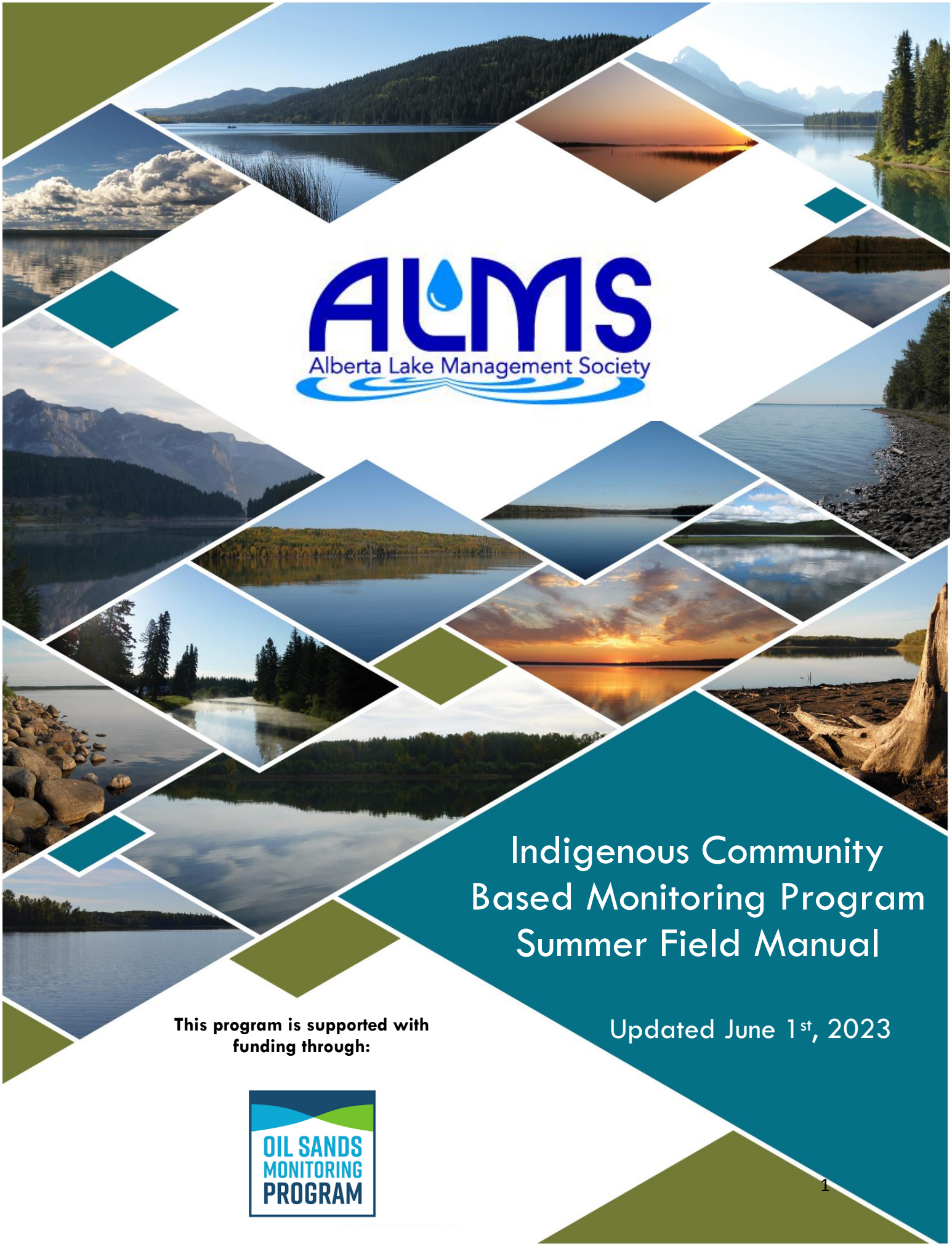

Alberta Lake Management Society

Indigenous Community Based Monitoring Program Summer Field Manual

Updated June 1st, 2023

This program is supported with funding through:

OIL SANDS MONITORING PROGRAM

Table of Contents

Appendix:

For field sheets, shipping information, and a list of open water safety gear, visit: https://alms.ca/icbm/

This manual was prepared by Kurstyn Perrin. For more information, please contact: kurstyn.cappis@alms.ca or the ALMS office at 780-702-2567.

Manual last updated: June 1st, 2023

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1) BEFORE YOU HEAD OUT:

a) **Freeze a few ice packs the night before** a sampling trip to have some to bring out with the bottle set and to ship samples back to the office.

b) Make sure your probe is charged (see battery on top right of probe screen).

