



Inland Lakes Sampling Procedure Manual

(Appendix I of the Surface Water Field Sampling Manual for bacteria, chemistry and flows)



Division of Surface Water
Inland Lakes Section

May 2016

Revision History

This table shows changes to this document over time. The most recent version is presented in the top row of the table. Previous versions are maintained by the OEPA Division of Surface Water Inland Lakes Coordinator.

History	Effective Date
Added qPCR test to bottom sample and Phytoplankton and Cyanotoxin section	April, 2016
Changed the phytoplankton and cyanotoxin collection procedures as well as cyanotoxin sampling containers and separate submission form Changed holding times for cyanotoxins Changed lake modeling procedures Test for cylindrospermopsin, microcystin and saxitoxin Changed manual to reflect the order of sampling Added Atrazine to Table 1 Added Attachment 8 for specific requirements for PWS lakes Added a BSA Sample Submission Form in Attachment 4 Added updated Sample Submission Forms Added low-level phosphorus methodology Updated Attachment 6	April, 2015
General: Changed the references to the Surveillance Manual to Appendix I of the Surface Water Field Sampling Manual <i>for bacteria, chemistry and flows</i> . Changed the number of collections of phytoplankton and zooplankton to three times each year (Collect a sample on the first and fifth sampling events each year and on the third (July) sampling event.) Changed the Phytoplankton/Cyanotoxin Sampling Protocols Table Page number changes	June 17, 2013

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Lake Sampling Procedures

Sample Timing and Location

Lake sampling should occur 5 times between May and September. The sampling should be equally spaced as possible.

At each sample location samples should be collected and recorded on the Lake Sampling Data Sheet (Attachment 4.) The first sampling location (L-1) is generally the deepest location or may be the midpoint of the lake. Additional sampling locations (i.e L2, L3 etc.) may be necessary.

Additional sample locations may be needed if: 1) Reservoir is greater than 20 km long 2) Interest in Trophic State Status of various locations in lake 3) Major inflows occurs within lake at different locations, or where the lake is divided into significant sub-lake units by causeways with narrow connectors, or 4) A Public Water System intake is located more than 500 yards from L1 and there are tributaries entering the lake between L1 and the intake location. The first three additional locations should be coordinated with the modeling staff as the study plans are developed to ensure adequate coverage in the event a lake model is required. To determine if separate intake sampling is necessary (only for herbicides and nitrates) coordinate with DDAGW.

Sample Labeling

Lake Station Name, EA3 Station Number, Date, Preservatives
(Specific labeling instructions for different sample types are also provided below)

Use existing EA3 station ID if there is one, otherwise create one. If a valid EA3 station ID has not been established, one should be generated using the EA3 station creation application. Please note that historical water body ID-based stations should not be used. If collecting samples to be used in the lake model, refer to Attachment 2 for methodology. Instructions for printing lab sheets and containers labels using Cyber Intern software are found in Attachment 5. For routine sampling events three separate inorganic lab sheets are generally needed for each sampling location. Unique sample ID numbers are needed for surface chemistry, surface cyanotoxins and bottom chemistry. If needed, atrazine samples are submitted on an organic lab sheet.

Water Column Profiles

Field parameters are measured with multi-parameter sondes or other meters. The field meter must be calibrated in accordance with the manufacturer instructions and properly calibrated no longer than 24 hours prior to sampling of the lake. At regular intervals record: (1) dissolved oxygen concentration (mg/l) and percent saturation, (2) pH (S.U.), (3) specific conductivity ($\mu\text{mhos/cm}$) (Some meters may not have a conversion feature to give this reading. Conductivity should be recorded and that it should be listed whether it is a corrected or uncorrected reading) and (4) temperature in degrees Celsius ($^{\circ}\text{C}$). The first reading should be taken at the surface (0.5 m depth), the second at 1.0 m, and then at 1.0 m intervals (0.5 m in lakes with a depth of less than 7.0 m). Final readings should correspond with the depth of the bottom samples approximately 0.5m from the bottom. Readings can be collected using a field meter connected to an appropriate length cord. The probe should be adequately weighted such that it falls vertically through the water column. Care should be taken to not submerge the probe into the sediment. A submersible pump may also be used to pump water from specific depths to collect field readings. If using this method, be sure that all probe readings are stable before the actual data is recorded and that the hose is properly weighted to insure that the end is at the appropriate depth.

Secchi Depth

To measure Secchi depth, remove sunglasses if applicable. Lower the disk (20 cm diameter black-white disk) into water at a location outside the influence of direct sunlight, such as within the shadow of the boat. Lower the disk until it disappears completely and, at that point, attach an alligator clip or similar marking device to the line at the water's surface. Lower the line an additional foot (30 cm), and then raise the disk until it reappears. Attach a second marker to the line at the water's surface. The actual Secchi depth is located at the midpoint between the point of disappearance and the point of reappearance. To find this point, grasp both markers in one hand and find the center of the loop of rope. Move one marker to that point and remove the other marker. Without stretching the line, use an etched meter stick to record the distance from the disk to this point. This will ensure consistency in the measuring methodology. Report the value to the nearest 0.1 centimeter.

Secchi depth should be measured between 0900 hr and 1600 hr for US North American latitudes during the spring, summer and fall months. The disk needs to deploy vertically in the water to obtain an accurate measurement. If necessary, the boat should be anchored to avoid drift. If it's not possible or practical to anchor the boat, working from

the downwind side and adding weight to the disk can be helpful. When the water is choppy average three readings.

Subjectivity inherent in the measurement can be minimized by having the same individual take the readings at a lake through the entire sampling season. Standard procedures such as always sitting or kneeling and leaning over the side of the boat can also help obtain consistent results.

Water Samples

(Refer to Flow Charts in Attachment 1 to see what should be sampled.)

Routine monthly water samples are taken from 0.5 m below the surface and 0.5 m above the bottom and tested for parameters listed in Table 1 of this manual. This applies whether the lake is stratified or un-stratified. Samples collected for chlorophyll a and herbicide analysis (PWS lakes) are only taken from 0.5 m below the surface. *E. coli* is sampled at a depth of 1 foot below the surface.

Deploy a discrete sampler (Van Dorn style) to the desired depth and collect a grab sample. Fill containers if a single grab contains enough volume. Otherwise place multiple grabs in a churn splitting device. At each sampling interval, fill 3 quart size Cubitainers™ (Low Density Polyethylene) with sample and add preservatives when appropriate. Fill a 125ml PETG bottle from the bottom sample for qPCR analysis. The sample submitted for orthophosphate is placed in a 1 quart size Cubitainer™ during the filtration process.

[NOTE: If collecting samples for the lake model, refer to Attachment 2 for supplemental information]

Samples are to be cooled and preserved following the most recent Ohio EPASurface Water Field Sampling Manual Use the “Inland Lake Water” template for submission of inorganic samples to the Division of Environmental Services. Parameters associated with the “Inland Lake Water” template are listed in Attachment 4. Be sure to call ahead to let the laboratory know if you will be sampling for orthophosphates, chlorophyll a, and any other parameter not on the inland lakes template.

Low Level Phosphorus (total and ortho)

Generally, low level methods can be restricted to surface samples. Best professional judgement and lake specific data objectives should be used to

determine if low level methods are needed for bottom samples. Write low-level P on the sample submission form and let DES know these will be submitted when scheduling sample submission

1. Submit samples in a 125ml glass jar with Teflon™ lined polypropylene cap.
2. The jars need to be pre-rinsed 3 times with Nanopure™. This can be done in the office or field.
3. The total-P sample is non-filtered and preserved with 0.25ml H₂SO₄ per 125ml of sample. The preservative needs to be added within 15 minutes of collecting the sample. The jar can be pre-dosed with preservative after it has been rinsed.
4. The ortho-P sample is filtered and non-preserved. Use a 60ml polypropylene syringe with Luer-Lock™ tip and Whatman™ 0.45µ GM/F to filter the sample. Draw 60 ml of Nanopure™ into the syringe and discard the rinsate a total of two times. On the third rinse attach the filter to the tip first and then discard the rinsate. Remove the filter, draw 60ml of sample into the syringe and re-attach the filter. Discarding the first few milliliters of sample is recommended before dispensing into the container.

Atrazine

Atrazine is only collected at PWS lakes. This sample is collected 0.5 meter below the surface (sampling at other depths may be determined on a case by case basis) during each sampling run, unless a change is identified in the lake-specific sampling plan. Use the ELISA method (40 ml vial) for all year 1 sampling. For year 2 sampling, use ELISA method if the maximum atrazine concentration in year 1 was <1.5 ug/l. If it was >1.5 ug/l, collect confirmation samples using the herbicide 525.2 method The 525.2 method requires a total of two 1- liter amber jars, both of which are preserved with **sodium sulfite (Na₂SO₃)** and 6N HCL (add sodium sulfite first, add sample and mix, then add 6N HCL). Request preservatives from Ohio EPA laboratory, HCL in vial should be clear.

Note: This may change if the ELISA method is considered level 3.

Other Organics

Other water column organics (semi volatiles, PCBs etc.) not part of the baseline lakes sampling should only be collected if determined to be necessary to address data quality objectives beyond routine assessment for the Lake Habitat use. For example, collection of samples for analysis of priority pollutant organic compounds may be necessary in lakes where source water data from a public water supply indicates the potential for a

problem, where there are known impairments for fish tissue consumption, or where contaminated sediments exist. In these cases, the study plan should address reasoning for collection of the samples, the parameters for analysis, the depth(s) of sample collection, the number of samples necessary to meet the data quality objectives, and quality assurance/quality control practices for sample collection.

When sampling for semi-volatile organics and pesticides, you should sample at 0.5 meter below the surface during the spring and fall runs only unless otherwise called for in the lake-specific sampling plan. There is no laboratory template parameter list for organics. Carbamate analysis requires 4 mg of **sodium thio-sulfate ($\text{Na}_2\text{S}_2\text{O}_3$)** in two (2) 40 ml vials; Fill vials approximately $\frac{1}{2}$ to $\frac{3}{4}$ full, add acid buffer (pre-measured 1.2 ml monochloroacetic acid buffer [Chlor AC]), and top with sample (meniscus not necessary). Shake vial vigorously to mix preservatives. For Glyphosate analysis, place 4 mg of $\text{Na}_2\text{S}_2\text{O}_3$ into (2) 40 ml vials, and fill vial with sample. Shake vial vigorously to mix preservative.

If collected, two (2) non-preserved 1 liter amber jars should be filled with sample water for PCB/Chlordane/Toxaphene analysis and 2 non-preserved 1 liter amber jars should be filled for BNA semi-volatile analyses. Be aware of possible contamination from the boat motor if using a gas-powered engine. See Table 1 for information on container type and size, analysis methodology, preservatives and holding times.

Chlorophyll a

Water may be obtained by a pump or grab sampler (i.e., Kemmerer bottle or Van Dorn sampler.) Collect the sample water at a depth of 0.5m. Filtration volume size will depend on the particulate load of the water and should be great enough to generate a noticeable discoloration of the filter generally 100-200 ml of sample water is required.

Filtering should be performed in subdued light as soon as possible after sampling to avoid errors resulting from changes in the algal populations in the sample after collection.

If the water sample cannot be filtered immediately, it is to be stored on ice in darkness. Filtration is to occur within 24 hours of water sample collection.

Whether on board or in the lab, all apparatus should be clean and acid free. Assemble the filtration apparatus by gently resting the filter (refer to next paragraph) on the clean 47 mm filter plate. Attach the clean tower/funnel and connect the vacuum source with

vacuum gauge and regulator. Vacuum filtration should not exceed a pressure of 15 cm Hg. Filtration time should not exceed 10 minutes. Higher filtration pressures and excessively long filtration times may damage cells and result in loss of chlorophyll.

The standard choice of filter used for the Inland Lakes Sampling Program is the Whatman GF/C™. The program's Quality Assurance Project Plan (QAPP) provides an explanation under the data quality objective (DQO) section (Attachment 7). There may be circumstances involving more specialized studies where the QAPP and DQOs will justify the selection of alternative filters such as Whatman GF/F™ (0.7 µ).

Prior to drawing a subsample from the bulk water sample container, thoroughly but gently agitate the container to suspend the particulates (stir or invert several times). Pour the sub-sample into a clean graduated cylinder and accurately measure the volume. Sample volumes should remain consistent for a given site.

Pour the subsample into the filter tower/funnel of the filtration apparatus and apply a vacuum (remember not to 15 cm Hg). Rinse the sides of the filter tower/funnel with DI water. Do not draw the filter dry with the vacuum; instead slowly release the vacuum as the final volume approaches the level of the filter. Add 1 ml of MgCO₃ (supernatant from a supersaturated container - prepared by dissolving 1 gram of MgCO₃ in 100 ml distilled water) and gently swirl the filter apparatus to distribute the MgCO₃ before completely releasing the vacuum as the last bit of buffered water is pulled through the filter. (Note: MgCO₃ preserves the chlorophyll and is especially important to be used when the sample is collected from an acidic lake. However MgCO₃ will be used for every chlorophyll sample collected regardless of pH conditions). Remove the filter from the base with tweezers and fold it in half once so that the particulate matter is inside. Carefully wrap the folded filter with labeled aluminum foil to protect the phytoplankton from light and store the filter frozen. The filter may be kept on ice or sandwiched between two ice packs for up to 4 hours before being frozen. Record the sub-sample volume on the chlorophyll sample submission sheet and on the foil wrapper for the filter. Freeze the sample as soon as possible and before shipping to the laboratory. Then send the filter to the laboratory between two freezer packs. If the laboratory will not process the filter immediately upon receipt, the laboratory should store the sample at -20° C.

