals until 0.5 m above the bottom.
vi. If the metalimnion is encountered (observed as a change of ≥1 °C per meter of depth), take measurements at least every meter within the metalimnion.
vii. Record the intervals on the Profile Data Sheet.

- Measure Temperature, DO, specific conductance, and pH:
  a) Lower the meter in the water and measure the vertical profile of temperature, DO, specific conductance and pH at the predetermined depth intervals. Be careful not to let the probe touch the bottom.
  b) Record the measurements on the Profile Data Sheet.
  c) Use the provided comment box to provide extra information about any measurements that the crew feels needs further comment or when a measurement cannot be made.

Filamentous Algae

Filamentous algae sampling procedures for Lake Catherine have been modified from the subsampling method for longitudinal surveys detailed in Griggs, et al., 2015. These procedures will accompany each monthly water sample.

Upon arrival to each site, samplers will navigate to each bank and follow a transect perpendicular to the bank (represented by red lines on each sampling point in the image above). Samplers will measure the distance from shore to a depth of 3 meters (average photic zone). The distance will be split into 10 m plots for visual estimation of filamentous algae. Plot 1 will always be closest to shore and plot 5 will be closest to mid-lake. All samplers must be able to recognize the difference between filamentous algae, macrophytes, and cyanobacteria.

Estimates will be made in a 1 m wide strip under the transect line (i.e. 10 x 1 m^2 plot). During normal pool, maximum distances from each bank should be 50 meters resulting in a maximum of 5 samples per bank or 10 samples per transect. Any transects that do not meet the maximum number of plots should be marked on the data as "NA" in the appropriate "% Cover" field. Filamentous algae estimates will be conducted visually to the maximum extent possible and shall be recorded as a percent coverage of the plot. Samplers will navigate along the plot and determine a visual estimate at the end. While navigating along the plot, at least 3 depth samples will be collected in meters to determine the average plot depth. At least two samplers will visually estimate independently and the result will be the average of the two estimates. Samplers will indicate if the observed algae was benthic, floating, or both. In plots where visual estimates are not possible due to water clarity, the sampler will note that on the "% Cover" field of the datasheet with "VDI" (for visual determination inhibited) along with a Secchi depth mid-plot, which will be recorded in the adjacent "Position" field.

During times of draw-down, samplers will measure the distance between the wetted width and the normal pool height to determine the length of exposed bank. Samplers will estimate the percent coverage of filamentous algae on the shoreline the exposed bank will count as an additional plot (drawdown plot = exposed bank length x 1m^2).

Incidental sampling

Because sites were selected primarily from the location of complaints, it's expected that there are more filamentous algae blooming areas than we are aware of. To address these unknowns, samplers will look for filamentous algae during navigation between sites and collect estimates at these locations. Samplers need not mark an incidental site unless the blooming area is approximately 5 m^2, or about the size of a sedan. At incidental sites, samplers will indicate the relative size of the blooming area, collect in situ data, and a Secchi depth. Samplers will indicate if the algae is benthic, floating, or both.

References

Griggs, A.N., Selckmann, G.M., Cummins, J. and Buchanan, C., 2015. Methods for estimating filamentous algae cover in streams and rivers of the Shenandoah River Basin. *Final Report. US EPA Region*, *3*, p.33.

WVDEP (West Virginia Department of Environmental Protection). 2018. Watershed Assessment Branch 2018 Field Sampling Standard Operating Procedures. Division of Water and Waste Management, Watershed Assessment Branch, Charleston, WV.

ADEE-DEQ (Arkansas Department of Energy and Environment – Division of Environmental Quality). 2023. Lake Sampling Standard Operating Procedures (SOPs) and Work Plan.Office of Water Quality, Planning Branch, North Little Rock, AR.

Lake Catherine Filamentous Algae Study

Date: | Sampler Names:

Water Chemistry

Site	Time (24 hr)	Depth at site (m)	Epilimnion sample collected (Y/N)	Hypolimnion sample collected (Y/N)	Epilimnion pH	Epilimnion DO (mg/L)	Epilimnion Temp (C)	Epilimnion Conductivity (us/cm^2)	Profile collected (Y/N)	Secchi Depth (m)
LOUA016N										
LOUA016S										
LOUA016W										
LOUA016L										
LOUA016K										
LOUA016T										
LOUA016J										
LOUA016D										
Dup										

Incidental Sampling

Latitude	Longitude	Time (24 hr)	Depth at Site (m)	Position (Benthic, Floating, Both)	Relative Size (1 or 2)	Epilimnion pH	Epilimnion DO (mg/L)	Epilimnion Temp (C)	Epilimnion Conductivity (us/cm^2)	Secchi Depth (m)

Relative size categories: 1) Between a sedan and football field 2) Larger than a football field

Notes:

Lake Catherine Filamentous Algae Study

Filamentous Algae

Right Bank

Position: Benthic, Floating, Both

Site	Drawdown Plot		Plot 1			Plot 2			Plot 3			Plot 4			Plot 5		
	Area (m^2)	% Cover	% Cover	Avg. Depth	Position	% Cover	Avg. Depth	Position	% Cover	Avg. Depth	Position	% Cover	Avg. Depth	Position	% Cover	Avg. Depth	Position
LOUA016N																	
LOUA016S																	
LOUA016W																	
LOUA016L																	
LOUA016K																	
LOUA016T																	
LOUA016J																	
LOUA016D																	

Left Bank

Position: Benthic, Floating, Both

Site	Drawdown Plot		Plot 1			Plot 2			Plot 3			Plot 4			Plot 5		
	Area (m^2)	% Cover	% Cover	Avg. Depth	Position	% Cover	Avg. Depth	Position	% Cover	Avg. Depth	Position	% Cover	Avg. Depth	Position	% Cover	Avg. Depth	Position
LOUA016S																	
LOUA016W																	
LOUA016L																	
LOUA016K																	
LOUA016T																	
LOUA016J																	
LOUA016D																	

If plot is too turbid for visual estimates, mark "VDI" in % Coverand record the mid-plot Secchi depth in the adjacent "Position" field

Report all depths in meters

LAKE PROFILE FORM

Reviewed by (initial):

Site ID: Date: / /

DISSOLVED OXYGEN, TEMPERATURE, PROFILE

Intervals (m): Surface to 20 m = every 1 m; 20-50 m = every 2 m; last reading 0.5 m above bottom. If the site depth is <3 m, take readings at the surface, every 0.5 m, and 0.5 m above bottom.

METALIMNION = The region of the profile where the temperature changes at the rate of 1 °C or greater per meter of depth. Indicate the depth of the top of the metalimnion with a 'T', and the bottom of the metalimnion (when the rate change becomes less than 1 °C per meter) with a 'B'. After the metalimnion is encountered, take readings every 1 m until bottom of the metalimnion is reached.

Depth (m)	DO (mg/L)	Temp. (°C))	pH	Cond. (uS/cm)	Comments
Surface					
Dup Surface					

Is the Dup. DO reading within ±0.5 mg/L of the initial surface reading? ☐ YES ☐ NO

Flag	Comments