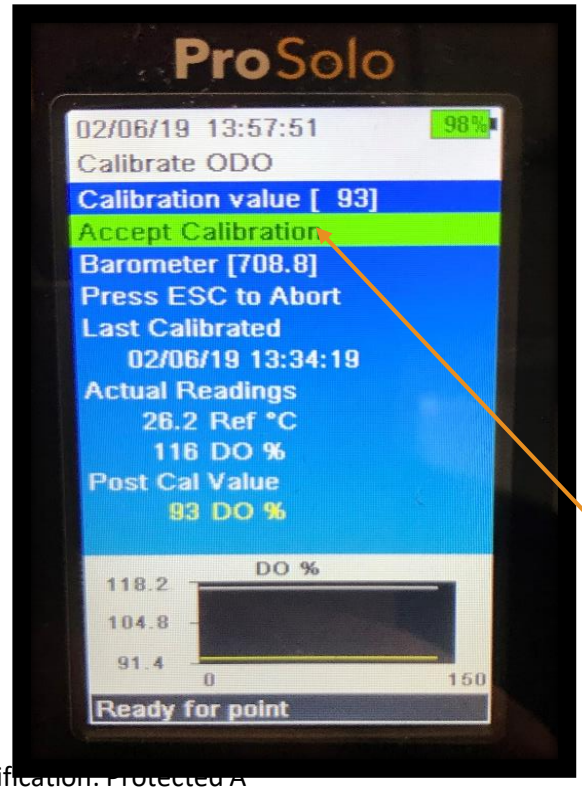
c) Review your GPS coordinates from the last trip if you have already been out to the site.

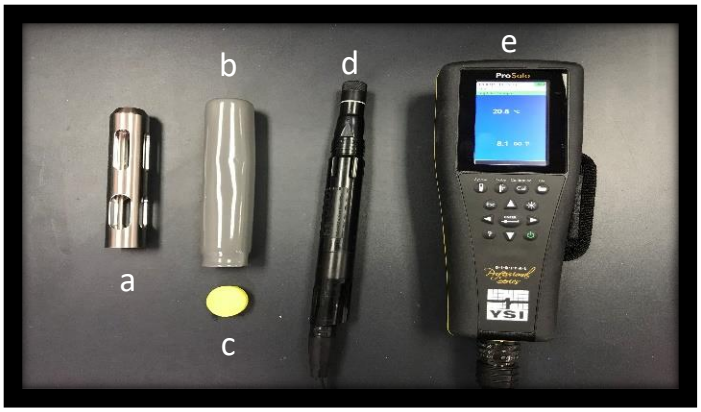
d) Plan a timeline for sample return with ALMS. If you are sampling in the morning, plan to filter chlorophyll either shortly after the trip or in the afternoon, in order to ship out samples that day or next day at the latest.

e) Bring a small cooler out to the site with your bottle site and a **cold ice pack.**

f) Always check the weather beforehand. If the wind gusts are too strong or a storm may pass through, re-schedule for another day.

g) Make sure your boat has enough gas and oil to be out on the lake for 1-2 hours. Make sure you have all boat safety gear and an **anchor with an appropriate length rope.**





2) CALIBRATE PROBE FOR DISSOLVED OXYGEN :

a) Calibrate your probe in your vehicle or at the lake on shore.

b) Remove the **grey sleeve** (b) from your **probe** (d).

c) Remove the **metal probe guard** (a) and gently wipe any water droplets from the probe with a Kimwipe (supplied tissue).

d) Carefully place the metal guard back over your probe.

e) There is a yellow sponge inside the grey calibration sleeve. Using water from the calibration bottle, wet the **yellow sponge** (c) with a few millilitres of water.

f) Place the grey sleeve (with yellow sponge inside) over the metal guard.

g) Wait five minutes to allow the air in the probe to become saturated with moisture from the sponge.

h) Connect your probe to your **handheld unit** (e).

i) Press the green power button on your handheld unit.

j) Press Cal

k) Choose ODO or DO by pressing Enter

l) Choose DO % by pressing Enter

m) Wait one minute or until the lines stabilize in black graph.

n) **Record the Barometer value on the front of your field sheet.**

o) Choose 'Accept Calibration' by pressing Enter.

p) Press escape until you see the 'log one sample ' screen.

q) Keep the metal guard on the probe, but keep the grey sleeve off as the probe needs to be calibrated for conductivity next.

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3) CALIBRATE PROBE FOR CONDUCTIVITY:

a) Calibrate your probe in your vehicle or at the lake on shore.

b) Remove the **grey sleeve** (b) from your **probe** (d) and place inside the graduated cylinder.

c) Fill up the graduated cylinder to the top with the conductivity calibration solution, so that the conductivity sensor (see below) is submerged. Let sit for 5 minutes.

d) If not done already, connect your probe to your **handheld unit** (e).

e) Turn on the handheld unit, and navigate to the conductivity calibration window: Press Cal 

f) Choose Conductivity by pressing Enter.

g) Choose Sp. Conductance by pressing Enter.