For quality control purposes, collect at least 10% duplicates. Before running the blanks, rinse the glassware with distilled water and conduct the filtration process using the exact same procedures and volumes as used for the lake sample. If using the same filtering apparatus, clean the apparatus between filterings. See Appendix I of the Surface Water

Field Sampling Manual *for bacteria, chemistry and flows* for the decontamination methodology.

USEPA Method 445 is utilized to determine chlorophyll *a* in algae by fluorescence. A full Adobe Acrobat Description of this method can be found on line at: http://www.epa.gov/nerlcwww/m445_0.pdf

The extraction procedure, data analysis and calculations are attached (Attachment 3).

Use the Chlorophyll *a* Sample Submission Form (Attachment 4) to submit data to the lab.

Important points:

Preservation -- Sampled filters should be stored frozen at -20 degrees C or below in the dark until extraction. One (1) ml of MgCO₃ shall be added. Prepare MgCO₃ solution by adding enough MgCO₃ powder to supersaturate the solution (i.e. there should be some powder remaining on the bottom of the container).

Labeling – Place the filters from each sampling location in zip-lock bag or other container clearly labeled with 1) sampling location 2) date and 3) volume filtered. Label the foil containing each filter separately. If collecting more than one filter from any one location, label the foil containing each filter separately as “A”. “B”, and “C” and label the blank as “Blank”.

Holding Time -- Filters can be stored frozen at -20°C, or below, for as long as 3½ weeks without significant loss of chlorophyll *a*.

Phytoplankton and Cyanotoxin Samples

Whole water samples for phytoplankton and cyanotoxin analysis will be collected using an integrated tube sampler following the method below. The equipment should be washed with a brush and phosphate-free detergent and rinsed with tap and deionized water after each collection. All lakes will have phytoplankton samples for species level cell counts and bio-volume estimates collected three times during the year. Cyanotoxin sampling type and frequency varies depending on the lake use. Use the guidance below to determine what samples to submit.

The need for a lab sample submission form and the number of labels depends on sampling run and if the lake is a public water supply or not. Instructions for how to create the lab sample submission form and container labels are described in Attachment 5. An inorganic sample submission form separate from the surface and bottom chemistry samples should be used so the cyanotoxin samples have a unique sample ID number. This is being done to expedite turnaround of the toxin results.

A separate sheet is created in Cyber Intern by repeating the same “run” used to create the other lab sheets. Type HABs in the comment section using the edit function so the sheets can be distinguished in the field. Check the appropriate parameter boxes on the sheet after it is printed. To ensure that an electronic copy of the results is delivered to DDAGW record DDAGW_HAB in the Project ID space. Up to four labels will be needed if a complete suite is done (microcystins/cylindrospermopsin, saxitoxin, phytoplankton and zooplankton). Record any preservatives added (i.e. Lugol’s for phytoplankton) on the label by hand. In the field, record the depth that the tube is deployed in the comments section of the sample submission form.

Integrated Tube Sampler Method:

1. The integrated tube sampler is used to vertically collect a whole water sample. The bottom of sampler should be deployed to 2m unless the secchi depth is <1m. Then it should only be deployed to 2 times the secchi depth.
2. Open the valve on the bottom of the sampler and remove the rubber stopper cap on the top. Field rinse by submerging the tube three times in the lake and draining. One of these can be used to rinse the churn splitter. Do this on the opposite side of the boat from which other water samples are collected.
3. Slowly lower the sampler into the lake as vertically as possible. Stop when the sampler reaches the proper depth.

4. Firmly cap the upper end of the tube with the rubber stopper and then slowly raise the sampler.
5. When the bottom of the sampler is near the surface close the valve on the bottom end.
6. Keep the sampler as vertical as possible and lift into the boat.
7. Place the contents of the tube into the churn splitter. Mix the sample with the churn to homogenize and dispense into containers through the spigot.

Cyanotoxins

Dispense any needed cyanotoxin samples from the churn splitter into the appropriate containers. Use a labeled 250ml polyethylene terephthalate glycol (PETG) container for the microcystins/cylindrospermopsin/qPCR sample. This sample is non-preserved. Use a labeled 40ml vial pre-dosed with preservative for saxitoxin. All cyanotoxin samples must be protected from sunlight and cooled on ice to 6°C immediately after collection. Submit toxin samples to the DES along with all other chemistry samples. Note on the sample submission form that results must be reported directly to the DSW HAB coordinator (Linda Merchant-Masonbrink), and include the DDAGW HAB coordinator (Heather Raymond) if the lake is a PWS lake.

Routine Sampling

Recreation Lakes (with no PWS intake):

Submit a sample for microcystins and cylindrospermopsin analysis, and a sample for saxitoxin analysis from lake station L-1 during the first, third and fifth sampling events.

Public Water Supply Lakes:

Submit a surface sample for microcystins ,cylindrospermopsin and qPCR analysis, and a sample for saxitoxin analysis from L-1 during all five sampling events. Submit a bottom sample for qPCR analysis.

Response Sampling

If it's judged that a HAB is present at a location where lake water is drawn into a water treatment plant; near a beach or another in-water recreational area during any of the sampling events, collect a sample for microcystins and cylindrospermopsin analysis, and a sample for saxitoxin analysis. Also collect a phytoplankton sample from the bloom using the integrated tube sampler. If it is a scum, collect live phytoplankton cells at the water/bloom interface. This response sampling will require the sampler to have extra set(s) of containers on hand. Sheets and labels can be processed after the fact or ahead of time undated and discarded if not used. Phytoplankton and cyanotoxin samples from responsive sampling are sent directly to DES.

Phytoplankton

A whole water sample for species level phytoplankton density (cells/L) and bio-volume ($\mu\text{m}^3/\text{L}$) analysis will be collected at L-1 on the first, third and fifth sampling events. A sub-sample from the churn splitter will be dispensed into a labeled 125ml glass jar and preserved with 0.7ml (about 10 drops) of stock Lugol's solution per 100 ml sample. The final preserved sample should be the color of weak tea. If algal biomass is great, additional Lugol's may be necessary to achieve weak tea coloration (use best professional judgment). Submit the samples directly to BSA Environmental Services, Inc. right after each sampling event using the Chain of Custody Form in Attachment 4. Use Ohio EPA and district name for client information. Use Ohio EPA Lazarus Government Center and Inland Lakes Program Coordinator (Linda Merchant-Masonbrink) for invoice information. Project name is Ohio EPA Inland Lakes Program. Under special instructions request results to be e-mailed to both client and invoice addresses. In addition, a copy of the results must be e-mailed to the DDAGW HAB coordinator as soon as possible if the lake is a public water supply.

Zooplankton

Collect a sample on the first, third, and fifth sampling event/year at L-1. Send the sample to the Inland Lakes Program Coordinator (Linda Merchant-Masonbrink) for holding until it can be processed.

Zooplankton Collection Method:

1. Use an 80 μ Wisconsin plankton net with 12 cm diameter opening.
2. Prior to each use, carefully clean and thoroughly rinse the interior of the plankton net and bucket with tap water.
3. Carefully inspect the net and buckets for holes or tears.
4. Attach the collection bucket to the "cod" end of the nets and secure.
5. Attach the bridled end of the plankton net to a calibrated line with markings every 0.5 m (you could use the line for the Secchi disk if necessary).
6. Carefully and slowly, lower the net in a constant upright position over the side of the boat.
7. Continue lowering the net until the mouth of the net is 0.7 m -1 m above the lake bottom. If the lake is deeper than 50 m, lower the net to a depth of 50 m and proceed.

8. Retrieve the net by pulling back to the surface at a steady constant rate without stopping (0.3 m or 1 ft per second).
9. Once at the surface, slowly dip the net up and down in the water without submersing the net mouth and help rinse contents into the collection bucket. Feel free to splash lake water through the sides of the net (not over the top into the mouth of the net) to dislodge and direct the plankton from the sides of the net and into the collection bucket.
10. Complete the rinsing of the net contents by spraying water against the outside of the net with a squirt bottle or similar tool.
11. Concentrate the contents of the collection bucket by tilting the bucket to one side and continually spraying until you have dislodged the majority of the plankton and have contained them in the bucket. The bucket should be less than $\frac{1}{4}$ full of water. Excess lake water will filter out of the bucket from the screened sides.
12. Set the bucket in a 500-mL container filled three-fourths full with lake water to which a CO₂ tablet has been added (do not add Alka Seltzer to the trap). Be careful not to allow the CO₂ solution to spill over and into the bucket. Alternatively, Alka-Seltzer or club soda may be used. The CO₂ narcotizes the zooplankton to relax their external structure prior to preservation in ethanol. This facilitates taxonomic identification. Wait until zooplankton movement has stopped or until a majority stops moving. Release the clamp on the discharge hose and empty the sample into a sample jar while spraying down the inside of the bucket with distilled water. A 125 ml graduated glass sample jar is mandatory. Replace the cap on the sample jar and set it aside. Spray the inside of the net and bucket with distilled water until it is clean, clamp the discharge hose and reassemble the bucket to the net.
13. Preserve zooplankton sample by using 95% ethanol after narcotizing and rinsing the animals into the sample jar with distilled water to provide a final solution of 70% EtOH. For a 4 oz. sample jar, 87 ml of 95% EtOH to 30 ml of sample provides the necessary 70% final EtOH solution for preservation.
14. Label the zooplankton sample with the template label provided in Attachment 4. Labels will not be put in the sample container.

Bacteria

A bacteria sample to be analyzed for *E. coli* bacteria should be collected at each lake if no current level 3 credible data is being collected by any other entity. Collect a sample at the first station location if the lake is used for any open water recreational activity (e.g., waterskiing, boating). Collect additional samples from the surface as close to any beach as possible, if one exists. If no beach exists, then bacteria should be collected near the boat ramp or other places with potential for human contact with water. Specific

sampling locations and sampling frequencies should be listed in the lake-specific sampling plan.

The bacteria sample should be collected as follows:

1. Remove the cap of the container.
2. Invert the bottle and submerge the container to a depth of 1 foot. Be careful not to stir up any sediment or algae in the area of the collection.
3. Turn up the submerged container and quickly remove above the surface of the water.
4. Secure cap on container and place on ice immediately. Samples must be delivered to the testing lab within 6 hours of collection.

Note: If a sample is to be collected near the boat ramp, collect it approximately 50 feet from the shoreline of the dock.

Note: If Ohio DNR or other organization is collecting Level 3 data at bathing beaches, we can use that information to supplement Ohio EPA data to evaluate use attainment.

Sediment

Collect sediment samples using a dredge (i.e., Ponar or Eckman) to bring bottom sediments to the surface. Follow QA/QC methods in the current Ohio EPA “Sediment Sampling Guide and Methodologies” document. See Attachment 1, Decision Matrix for Inland Lakes Sediment Sampling for a complete list of parameters. If the sediment screening turns up parameters of human health concern, then the water column should be tested for those parameters to determine if there is a water column impairment related to human health. This may include mercury and PCBs.

Manual of Ohio EPA Surveillance Methods
And Quality Assurance Practices
Section: Inland Lakes Sampling

Table 1. Containers/Methods for Baseline Lake Sampling

Matrix	Containers	Analytical Group(s)	Method(s)	Preservative	Holding Time
Sediment	1-500 ml Amber jar	BNA PCBs	8082, 8270	Non	14 days
Sediment	1-250 ml opaque square jar (HDPE)	Nutrients* TOC, Select Metals including Hg**	ICP (Zn, Cr, Cu, Pb) otherwise several methods, (see lab manual for current methods)	Non	7 days (sediment nutrients); up to 6 months for other parameters
Water	1-qt. Cubitainer	Nutrients (TOC, Sulfate, Nitrate, Nitrite Ammonia, TKN, Phosphorus)		H ₂ SO ₄	28 days
Water	1-qt. Cubitainer	Metals (No Hg)	ICP-MS1, ICP-1	HNO ₃	6 months
Water	1-qt. Cubitainer	"Demand"	Several	Non	24 hours to 28 days
Water	1-qt Cubitainer	Ortho-P		Filtered (NP)	48 hours
Water	1-125 ml glass jar	Total P	Low Level	Sulfuric Acid	28 days
Water	1-125 ml glass jar	Ortho-P	Low Level	Filtered (NP)	48 hours
Water	2-Amber jars (only needed in year 2 if triggered by year 1 results)	Atrazine (at PWS lakes only)	525.2	HCl/Na ₂ SO ₃	14 days
Water	1-40 ml glass vial	Atrazine (at PWS lakes only)	ELISA	None	14 days
Water	glass fiber filter	Chlorophyll a	U.S.A. EPA Method 445	MgCO ₃ (freeze)	25 days
Water	1-speciman jar	E.coli		Non	6 hours
Water	1-125 ml graduated glass jar (1- liter Cubitainer for responsive samples going to DES) Take extras for possible responsive sampling.	Phytoplankton		0.7 ml (10 drops from eye dropper/100 ml sample) Lugol's within 8 hours of collection	Send all phytoplankton to BSA (Lugol's solution expires after 1 year)
Water	1-125 ml graduated glass jar	Zooplankton		95% alcohol resulting in 70% alcohol dilution	Send to lakes coordinator for holding
Water	1-250 mL PETG container provided by DES (Take extras for possible responsive sampling.)	Microcystin/ Cylindrospermopsin/qPCR		None (freeze if can't get to DES within holding period); keep cool and in dark	5 days (can be longer if frozen)****
Water	1-40 ml glass vial with preservative	Saxitoxin		Preservative already included in the vial. Must stay refrigerated	6 days (can be longer if frozen)**** (Preservative in vials; expires after 1 year in the refrigerator)

*Must request prior approval on sediment nutrient submittal. Nutrients include neither TKN nor Nitrate.

**Hg – request prior approval, 28-day holding time.

(Prior approval is also required for chlorophyll a, Orthophosphate, *E. coli*, Chloride, Carbonate, Bicarbonate)

*** See Attachment 6 for Collection Procedures

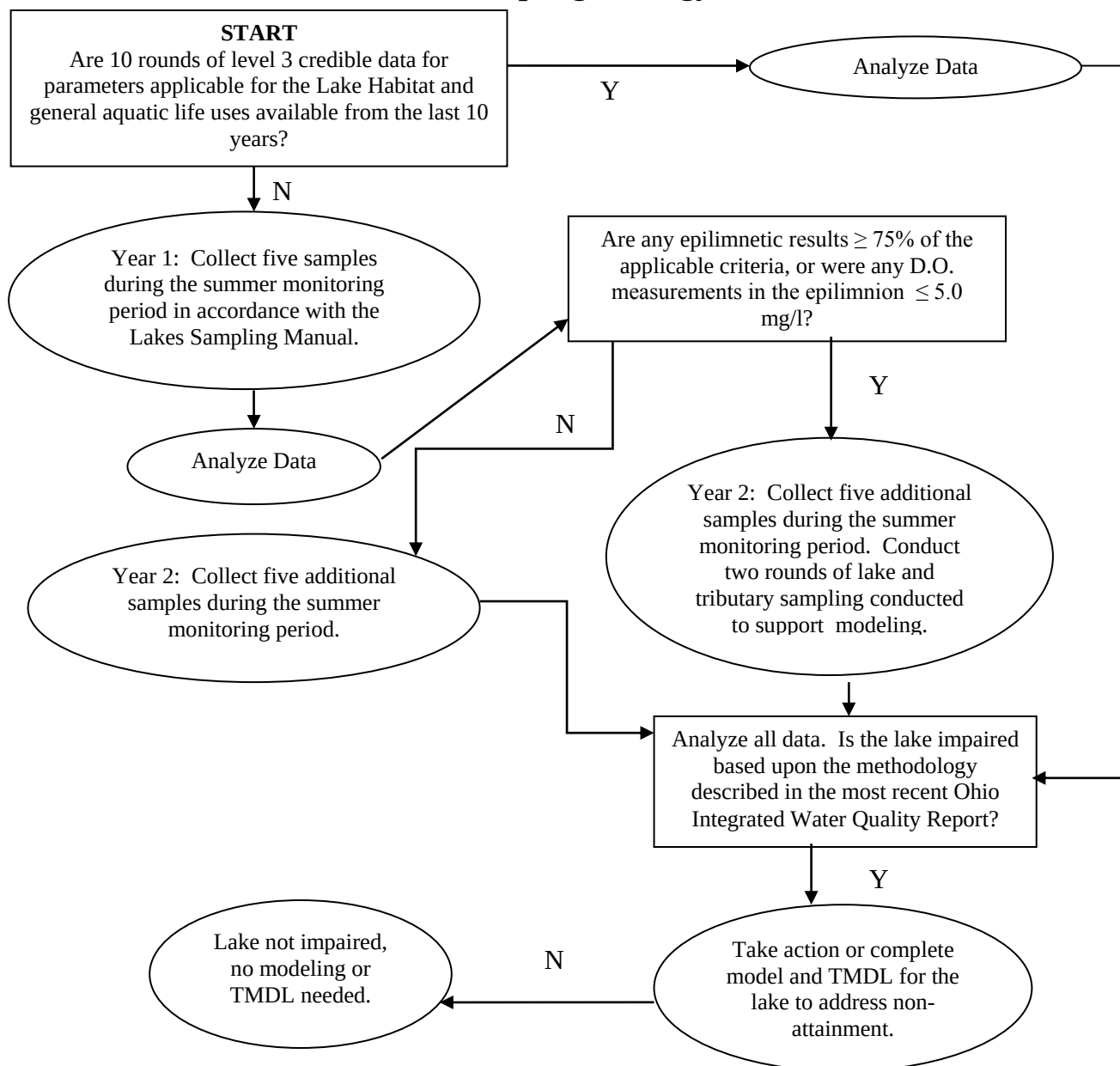
All prior approval parameters need to be added to the Template when ordering.

**** When freezing, allow adequate volume for expansion and place the sample container on its side

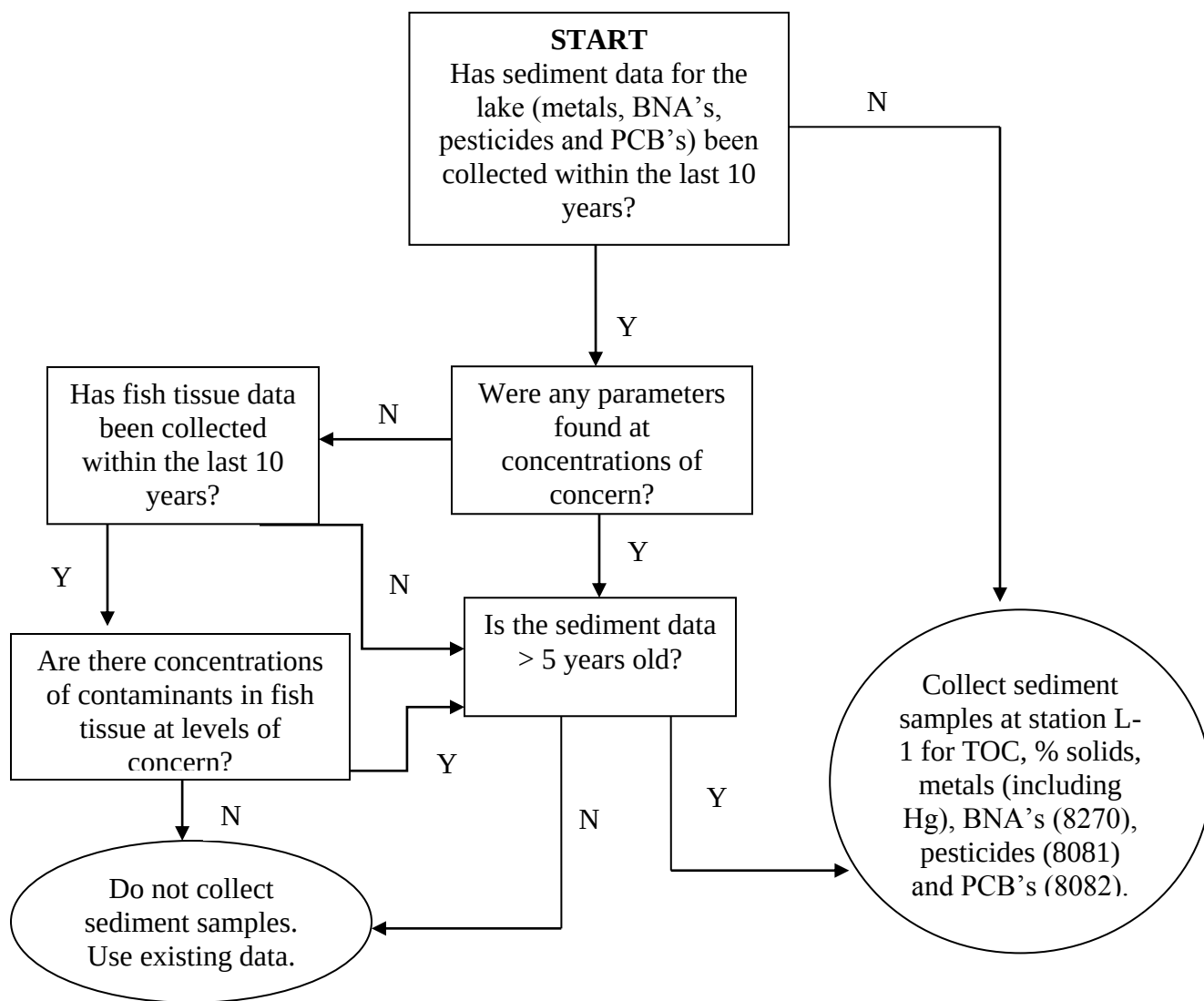
ATTACHMENT 1

Decision Matrices Sampling Flow Charts

Inland Lake Sampling Strategy Flow Chart



Decision Flow Chart for Inland Lakes Sediment Sampling



ATTACHMENT 2

Lake Modeling Methodology Sampling Profile Graphic And Flow Tracker

Supplement - Lake Modeling Sampling Protocol

Model sampling must begin with a determination of lake stratification, or whether or not a thermocline exists. To do this, a depth profile of the site—including temperature, pH, dissolved oxygen, and conductivity readings—must be collected at a maximum of 1 meter intervals. If these measurements show a sharp thermocline, then the sampling methods outlined below for stratified lakes should be used.

Ohio EPA employs various lake models with different input requirements. When possible, a mass balance approach is used, which allows the modeler more control over in-lake and environmental processes. The limitation of the mass balance method is that it can only be used for conservative parameters, such as phosphorus and metals. For non-conservative parameters, a different lake model would be necessary.

Sampling needs outlined in this section are tailored for the mass balance model, although they should also align well with other models. The accuracy of the mass balance lies with a daily water budget, so detailed hydrologic data is of great importance. Therefore, the sampling for this model must include the use of level loggers or other long-term stage devices.

If a model other than mass balance is needed, changes in sampling protocol should be coordinated with WQM staff.

Lake Chemistry Sampling

Timing

- Samples should be taken throughout the modeling period (typically at least one year), every two weeks. Ice cover may make this impossible during winter months.
- In stratified lakes, samples taken after lake turnover (loss of thermocline) should be collected as outlined for unstratified lakes.
- Samples must be taken between 10:00 am and 4:00 pm for the following:
 - o Secchi depth
 - o Chlorophyll a

Segmentation

- Choosing segments should be completed in cooperation with WQM staff.
- Simplest configuration is one segment. Additional segments needed if:
 - o Lake is greater than 20 km long
 - o Interest in Trophic State Status of various locations in lake
 - o Major inflows occur within lake at different locations

Sampling

Unstratified (mixed without thermocline)

- Three samples – all discrete
 - Surface (0.50 meter from surface)
 - Mid-depth
 - Bottom (1.0 meter from bottom)

Stratified (thermocline exists)

- Three samples – composite sample in epilimnion only
 - Epilimnion – composite of three equivalent volume aliquots
(Note: Use of a Churn Sample Splitter to composite samples is described in Attachment 3.)
 - Surface (0.50 meter from surface)
 - Mid-depth
 - Bottom (1.0 meter from bottom of epilimnion)
 - Metalimnion – discrete sample (at thermocline)
 - Composite aliquots if needed for sufficient volume
 - Hypolimnion – discrete sample (1.0 m from bottom)
 - Composite aliquots if needed for sufficient volume

Note: All “surface samples” should be taken at a depth of 0.5 meter from the surface. All aliquots must be composited into respective sample prior to filtering for chlorophyll a and orthophosphate. Point readings for temperature, conductivity, dissolved oxygen, and pH should be collected along with each chemistry sample.

Tributary and Outlet Chemistry Sampling

- Grab samples should be taken at the mouth of all lake tributaries to be modeled and at the lake outlet.
- These samples should cover the array of hydrologic conditions and seasons in order to build strong flow/concentration relationships.
- The Inland Lakes Tribs template (see Attachment 4) should be used, with chlorophyll a added as needed.
- Point readings for temperature, conductivity, dissolved oxygen, and pH should be collected along with each chemistry sample.

Hydrology Data Collection

Timing

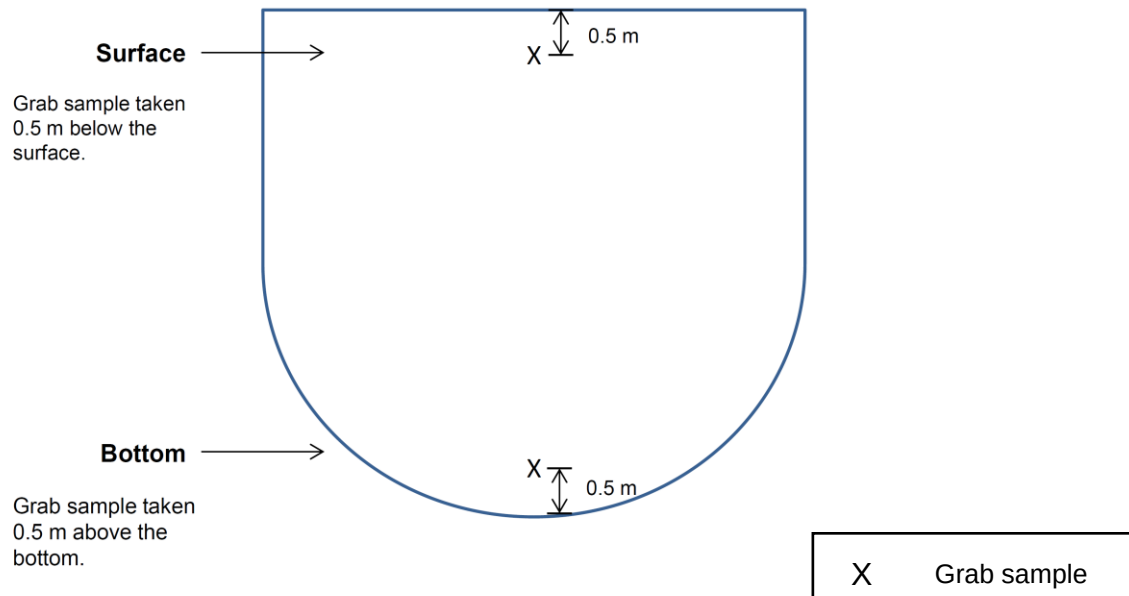
- Hydrology data should be collected for the full model period (typically at least one year).
 - o Multiple years may be necessary if primary sampling is in a very wet or very dry year, or if modeler needs to calculate flushing rates.
- Continuous data (level loggers) should take readings at least every hour.

Types of Data

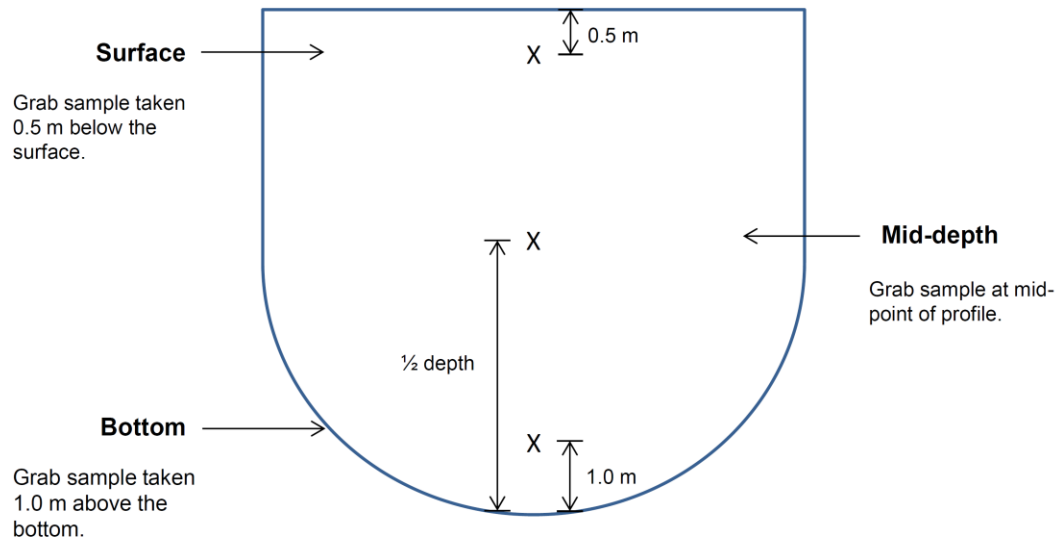
- Level data – long-term, continuous level logger (at least 1/hour)
 - o Lake level
 - o As needed on tributaries/outlet to create a daily flow record.
 - o This may not be necessary if there is a good USGS gage relationship.
- Flow data – ADV (FlowTracker) or ADCP (StreamPro/RiverRay) flow measurements
 - o As needed on tributaries/outlet to build a strong rating curve.

Sampling Profile: Unstratified Lakes

Routine Unstratified Lake Samples

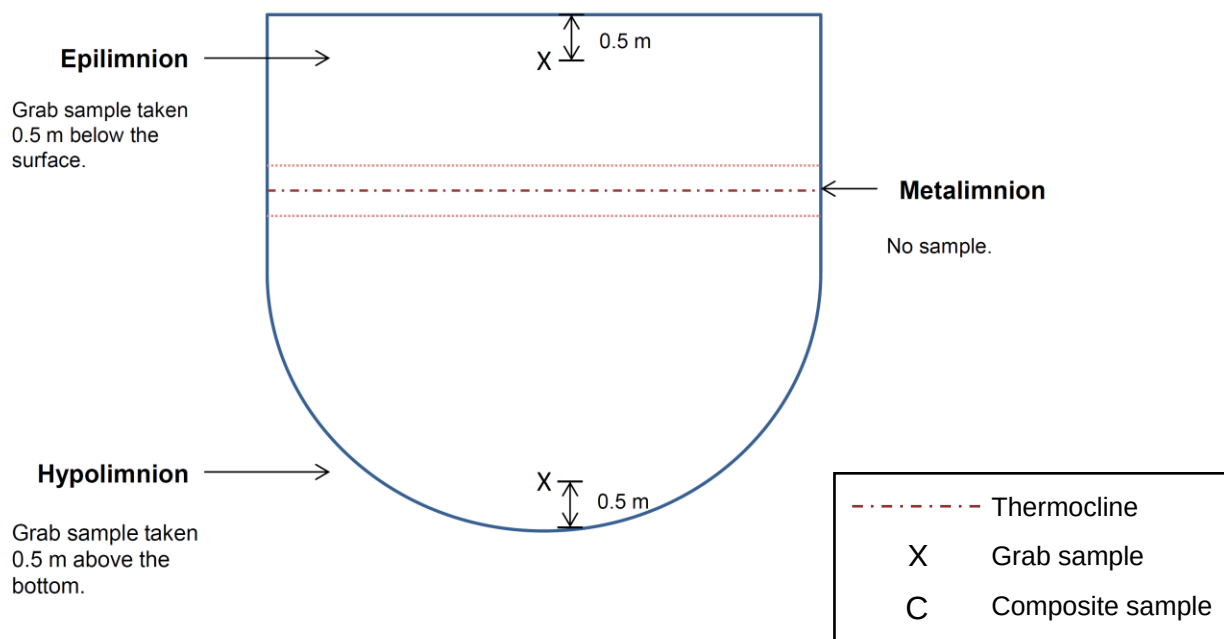


Modeling Unstratified Lake Samples

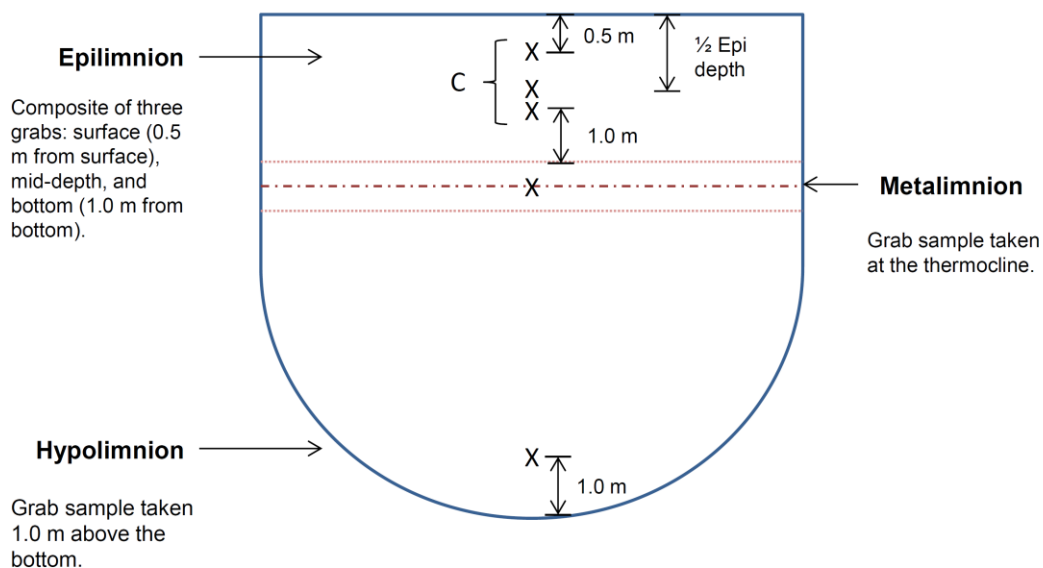


Sampling Profile: Stratified Lakes

Routine Stratified Lake Samples



Modeling Stratified Lake Samples



Flow Tracker Directions

For More Detailed Information go to:

ftp://ksh.fgg.uni-lj.si/students/podipl/merska_oprema/Flow_Tracker_Manual.pdf

Quick Start

- Install the batteries (access the battery compartment from the back of the Flow Tracker).
- Turn the system on by holding the **On/Off** switch for 1 second; hold the switch for 4 seconds to turn the system off.
- Explore the **Setup Parameters** menu by pressing **1** from the **Main Menu**.
 - Press **Enter** to switch between the multiple display screens.
 - Use the menu items to change the parameters that affect data collection.
- Explore the **System Functions Menu** by pressing **2** from the **Main Menu**.
 - Press **Enter** to switch between the multiple display screens.
 - Use the menu items to access FlowTracker diagnostic procedures.
- Collect a test data set.
 - Select a data collection mode (general/discharge) from the **Setup Parameters Menu**.
 - Start the data run by pressing **3** from the **Main Menu**.
 - Follow the on-screen prompts. Use the **Next Station** and **Prev. Station** keys to scroll between stations. Use the **Set** keys to set various parameters.
 - See Sections 4 and 5 of the *FlowTracker Operation Manual* for a description of the General Mode and Discharge Mode data collection procedures.

PC Software Installation

- The PC software is used to download data from the FlowTracker, to extract data to ASCII-text data files, and to perform detailed system diagnostics.
- Insert the FlowTracker Software CD into your computer's CD-ROM driver.
- An installation menu should automatically appear after the CD has been inserted.
 - If the installation window does not appear in a few seconds, click **Start/Run** and type d:\install.exe where d:\ is the letter of your CD-ROM drive.
- On the menu, click the **FlowTracker Software Installation** button.
- Follow the on-screen installation instructions.
- See Section 6.1 of the *FlowTracker Operation Manual* for detailed instructions.

Downloading Data Files from the FlowTracker

- Connect the power/communication cable from the FlowTracker to COM1 of your PC.
- Start the *FlowTracker* software using **Start/Programs/SonTek Software/FlowTracker**.
- Click **SonRecW** to launch the data download software.

- Click **Connect** to establish communication with the FlowTracker.
- Select one or more files from the downloaded recorder directory.
- Specify a destination directory for the downloaded files using the **Browse** button.
- Click **Download** to retrieve the files from the FlowTracker to your PC.
- See Section 6.4 of the *FlowTracker Operation Manual* for detailed instructions.

Extacting Data from FlowTracker Data files

- Start the FlowTracker software using **Start/Programs/SonTek Software/Flow Tracker**.
- Click **Data Export** to launch the data extraction software.
- Click **Open** and select a Flow/Tracker file to access.
- Click **Options** to specify the units system to use.
- Select a file type to output and click **Export Selected Variable** to create the specified file, or click **Export All Variables** to create all available output files.
- See Section 6.5 of the *FlowTracker Operation Manual* for detailed instructions.

Basic FlowTracker data collection process, using the keypad interface

- At the start of data collection, the user is prompted for a file name.
- For **Discharge** measurements, the user enters site-specific data before data collection: staff/gauge height (optional), rated flow (optional), and edge location data (required).
- At each measurement location, the user specifies location, water depth, and measurement depth data to document the data set. For **Discharge** measurements, these are used to calculate discharge in real-time.
- A fixed-length burst of velocity data is recorded at each measurement location. Velocity data is recorded once per second during the burst; mean velocity and quality control data are recorded at the end of each burst.
- Summary velocity and quality control data are displayed at the end of each measurement. The user is allowed to repeat individual measurements if desired.
- The user proceeds through a series of measurement locations (up to 100 stations can be recorded with each file.)
- The user can scroll through previous stations to view data and edit station information.
- When done, the user presses **End Section** to close the file. For **Discharge** measurements, the user enters ending-edge information and is then shown the final discharge data.

ATTACHMENT 3

Ortho P Syringe, Beta Bottle, Churn Splitter, Pump and Probe Procedures

Ortho P Syringe Procedure

Use GF/C glass filter and a .45 micron cellulose filter sandwich using a minimum of 50-60 ml. The glass filters out the larger material and the cellulose filters the finer material.

Or:

Ortho-phosphate and Dissolved P (Syringe Filtration method):

Sampling supplies

Whatman GMF 25 mm Luer-Lok 0.45 micron filter
60 mL BD Luer-Lok syringe
stock container (bucket, cubitainer)

Method:

- Collect sample in stock container
If turbid, allow to settle a moment.
- Use syringe w/o filter, to draw the sample from top of stock container into the syringe by pulling the plunger outward until full.
- Tap the side of the syringe to free excess liquid, and attach the filter.
- Press plunger to push liquid through the filter into quart Cubitainer. (You will need 50mL for the lab) The graduated syringe will allow you to easily know how much filtrate you have pushed through the filter.

***** In samples that are sediment or algae laden, it is possible that the filter will clog prior to collecting 50mL. In that case twist off and discard clogged filter, and replace with new one. The syringe will become difficult to push when the filter is clogged. Once you encounter moderate resistance, DO NOT push harder or you may burst the filter, and you'll have to start over.**

- Finish collecting 50 mL.

Note: Ortho-phosphate has 2 day holding time and is unpreserved, Dissolved P is preserved (~2 drops (0.2 mL) H₂SO₄ per 50 mL) and has 28 day holding time. Both must be kept on ice or chilled to 4 degrees.

- Rinse stock container or bucket before collecting new sample

Please save, but do not reuse syringes in the field. These can then taken back to your field office/lab area and cleaned following the Phosphorus Syringe Cleaning Protocol. The syringes can be cleaned and re-used up to three times before disposal (saving money and landfill space).

Operating Instructions for 1920-1940 Horizontal Beta™ Bottles

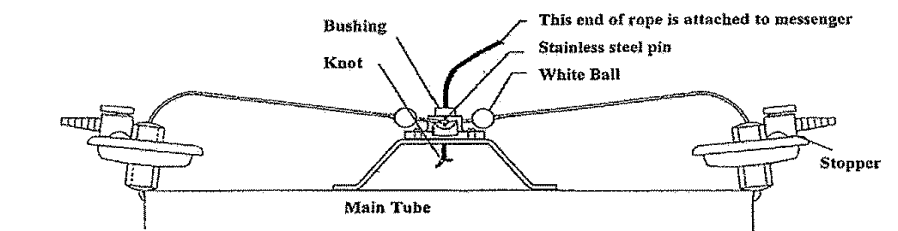
Safety:

To prevent personal injury, keep your hands clear of open ends of the main tube while the bottle is in the open position.

- The bottle release mechanism is designed to be used *only* in a *non-series* operation mode.
- A messenger is required to activate the tripping mechanism. Wildco® recommends an 11 oz. messenger (such as **45-B10**) unless there is a very long air drop and the bottle is close to the surface of the water, in which case a lighter weight messenger may be desirable.
- The maximum height a messenger should be dropped through the air is 30 feet (10m). Distances greater than this can damage the bottle. Use a Wildco® shock absorber (**45-B40**) for long air drops. For air drops longer than 50 feet, please call for advice on the best method of tripping your bottle without damaging it.

Procedure:

1. Make a preliminary inspection prior to use of the bottle. Close the air vent and the drain valve.
2. Place the bottle so that the bushing on the trip mechanism is on the top of the handle.
3. Run a line or cable through the hole in the trip assembly and knot the line or secure the cable so that it cannot pull back through the hole. It must be securely fastened to hold the weight of the bottle when filled with the sample.
4. Find the two stainless steel (SS) pins in the trip assembly. Both pins are 1/16" above the plastic trip assembly.
5. Grasp the round, white balls on the cable assembly. Pull the stopper out of the end of the main tube so the loop in the cable can be placed over the closest pin of the trip assembly.
6. Repeat the above instructions with the other stopper and hook the cable loop on the pin which projects above the plastic trip assembly. The bottle is now in the "SET" position.
7. Lower the bottle to desired depth in the water, keeping the line taut. Pull bottle sideways to obtain a water sample for the desired depth. Drop messenger down the line. It will strike the tripping mechanism, causing the cables to release and the stoppers to close, trapping the sample inside the bottle.



Recommended Accessories:

- **45-B10** 11 oz. split messenger
- Messenger shock absorber **45-B40** for long air drops.
- 5 mm (3/16") dia line, or 3 mm (1/8") dia cable.
- Winches and winch mount.
- **910-G22** Plastic Carry Case
- **66-A50** Hand reel

Warranty and Parts:

We replace all missing or defective parts free of charge. All products guaranteed free from defect for 90 days. This guarantee does not include accident, misuse, or normal wear and tear and applies to original purchaser only.

INSTRUCTIONS



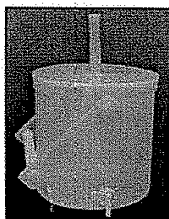
Churn Sample Splitter

Catalog No. 37805-0004, 37805-0008, 37805-0014

The water-quality laboratory requires subsamples of a representative cross-section sample of rivers and streams for water-quality analysis. The cross-section sample is collected in 1-liter bottles or 1- or 8-liter bags using isokinetic samplers (for streamflow velocities >1.5 feet per second) or four to nine verticals using the Equal Discharge Increment (EDI) technique or a minimum of 10 verticals using the Equal Width Increment (EWI) method (Edwards and Glysson, 1999). These samples are composited into one single representative cross-section sample of the streamflow. This composited sample can then be split, using the churn splitter, into the required representative subsamples as explained in the following procedure.

Procedure:

This procedure is for the 14 liter Churn Sample Splitter. For smaller units, use fewer or smaller samples. This size sample splitter does not reliably produce representative water-sediment mixture subsamples when it contains less than 4 liters. The total sample volume is 8 to 14 liters, of which 4 to 10 liters are suitable for water-sediment mixture (unfiltered) subsamples. The remaining 4 or more liters may be used for filtered subsamples. Before starting to collect the representative sample of the streamflow, label all the subsample containers to be used and determine the total sample volume needed. Add an additional 10% to this sample volume to cover filter losses and spillage. Collect 2 to 4 liters of water and thoroughly rinse the churn splitter by swirling it and emptying the water out through the valve spigot. Determine the correct transit rate for the sampler being used and the volume of water to be collected at each vertical (U.S. Geological Survey, variously dated). Collect samples of a predetermined number of verticals. Only one sampler bottle or bag is used over and over again in collecting the cross-section samples in order to minimize the amount of sediment lost in transferring samples from the bottles to the churn splitter. Each time the bottle or bag is filled, the sample is poured into the splitter and the bottle is used again so that each succeeding sample washes the sediment left from the previous one into the splitter. Remember that the volume to be used for water-sediment mixture (unfiltered) subsamples must be "on top of" the 4 liters of sample in the tank from which representative water-sediment mixture subsamples cannot be obtained. When the required volume, plus 10% for waste, is in the churn splitter, move to a clean sample processing area and place all water-sediment mixture subsample containers within easy reach so that, once started, the stirring can be continuous. The largest volume subsample should be withdrawn first. The sample should be stirred at a uniform rate of approximately 9 inches per second by raising or lowering the churn paddle. As the volume in the tank decreases by withdrawing subsamples, the round-trip frequency should increase so that the churning disc velocity remains the same. The disc should touch the bottom of the tank on every stroke, and the stroke length should be as long as possible without breaking the water surface. Before using the churn sample splitter for the first time, practice this stroke using tap water. Observe as the stroke length and/or disc velocity is increased beyond the recom-



mended rate, there is a sudden change of sound and churning effort which is accompanied by the introduction of excessive air into the mixture. The introduction of excessive air into the sample is undesirable because it may change the dissolved gases, bicarbonate, pH, and other characteristics. On the other hand, inadequate stirring may result in nonrepresentative subsamples. The sample in the churn splitter should be stirred at the uniform churning rate for about 10 strokes prior to the first withdrawal to establish the desired stirring rate of 9 inches per second and to assure uniform dispersion of the suspended matter. The churning must be continuous during the withdrawals. If a break in withdrawals is necessary, the stirring rate must be reestablished before continuing the withdrawals. The valve spigot should always be operated in the **full open** position. The operating lever is equipped with a positive stop

when fully open. When all of the required water-sediment mixture (unfiltered) subsamples have been obtained, the remaining portion of the sample is used, as necessary, for the filtered samples. It will be advantageous to allow the sediment to settle out in the mixing tank for a few minutes before processing the filtered subsamples. When all the necessary filtered subsamples have been obtained, all parts of the churn splitter should be cleaned thoroughly.

Cleaning

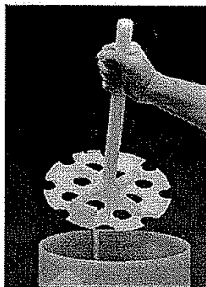
Cleaning in the laboratory includes the following steps: 1) soak for 30 minutes in a 0.1 to 2 percent non-phosphate, laboratory-grade detergent solution; 2) scrub with a non-metallic brush; 3) rinse well with tap water, passing some through the spigot; 4) (for trace-element samples) soak for 30 minutes in a 5 percent (by volume) trace-element grade hydrochloric acid solution; 5) rinse well with deionized water, passing some through the spigot; 6) place in doubled plastic bags.

Cleaning in the field between sites includes the following steps: 1) Rinse all surfaces with a 0.1 to 0.2 percent non-phosphate, laboratory grade detergent solution and allow to soak for about 10 minutes; 2) scrub with a non-metallic brush; 3) rinse well with tap water; 4) (for trace-element samples) using a wash bottle, rinse all surfaces with a 5 percent (by volume) trace-element grade hydrochloric acid solution; 5) rinse well with deionized water; 6) place in doubled plastic bags (U.S. Geological Survey, variously dated).

References:

Edwards, T.K. and Glysson, G. D., 1999, Field methods for measurement of fluvial sediment: U.S. Geological Survey Techniques of Water-Resources Investigations, book 3, chapter C2, available online at <http://water.usgs.gov/pubs/twri/twri3-c2/>

U.S. Geological Survey, variously dated, National field manual for the collection of water-quality data: U.S. Geological Survey Techniques of Water-Resources Investigations, book 9, chaps. A1-A9, available online at <http://pubs.water.usgs.gov/twri9A>.



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10/04

Pump and Probe Procedures

Water Column Profile Pump and Probe Methodology

If a multi-probe meter with sufficient cable length is not available for water column profile measurements, a pump attached to a hose is acceptable. Ohio EPA crafted a device that consists of a garden variety hose coupled with a 12 V submersible pump on the bottom end and a small plastic collection basin on the top end. The hose should be labeled with appropriate depth increments and constructed of a material that is rigid enough to prevent it from collapsing. The power leads from the pump should be fastened to the hose to minimize tangling and facilitate connection to the power source. In previous prototypes the collection basin is constructed of PVC and is equipped with an overflow tube. Ideally, the basin should fix to the rail of the sampling vessel so the overflow discharges back into the lake. The basin needs to be large enough to hold an assortment of probes that might be used to take measurements. Once the pump is lowered to the desired depth and engaged, sufficient time should be allowed for water in the basin to exchange and for the meter readings to stabilize before they are logged.

ATTACHMENT 4

Forms and Labels

Manual of Ohio EPA Surveillance Methods
And Quality Assurance Practices
Section: Inland Lakes Sampling

OhioEPA Division of Environmental Services

Report for Test Schedule: INLAND_LAKES_TRIBS

Modified On 4/23/2012 10:44:25

Modified By COESCH

Description Samples submitted by DSW WQ staff for tributaries for modeling.

Group Name INORGANIC

Analysis / Schedule	Description	Instrument	Rep	Std	A/S
Alkalinity	TOTAL ALKALINITY		1	✓	✓
Ammonia	AMMONIA		1	✓	✓
Carb_Bicarb	CARBONATE/BICARBONATE		1	✓	✓
CBOD-20	CBOD, 20-DAY		1	✓	✓
Chloride	CHLORIDE		1	✓	✓
Nitrate	NITRATE+NITRITE		1	✓	✓
Nitrite	NITRITE		1	✓	✓
Orthophosphate	ORTHOPHOSPHORUS		1	✓	✓
Solids_Diss	TOTAL DISSOLVED SOLIDS		1	✓	✓
Solids_Susp	TOTAL SUSPENDED SOLIDS		1	✓	✓
Solids_Susp_Vol	TOTAL SUSPENDED VOLATILE SOLIDS		1	✓	✓
Sulfate	SULFATE		1	✓	✓
TKN	TOTAL KJELDAHL NITROGEN		1	✓	✓
TOC	TOTAL ORGANIC CARBON, WATER		1	✓	✓
TP	TOTAL PHOSPHORUS		1	✓	✓
Turbidity	TURBIDITY		1	✓	✓

Manual of Ohio EPA Surveillance Methods
And Quality Assurance Practices
Section: Inland Lakes Sampling

OhioEPA Division of Environmental Services

Report for Test Schedule: INLAND_LAKES_WATER

Modified On 5/1/2012 13:16:58

Modified By COESCH

Description DSW inland lakes water amples--inorganic analysis

Group Name INORGANIC

Analysis / Schedule	Description	Instrument	Rep	Std	A/S
Alkalinity	TOTAL ALKALINITY		1	✓	✓
Ammonia	AMMONIA		1	✓	✓
Carb_Bicarb	CARBONATE/BICARBONATE		1	✓	✓
Chloride	CHLORIDE		1	✓	✓
ICP_1	ICP 1 (Al,Ba,Ca,Fe,Mg,Mn,Na,K,Sr,Zn,Hardness), PACKAGE, WATER		1	✓	✓
ICPMS_1	ICPMS 1 (As,Cd,Cr,Cu,Ni,Pb,Se), PACKAGE, WATER		1	✓	✓
Nitrate	NITRATE+NITRITE		1	✓	✓
Nitrite	NITRITE		1	✓	✓
Orthophosphate	ORTHOPHOSPHORUS		1	✓	✓
Solids_Diss	TOTAL DISSOLVED SOLIDS		1	✓	✓
Solids_Susp	TOTAL SUSPENDED SOLIDS		1	✓	✓
Solids_Susp_Vol	TOTAL SUSPENDED VOLATILE SOLIDS		1	✓	✓
Sulfate	SULFATE		1	✓	✓
TKN	TOTAL KJELDAHL NITROGEN		1	✓	✓
TOC	TOTAL ORGANIC CARBON, WATER		1	✓	✓
TP	TOTAL PHOSPHORUS		1	✓	✓
Turbidity	TURBIDITY		1	✓	✓

Manual of Ohio EPA Surveillance Methods
And Quality Assurance Practices
Section: Inland Lakes Sampling

Lake Sampling Data Sheet

Profile

Lake Name: _____

Station ID: _____

Lat/Long: _____

Collected By: _____

Date/Time: _____

Secchi Depth (m): _____

Max. Depth: _____

Management: _____

Water Color

clear lt grn very grn gr/br lt brn very brn

Cloud Cover

clear hazy few clouds many clouds overcast

Waves

calm ripples mod waves white caps

Air Temperature (F)

40-50 50-60 60-70 70-80 80-90 90+

Wind Condition

calm light breeze strong breeze gusty

Wind Direction

N NE E SE S SW W NW

Recreational Use

none light moderate heavy

Zebra Mussels Y, N
Bluegreen Algae Y, N

Comments:

Conductivity values corrected to 25°C? Y , N

Depth (m)	Temp (°C)	Cond. (µmhos/cm)	D.O. (%sat.)	D.O. (mg/l)	pH (S.U.)
0.5 (Surface)					
1.0					
1.5/2.0					
2.0/3.0					
2.5/4.0					
3.0/5.0					
3.5/6.0					
4.0/7.0					
4.5/8.0					
5.0/9.0					
5.5/10.0					
6.0/11.0					
6.5/12.0					
7.0/13.0					
14.0					
15.0					
16.0					
17.0					
18.0					
19.0					
20.0					
21.0					
22.0					

Manual of Ohio EPA Surveillance Methods
And Quality Assurance Practices
Section: Inland Lakes Sampling



Inorganic Sample Submission Form

DES Use Only

Sample # _____

MM DD YY

Date Received / /

Sample Information		Parameters																																																																													
Client (Bill to) Project Identity (project identity requires prior approval) No Folder ☐ Division (check one) DAPC ☐ DDAGW ☐ DERR ☐ DMWM ☐ DSW ☐ ODNR ☐ Other _____ OEPA District (check one) CO ☐ CDO ☐ NEDO ☐ NWDO ☐ SEDO ☐ SWDO ☐ ODNR ☐ Other _____ Sample Type (check one) Ambient ☐ Complaint ☐ Compliance ☐ Litigation ☐ Survey ☐ Raw ☐ Distribution ☐ Other _____ Matrix (check one) Air Filter ☐ Air Filter Composite ☐ Drinking water ☐ Ground water ☐ Sediment ☐ Surface water ☐ Waste water ☐ Reagent Water ☐ Other _____ Collection Date Grab ☐ (or) Composite ☐ MM DD YY HH MM Begin / / End / / Frequency & Duration of Composite Sample: <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th colspan="3">Container Information</th> <th>Field QC (Check one)</th> </tr> </thead> <tbody> <tr> <td>Qty.</td> <td>Type</td> <td>Pres.</td> <td>Field Duplicate ☐</td> </tr> <tr> <td></td> <td>Air Filter</td> <td>N/P</td> <td>Field/Equip/Acid Blank ☐</td> </tr> <tr> <td></td> <td>Bacteria</td> <td>Sterile</td> <td>MSD ☐</td> </tr> <tr> <td></td> <td>Cubitainer</td> <td>NaOH</td> <td></td> </tr> <tr> <td></td> <td>Cubitainer</td> <td>HNO₃</td> <td></td> </tr> <tr> <td></td> <td>Cubitainer</td> <td>HNO₃ Filt</td> <td></td> </tr> <tr> <td></td> <td>Cubitainer</td> <td>H₂SO₄</td> <td></td> </tr> <tr> <td></td> <td>Cubitainer</td> <td>H₂SO₄ Filt</td> <td></td> </tr> <tr> <td></td> <td>Cubitainer</td> <td>N/P</td> <td></td> </tr> <tr> <td></td> <td>Cubitainer</td> <td>N/P Filt</td> <td></td> </tr> <tr> <td></td> <td>Cubitainer</td> <td>Frozen/HAB</td> <td></td> </tr> <tr> <td></td> <td>Cubitainer</td> <td>Lucifer</td> <td></td> </tr> <tr> <td></td> <td>Jar</td> <td>H₂SO₄/Phenol</td> <td></td> </tr> <tr> <td></td> <td>Jar</td> <td>H₂SO₄/O&G</td> <td></td> </tr> <tr> <td></td> <td>Jar</td> <td>N/P Filt/LTOP</td> <td></td> </tr> <tr> <td></td> <td>Jar</td> <td>H₂SO₄/LLTP</td> <td></td> </tr> <tr> <td></td> <td>Sed</td> <td>N/P</td> <td></td> </tr> <tr> <td></td> <td>Vial</td> <td>Buffer/STX</td> <td></td> </tr> </tbody> </table> Customer ID # _____ Station ID # _____ County: _____ Sample Location Field Comments Lab Comments				Container Information			Field QC (Check one)	Qty.	Type	Pres.	Field Duplicate ☐		Air Filter	N/P	Field/Equip/Acid Blank ☐		Bacteria	Sterile	MSD ☐		Cubitainer	NaOH			Cubitainer	HNO ₃			Cubitainer	HNO ₃ Filt			Cubitainer	H ₂ SO ₄			Cubitainer	H ₂ SO ₄ Filt			Cubitainer	N/P			Cubitainer	N/P Filt			Cubitainer	Frozen/HAB			Cubitainer	Lucifer			Jar	H ₂ SO ₄ /Phenol			Jar	H ₂ SO ₄ /O&G			Jar	N/P Filt/LTOP			Jar	H ₂ SO ₄ /LLTP			Sed	N/P			Vial	Buffer/STX	
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Metals (Please select one ICP and one ICMS package if needed) ☐ ICP 1, Water only (Al, Ba, Ca, Fe, Mg, Mn, Na, K, Sr, Zn, Hardness) ☐ ICP 2, Water only (Ca, Mg, Hardness) ☐ ICP 3, Sediment only (Al, Ba, Ca, Fe, Mg, Mn, Na, K, Sr, Zn) ☐ ICP 4, SW846 only (Al, Ba, Ca, Fe, Mg, Mn, Na, K, Sr, Zn, V, Ti, Hardness) ☐ ICP 5, SW846 SED only (Al, Ba, Ca, Fe, Mg, Mn, Na, K, Sr, Zn, V, Ti) ☐ ICP 6, Air Filters only (Zn, Mn) ☐ ICMS 1, Water only (As, Cd, Cr, Cu, Ni, Pb, Se) ☐ ICMS 2, Sediment only (As, Cd, Cr, Cu, Ni, Pb, Se) ☐ ICMS 3, Air Filter only (As, Cd, Cr, Ni, Pb, Se) ☐ ICMS 4, SW846 Water only (As, Be, Cd, Co, Cr, Cu, Ni, Pb, Se) ☐ ICMS 5, SW846 Sediment only (As, Be, Cd, Co, Cr, Cu, Ni, Pb, Se) Single element metals - please list only if NOT using Metals packages ☐ Antimony ☐ Thallium ☐ Beryllium ☐ Tin ☐ Boron ☐ Titanium ☐ Cobalt ☐ Vanadium ☐ Mercury ☐ ☐ Silver ☐ SW846 (Check this box if single elements require SW846 method) The following require prior notification to DES before submittal: ☐ Chromium, Hexavalent (N/P Filt) Other tests are available; please check current price list																																																																															
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And Quality Assurance Practices
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Organic Sample Submission Form

DES Use Only

Sample # _____

MM DD YY

Date Received ____/____/____

Sample Information		(Instructions on Intranet Site)		Parameters																																																																				
Client (Bill to) _____ Project Identity _____ (project identity requires prior approval) No Folder ☐		Template _____ ☐ ----- % Solids, Sed only Volatiles ☐ ----- VOC, 524.2 ☐ ----- VOC, 624 ☐ ----- VOC, 8260 ☐ ----- VOC, TICs																																																																						
Division (check one) DAPC ☐ DDAGW ☐ DERR ☐ DMWM ☐ DSW ☐ Other _____		OEPA District (check one) CO ☐ CDO ☐ NEDO ☐ NWDO ☐ SEDO ☐ SWDO ☐ Other _____																																																																						
Sample Type (check one) Ambient ☐ Complaint ☐ Compliance ☐ Litigation ☐ Survey ☐ Raw ☐ Plant ☐ Distribution ☐ Other _____		Matrix (check one) Air Canister ☐ Drinking water ☐ Ground water ☐ Sediment ☐ Surface water ☐ Waste water ☐ Reagent water ☐ Other _____																																																																						
Collection Date Grab ☐ MM ____ DD ____ YY ____ HH ____ MM ____ (or) Composite ☐ Begin ____/____/____ End ____/____/____		Semivolatiles / Herbicides (See Instructions) ☐ ----- Atrazine, ELISA ☐ ----- Cyanazine, 525.2 ☐ ----- Herbicides, 525.2 ☐ ----- Herbicides, TICs ☐ ----- BNA, 625 ☐ ----- BNA, 8270 ☐ ----- BNA, TICs ☐ ----- SAS-305 ☐ ----- SAS-310																																																																						
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Revised (3/14)

All Rush Samples require prior approval

Chlorophyll a Sample Submission Form

Sample Submission Date: _____ Name/District/Division: _____

One sheet can be used for each batch of samples submitted to the lab regardless of when they were collected. Use the sheet for both water and rock scrape samples. Fill out the appropriate spaces for that particular sample you are collecting. Duplicate filters should be noted in the location. Field blanks should be labeled as such. Field blank should be submitted every 10 filters. ****REMINDER**** - All filters must be filtered in the field, placed in foil, labeled and frozen.

Location	Sample # (for lab use)	Collection Date	Time	Area Scraped (cm ²)	Slurry Volume (ml)	Volume Filtered (ml)

Field Comments: _____

PLANKTON LABELS


DATE: _____
DISTRICT: CDO NEDO NWDO SEDO
SWDO
LAKE: _____

EA3 Station: _____ **STA:** L-1
L-2
SAMPLE DEPTH(S): _____ TO _____ m
PRESERVATIVE: Lugols 70% EtOH

DATE: _____
DISTRICT: CDO NEDO NWDO SEDO
SWDO
LAKE: _____

EA3 Station: _____ **STA:** L-1
L-2
SAMPLE DEPTH(S): _____ TO _____ m
PRESERVATIVE: Lugols 70% EtOH
Other
COLLECTION METHOD: Int. Tube


DATE: _____
DISTRICT: CDO NEDO NWDO SEDO
SWDO
LAKE: _____

EA3 Station: _____ **STA:** L-1
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NOT FOR
OFFICIAL USE
2/13/2008
CH0134
348L-1
Exhibit ID

17 - DEER CREEK
RESERVOIR L-1
SURFACE
H2SO4

NOT FOR
OFFICIAL USE
2/13/2008
CH0134
348L-1
Exhibit ID

17 - DEER CREEK
RESERVOIR L-1
SURFACE
HN03

NOT FOR
OFFICIAL USE
2/13/2008
CH0134
348L-1
Exhibit ID

17 - DEER CREEK
RESERVOIR L-1
SURFACE
NP

NOT FOR
OFFICIAL USE
2/13/2008
CH0134
348L-1
Exhibit ID

17 - DEER CREEK
RESERVOIR L-1
SURFACE
FILTERED + H₂SO₄

NOT FOR
OFFICIAL USE
2/13/2008
CH0134
348L-1
Exhibit ID

18 - DEER CREEK
RESERVOIR L-1
Bottom
H2SO4

NOT FOR
OFFICIAL USE
2/13/2008
CH0134
348L-1
Exhibit ID

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NP

NOT FOR
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2/13/2008
CH0134
348L-1
Exhibit ID

18 - DEER CREEK
RESERVOIR L-1
Bottom
FILTERED + H₂SO₄

NOT FOR
OFFICIAL USE
2/13/2008
CH0134
348L-1
Exhibit ID

19 - DEER CREEK
RESERVOIR L-1 Dup - A
Composite
H2SO4

NOT FOR
OFFICIAL USE
2/13/2008
CH0134
348L-1
Exhibit ID

19 - DEER CREEK
RESERVOIR L-1 Dup - A
Composite
NP

NOT FOR
OFFICIAL USE
2/13/2008
CH0134
348L-1
Exhibit ID

19 - DEER CREEK
RESERVOIR L-1 Dup - A
Composite
FILTERED - H₂SO₄

NOT FOR
OFFICIAL USE
2/13/2008
CH0134
348L-1
Exhibit ID

20 - DEER CREEK
RESERVOIR L-1 Dup - B
Composite
H2SO4

NOT FOR
OFFICIAL USE
2/13/2008
CH0134
348L-1
Exhibit ID

Composite
20 - DEER CREEK
RESERVOIR L-1 Dup - B

NP

NOT FOR
OFFICIAL USE
2/13/2008
CH0134
348L-1
Exhibit ID

20 - DEER CREEK
RESERVOIR L-1 Dup - B
Composite
FILTERED - H₂SO₄

OhioEPA

Date Received (Lab use only)	<table border="1" style="display: inline-table; text-align: center;"> <tr> <td>Year</td> <td>Month</td> <td>Day</td> </tr> <tr> <td style="width: 30px; height: 20px;"></td> <td style="width: 30px; height: 20px;"></td> <td style="width: 30px; height: 20px;"></td> </tr> </table>	Year	Month	Day				Collected by *																																			
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Additional Information/Comments																																											
Condition of Container of Transfer: (Seal all containers) ☐ Locked or Tamper Proof ☐ Unlocked or Not Tamper Proof ☐ Initial																																											
Number of Samples (Containers/Sites) MILITARY TIME																																											
Relinquished by (must be collector*)		<table border="1" style="width: 100%; text-align: center;"> <tr> <th>Year</th> <th>Month</th> <th>Day</th> <th>Hour</th> <th>Minute</th> </tr> <tr><td style="width: 30px; height: 20px;"></td><td style="width: 30px; height: 20px;"></td><td style="width: 30px; height: 20px;"></td><td style="width: 30px; height: 20px;"></td><td style="width: 30px; height: 20px;"></td></tr> <tr><td style="width: 30px; height: 20px;"></td><td style="width: 30px; height: 20px;"></td><td style="width: 30px; height: 20px;"></td><td style="width: 30px; height: 20px;"></td><td style="width: 30px; height: 20px;"></td></tr> <tr><td style="width: 30px; height: 20px;"></td><td style="width: 30px; height: 20px;"></td><td style="width: 30px; height: 20px;"></td><td style="width: 30px; height: 20px;"></td><td style="width: 30px; height: 20px;"></td></tr> <tr><td style="width: 30px; height: 20px;"></td><td style="width: 30px; height: 20px;"></td><td style="width: 30px; height: 20px;"></td><td style="width: 30px; height: 20px;"></td><td style="width: 30px; height: 20px;"></td></tr> <tr><td style="width: 30px; height: 20px;"></td><td style="width: 30px; height: 20px;"></td><td style="width: 30px; height: 20px;"></td><td style="width: 30px; height: 20px;"></td><td style="width: 30px; height: 20px;"></td></tr> <tr><td style="width: 30px; height: 20px;"></td><td style="width: 30px; height: 20px;"></td><td style="width: 30px; height: 20px;"></td><td style="width: 30px; height: 20px;"></td><td style="width: 30px; height: 20px;"></td></tr> <tr><td style="width: 30px; height: 20px;"></td><td style="width: 30px; height: 20px;"></td><td style="width: 30px; height: 20px;"></td><td style="width: 30px; height: 20px;"></td><td style="width: 30px; height: 20px;"></td></tr> </table>		Year	Month	Day	Hour	Minute																																			
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BSA ENVIRONMENTAL
SERVICES, INC.

CHAIN OF CUSTODY

Client Information			Invoice Information		
Client Name:			Invoice To:		
Address:			Address:		
City:	State:	Zip:	City:	State:	Zip:
Contact:			Contact:		
Phone Number:		Fax Number:	Phone Number:		Fax Number:
Email:			Email:		

Project Name:	
Project Number:	
Special Instructions:	

[illegible]

Relinquished By:	Date:	Time:	Received By:	Date:	Time:
Relinquished By:	Date:	Time:	Received By:	Date:	Time:
Relinquished By:	Date:	Time:	Received By:	Date:	Time:

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ATTACHMENT 5

CyberIntern Procedures

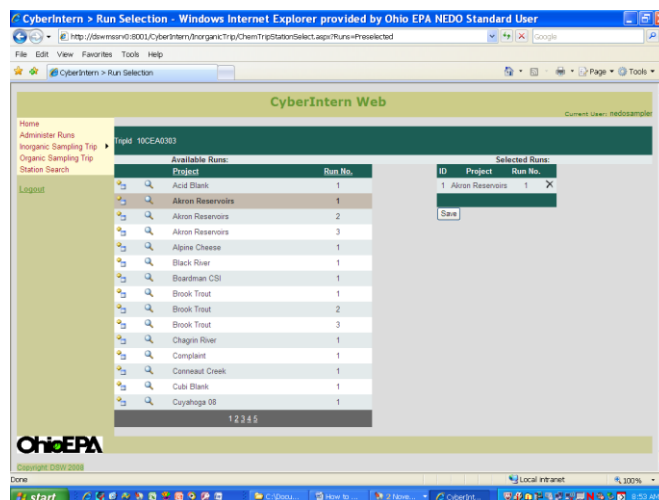
How-To for Lakes Sampling in CyberIntern

[a.k.a. creation of multiple field forms for the same station for the same sampling trip]

1. Create a “Survey” for Inland Lakes Sampling. Each lake can be an individual survey, or a master survey (e.g. “CDO Inland Lakes”) can be used.
2. Create a separate “Run” for each of the sampling stations using the “Administration of Runs” program in CyberIntern. Save the “Run” and exit “Administration of Runs”.
 - ◆ NOTE: it is not possible to use two instances for the same station when creating a “run” within a “survey”. That’s OK.
 - ◆ If you have more than one sampling point (e.g. a beach or boat ramp site) and you will not be collecting from multiple depths at the other location(s), create a separate “run” for the location(s) in your “survey”. Do not include it with your L-1 site in a “run” [this will prevent the creation of multiple sets of paperwork for stations where only the surface will be sampled].
 - ◆ Since we will be sampling more often using the Inland_Lakes_Water template, use it as the default for the L-1 site. For locations where only bacteria will be collected, use the “-” (no template) option and check off parameters and container types on the sample submission form manually.
 - ◆ The system is now ready for the creation of trips.
3. Create a new “Trip” under the “Generate a New Trip” program in CyberIntern.
4. After entering the sampling information (date, division, location, crew leader, additional samplers, vehicle, and type of sampling), select the “Run” from the pick list (e.g. “Inland Lakes-NEDO” Run 1). This will give 1 instance of the “Run” in the “Chosen Run(s)” field.

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Example:



- To allow for sampling at multiple depths, repeat picking the same “Run” as many times as necessary to give the number of instances needed in the “Chosen Run(s)” field (*e.g., for surface, metalimnion, and hypolimnion samples, create 3 instances of the “Run”*).

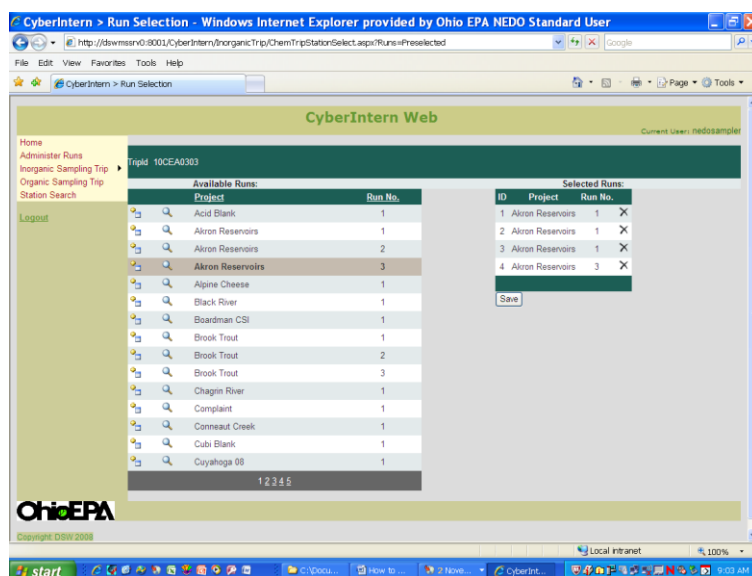
Example (creation of a BATHTUB run for a lake, three instances of the same run selected – this will allow sampling at three depths):



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- ◆ NOTE 1: this **does not** equate to creating a field duplicate. As with any sampling run, duplicates should be created by checking the “Field Duplicate” check box on the “Trip Creator” form.
- ◆ NOTE 2: for BATHTUB sampling select your L-1 station run three times when creating the trip (epilimnion, metalimnion, hypolimnion).
- ◆ NOTE3: when sampling multiple lakes, repeat the procedure to provide the correct number of instances for that lake as well.
- ◆ NOTE4: if a bacteria only site is included in the trip, select that run only once.

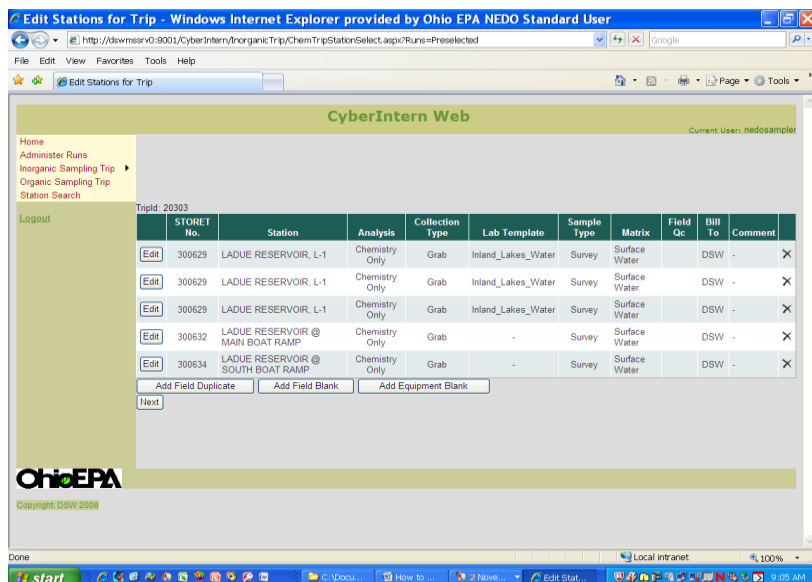
Example (bacteria site run added to the list):



6. Hit “Save” to proceed to the site-specific window.
7. The list of stations, template information, sample type (grab or composite), and “bill to”, and “comments” (**VERY IMPORTANT**) information for each sample can now be modified.

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Example (starting window for editing the sites):



- ◆ Note that the “Analysis” column may need to be changed to reflect the addition or subtraction of chemistry samples, bacteria samples, or both.
- ◆ **The depth of sample collection should be added at this stage in the “comments” column to differentiate the samples.**
- ◆ Add field dups or blanks at this stage as with any other trip.

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Example (completed trip creation page – note: field blank added):

The screenshot shows a web application titled 'Edit Stations for Trip - Windows Internet Explorer provided by Ohio EPA NEDO Standard User'. The browser address bar shows a URL starting with 'http://devmsr+0:8001/CyberIntern/InorganicTrip/ChemStationList.asp?SampleTripId=20303'. The application interface includes a sidebar with navigation links like 'Home', 'Administer Runs', 'Inorganic Sampling Trip', 'Organic Sampling Trip', and 'Station Search'. The main content area displays a table for 'Trip 20303' with the following data:

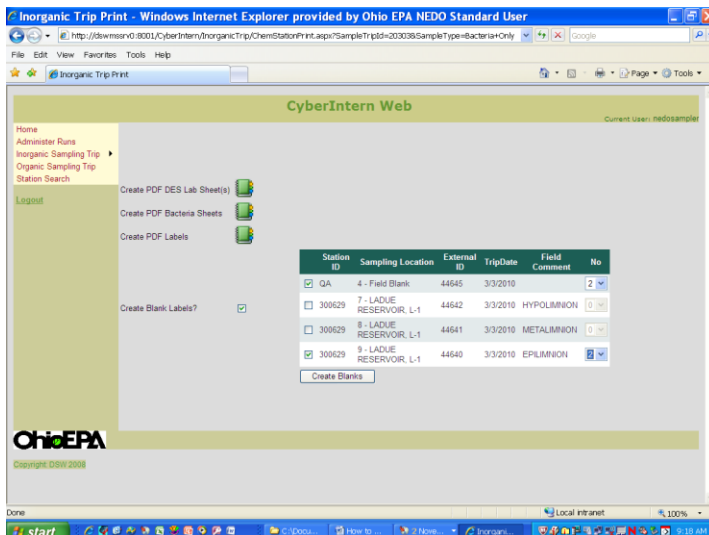
	STORET No.	Station	Analysis	Collection Type	Lab Template	Sample Type	Matrix	Field Qc	Bill To	Comment
Edit	300629	LADUE RESERVOIR, L-1	Chem + Bact	Grab	BATHTUB	Survey	Surface Water		DSIW	EPIUMINON
Edit	300629	LADUE RESERVOIR, L-1	Chemistry Only	Grab	BATHTUB	Survey	Surface Water		DSIW	METALMINON
Edit	300629	LADUE RESERVOIR, L-1	Chemistry Only	Grab	Inland_Lakes_Water	Survey	Surface Water		DSIW	HYPOLIMNION
Edit	300632	LADUE RESERVOIR @ MAIN BOAT RAMP	Bacteria Only	Grab	-	Survey	Surface Water		DSIW	SURFACE
Edit	300634	LADUE RESERVOIR @ SOUTH BOAT RAMP	Bacteria Only	Grab	-	Survey	Surface Water		DSIW	SURFACE
Edit	QA	QA/QC Sample	Chemistry Only	Grab	BATHTUB	Other	Reagent Water	FB	DSIW	-

Below the table are buttons for 'Add Field Duplicate', 'Add Field Blank', and 'Add Equipment Blank'. A 'Next' button is located at the bottom left of the table area. The Ohio EPA logo and 'Copyright ©2008' are visible at the bottom of the application window.

8. Hit the “Next” button to proceed to lab sheet creation.
9. **IMPORTANT:** Make sure to create any extra labels needed for chlorophyll prior to finalization of the sheet/label creation.

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Example (screen for creation of blank labels – create as many as needed for the trip – in the example, two additional labels were created for chlorophyll for the epilimnion and the field blank)



10. Create the pdf files, print sheets and labels.

11. Go enjoy your day in the field!

ATTACHMENT 6

Protocol for Processing Cyanotoxin Sample Submissions at DES

Terminology:

Responsive HAB sampling - When samples are taken from finished water during a bloom event, or from a bloom at an intake, beach or other contact recreation area

Contact Recreation Area – Water area where swimming, wading, diving, jet skiing, water skiing, tubing, wakeboarding, windsurfing, kite boarding, or any other in-water activity may occur that is likely to result in immersion or ingestion of water.

Processing Protocol: For Responsive HAB sampling (should be identified on the Sample Submission Form and collection container)

Phytoplankton samples will be preserved with Lugol's iodine within 8 hours of collection. A notation on the Sample Submission Form shall include the time of collection and the time of Lugol's solution was added to the sample. Any phytoplankton samples not preserved within 8 hours of collection will have qualified results.

All phytoplankton samples will be submitted to BSA and will be reviewed under a light microscope to determine the genus, species and biovolume. All cyanotoxin samples submitted to DES will be analyzed for microcystin and cylindrospermopsin

Cyanotoxin samples from raw water will be processed for total toxin. Cyanotoxin samples from finished water will be processed for free toxins. Finished water samples must be quenched with 10 mg sodium thiosulfate or ascorbic acid added per 100 mL of sample during collection.

Samples shall be analyzed for cyanotoxins within 24 hours of receipt if the chief of DSW or DDAGW (or their alternate) approve of expedited processing and reporting of results. For non-expedited processing of samples collected for responsive sampling, samples shall be analyzed for cyanotoxin within 5 days of collection. If cyanotoxin samples cannot be processed within 5 days of collection, samples shall be frozen until they can be processed.

ATTACHMENT 7 (A)

Data Quality Objectives – Sediment (See Lake Sampling Procedures - Sediment Samples)

Table 1. PAH Final Chronic Values and Maximums

PAH	Final Chronic Value (µg/g_{oc})	Maximum (µg/g_{oc})
Indan	349	127200
Naphthalene	385	61700
C1-naphthalenes	444	--
1-methylnaphthalene	446	165700
2-methylnaphthalene	447	154800
Acenaphthylene	452	24000
Acenaphthene	491	33400
1-ethylnaphthalene	507	142500
2-ethylnaphthalene	509	129900
C2-naphthalenes	510	--
1,4-dimethylnaphthalene	510	192300
1,3-dimethylnaphthalene	513	157100
2,6-dimethylnaphthalene	513	33800
2,3-dimethylnaphthalene	513	49900
1,5-dimethylnaphthalene	514	62400
Fluorene	538	26000
C3-naphthalenes	581	--
2,3,5-trimethylnaphthalene	584	--
1,4,5-trimethylnaphthalene	584	129300
Anthracene	594	1300
Phenanthrene	596	34300
C1-fluorenes	611	--
1-methylfluorene	612	49700
C4-naphthalenes	657	--
2-methylanthracene	667	2420
1-methylanthracene	667	--
9-methylanthracene	668	21775
2-methylphenanthrene	669	--
1-methylphenanthrene	670	24100
C1-phenanthrene/anthracenes	670	--
9-ethylfluorene	673	--
C2-fluorenes	686	--
Pyrene	697	9090
Fluoranthene	707	23870
2-ethylanthracene	739	--
C2-phenanthrene/anthracenes	746	--

PAH	Final Chronic Value (µg/g_{oc})	Maximum (µg/g_{oc})
9,10-dimethylanthracene	748	14071
3,6-dimethylphenanthrene	749	--
C3-fluorenes	769	--
C1-pyrene/fluoranthenes	770	--
2,3-benzofluorene	787	558
Benzo(a)fluorene	787	12500
C3-phenanthrene/anthracenes	829	--
Naphthacene	838	207
Benz(a)anthracene	841	4153
Chrysene	844	826
Triphenylene	846	19400
C4-phenanthrene/anthracenes	913	--
C1-benzanthracene/anthracenes	929	--
C3-pyrene/fluoranthenes	949	--
Benzo(a)pyrene	965	3840
Perylene	967	431
Benzo(e)pyrene	967	4300
Benzo(b)fluoranthene	979	2169
Benzo(j)fluoranthene	981	3820
Benzo(k)fluoranthene	981	1220
C2-benzanthracene/chrysenes	1008	--
9,10-dimethylbenz(a)anthracene	1021	124200
7,12-dimethylbenz(a)anthracene	1021	145300
7-methylbenzo(a)pyrene	1058	--
Benzo(ghi)perylene	1095	648
C3-benzanthracene/chrysenes	1112	--
Indeno(1,2,3-cd)pyrene	1115	--
Dibenz(a,h)anthracene	1123	2389
Dibenz(a,j)anthracene	1123	47680
Dibenz(a,c)anthracene	1129	7400
C4-benzanthracene/chrysenes	1214	--
C1-dibenz(a,h)anthracenes	1221	--
Coronene	1230	821
C2-dibenz(a,h)anthracenes	1325	--
C3-dibenz(a,h)anthracenes	1435	--

From: U.S. EPA's Procedures for the Derivation of Equilibrium Partitioning Sediment Benchmarks (ESBs) for the Protection of Benthic Organisms: PAH Mixtures, Office of Research and Development, November 2003, EPA/600/R-02/013.
<http://www.epa.gov/nheerl/publications/files/PAHESB.pdf>

Table 2. PAH Uncertainty Factors

Percentile	13 PAH Uncertainty factor	23 PAH Uncertainty factor
50	2.75	1.64
80	6.78	2.8
90	8.45	3.37
95	11.5	4.14
99	16.9	6.57

From: U.S. EPA's Procedures for the Derivation of Equilibrium Partitioning Sediment Benchmarks (ESBs) for the Protection of Benthic Organisms: PAH Mixtures, Office of Research and Development, November 2003, EPA/600/R-02/013.
<http://www.epa.gov/nheerl/publications/files/PAHESB.pdf>

ATTACHMENT 7(B)

Data Quality Objectives – Water Column

(See Lake Sampling Procedures – Water Samples)

1) Water Quality Standards

Ohio Administrative Code 3745-1-07

2) MDLs and RLs

http://epaintra.epa.state.oh.us/des/html/limits_ rls_ mdl_ .html

Note: The correct Metal RLs are as follows:

OhioEPA Division of Environmental Services

Reporting Limits

DRINKING WATER						
PARAMETER	REPORTING LIMITS	UNITS	CAS NUMBER	REFERENCE	ANALYTICAL METHOD ELIMS	DESCRIPTION
Aluminum	200µg/L	P1105	USEPA200.7	ICP DW	ICP	
Antimony	2µg/L	P1097	USEPA200.8	ICPMS DW	ICPMS	
Arsenic	2µg/L	P1002	USEPA200.8	ICPMS DW	ICPMS	
Barium	15µg/L	P1007	USEPA200.7	ICP DW	ICP	
Beryllium	0.2µg/L	P1012	USEPA200.8	ICPMS DW	ICPMS	
Cadmium	0.2µg/L	P1027	USEPA200.8	ICPMS DW	ICPMS	
Calcium	2mg/L	P916	USEPA200.7	ICP DW	ICP	
Chromium	2µg/L	P1034	USEPA200.8	ICPMS DW	ICPMS	
Cobalt	2µg/L	P1037	USEPA200.8	ICPMS DW	ICPMS	
Copper	2µg/L	P1042	USEPA200.8	ICPMS DW	ICPMS	
Hardness, Total	10mg/L	P900	USEPA200.7	ICP DW	ICP	
Iron	50µg/L	P1045	USEPA200.7	ICP DW	ICP	
Lead	2µg/L	P1051	USEPA200.8	ICPMS DW	ICPMS	
Magnesium	1mg/L	P927	USEPA200.7	ICP DW	ICP	
Manganese	10µg/L	P1055	USEPA200.7	ICP DW	ICP	
Mercury	0.2µg/L	P71900	USEPA245.1	Mercury DW	COLD VAPOR	
Nickel	2µg/L	P1067	USEPA200.8	ICPMS DW	ICPMS	
Potassium	2mg/L	P937	USEPA200.7	ICP DW	ICP	
Selenium	2µg/L	P1147	USEPA200.8	ICPMS DW	ICPMS	
Silver	0.2µg/L	P1077	USEPA200.8	ICPMS DW	ICPMS	
Sodium	5mg/L	P929	USEPA200.7	ICP DW	ICP	
Strontium	30µg/L	P1082	USEPA200.7	ICP DW	ICP	
Thallium	1.5µg/L	P1059	USEPA200.8	ICPMS DW	ICPMS	
Tin	2µg/L	P1102	USEPA200.8	ICPMS DW	ICPMS	
Zinc	10µg/L	P1092	USEPA200.7	ICP DW	ICP	

AQUEOUS, SURFACE WATER, WASTEWATER						
PARAMETER	REPORTING LIMITS	UNITS	CAS NUMBER	REFERENCE	ANALYTICAL METHOD ELIMS	DESCRIPTION
Aluminum	200µg/L	P1105	USEPA200.7	ICP (WAT)	ICP	
Antimony	2µg/L	P1097	USEPA200.8	ICPMS (WAT)	ICPMS	
Arsenic	2µg/L	P1002	USEPA200.8	ICPMS (WAT)	ICPMS	
Barium	15µg/L	P1007	USEPA200.7	ICP (WAT)	ICP	
Beryllium	0.2µg/L	P1012	USEPA200.8	ICPMS (WAT)	ICPMS	
Cadmium	0.2µg/L	P1027	USEPA200.8	ICPMS (WAT)	ICPMS	
Calcium	2mg/L	P916	USEPA200.7	ICP (WAT)	ICP	
Chromium	2µg/L	P1034	USEPA200.8	ICPMS (WAT)	ICPMS	
Cobalt	2µg/L	P1037	USEPA200.8	ICPMS (WAT)	ICPMS	
Copper	2µg/L	P1042	USEPA200.8	ICPMS (WAT)	ICPMS	
Hardness, Total	10mg/L	P900	USEPA200.7	ICP (WAT)	ICP	
Hexavalent Chromium	10µg/L	P1220	SM3500-GRD	CR+6	SPECTROPHOTOMETER	
Iron	50µg/L	P1045	USEPA200.7	ICP (WAT)	ICP	
Lead	2µg/L	P1051	USEPA200.8	ICPMS (WAT)	ICPMS	
Magnesium	1mg/L	P927	USEPA200.7	ICP (WAT)	ICP	
Manganese	10µg/L	P1055	USEPA200.7	ICP (WAT)	ICP	
Mercury	0.2µg/L	P71900	USEPA245.1	Mercury (WAT)	COLD VAPOR	
Nickel	2µg/L	P1067	USEPA200.8	ICPMS (WAT)	ICPMS	
Potassium	2mg/L	P937	USEPA200.7	ICP (WAT)	ICP	
Selenium	2µg/L	P1147	USEPA200.8	ICPMS (WAT)	ICPMS	
Silver	0.2µg/L	P1077	USEPA200.8	ICPMS (WAT)	ICPMS	
Sodium	5mg/L	P929	USEPA200.7	ICP (WAT)	ICP	
Strontium	30µg/L	P1082	USEPA200.7	ICP (WAT)	ICP	
Thallium	1.5µg/L	P1059	USEPA200.8	ICPMS (WAT)	ICPMS	
Tin	2µg/L	P1102	USEPA200.8	ICPMS (WAT)	ICPMS	

ATTACHMENT 7 (C)

Data Quality Objectives– Phytoplankton, Cyanotoxin, Zooplankton (See Lake Sampling Procedures - Plankton Samples)

Phytoplankton:

Collect sample with an integrated tube sampler; dispense in a churn splitter or clean container and thoroughly mix. Collect a 100 ml sub-sample and preserve with Lugols Iodine.

Cyanotoxin:

Ohio EPA developed thresholds for several cyanotoxins which are detailed below:

Threshold (µg/L)	Microcystin*	Anatoxin-a	Cylindrospermopsin	Saxitoxin*
Recreational Public Health Advisory	6	80	5	0.8
Recreational No Contact Advisory	20	300	20	3

Zooplankton:

Collect sample with an 80 micron Wisconsin dip net. Identify to species and identify dominance by using a semi-quantitative approach for the purpose of identifying the phytoplankton assemblage which dominates in the lake. This information is used to evaluate the temporal dynamics of each type of plankton in the lake and to identify relative abundance of non-native species with implications for management to meet goals.

ATTACHMENT 8

Public Water System Lakes Sampling

If the lake sampled has a public water system intake, these are the specific requirement from DDAGW:

CYANOTOXINS:

- Collect samples during all 5 sampling events for both Year 1 and Year 2.
- Sample for microcystin, cylindrospermopsin and qPCR (1- 250 ml PETG bottle, no preservative, remove from sunlight and cool immediately)
- Sample for saxitoxin (40 mL glass vial, pre-preserved, remove from sunlight and cool immediately)
- Collect at intake location. Can sample at L-1 if within 500 yards of intake structure and no tributaries entering lake between L-1 and intake.
- Collect samples using integrated tube sampler within photic zone, following phytoplankton sampling guidelines.
- Collect a separate surface sample if a surface accumulation or scum is visible (collect where biomass is highest, based on visual observation).
- Collect a separate bottom sample for qPCR (1 125 ml PETG bottle) using a sub-sample from the discrete sampler
- Use a separate inorganic sample submission sheet for cyanotoxins.
- Holding time is 5 days.

ATRAZINE:

- Collect in a 40 mL glass vial during all 5 sampling events for Year 1 (ELISA method, no preservative)
- If results all below 1.5 ug/L, can continue to use the ELISA method in Year 2. Otherwise, collect using method 525.2 (2 amber glass jars)

NITRATE:

Collect nitrate during all 5 sampling events for both Year 1 and Year 2. (1 liter Cubitainer, no preservative)