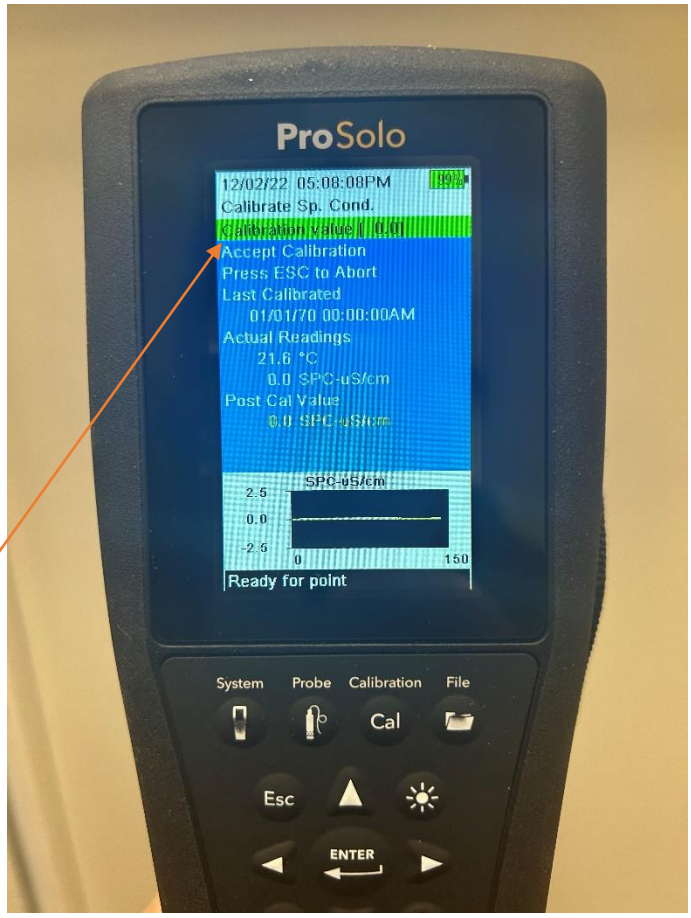
h) Change the "Calibration value" to the conductivity calibration solution used (this will be marked on the bottle, units are in µS/cm). **Record this value on the field sheet as well.**

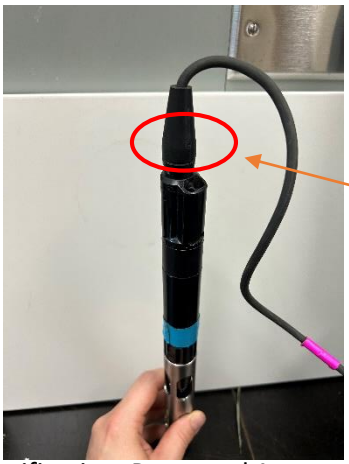
i) Watch the line on the bottom and wait 1 minute, or until the line stabilizes and then press "Accept Calibration".

j) Calibration is complete. Rinse the probe with water before putting the grey sleeve back on the probe.

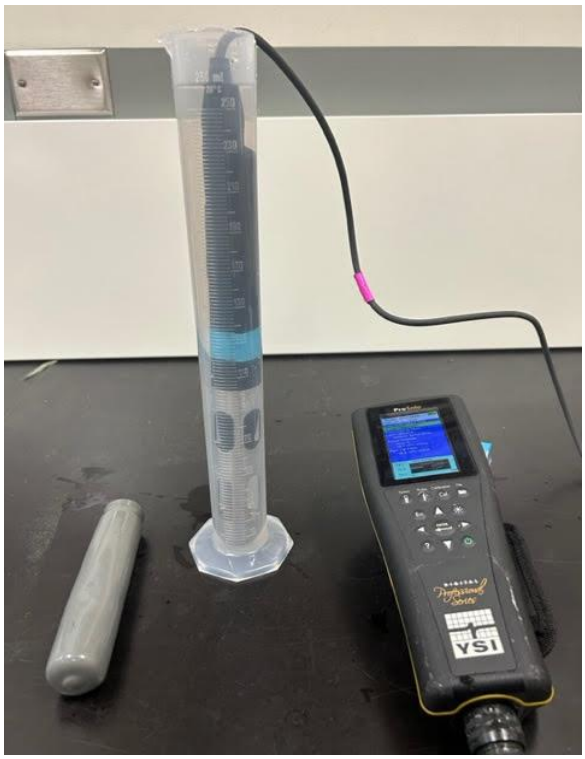
k) Press 'ESC' until back at the home screen. Power down the handheld.

Do not re-use the conductivity solution





Conductivity sensor



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4) RECORD BOTTOM DEPTH AND MEASUREMENTS:

a) Fill in the Environmental Observations portion of your field sheet. Use a weather app to find Air Temperature, Wind Direction, Wind Speed and 24 Hour Rainfall amounts. See Appendix (A4) for **cyanobacteria bloom** identification tips.

b) Use the 'tape and weight' to determine the bottom depth in meters, and record the depth in the '**Approximate Bottom Depth**' box on the back of the field sheet.

c) Measure your **Secchi Depth** with your secchi disk. See page 4 for instructions on measuring secchi depth.

d) With your probe turned on to the 'Log One Sample' screen, remove the grey sleeve, keep the metal guard on and lower the probe until the 0.1 m marker is at the surface of the water.

e) If your backlight turns off during sampling, press any key to reactivate it.

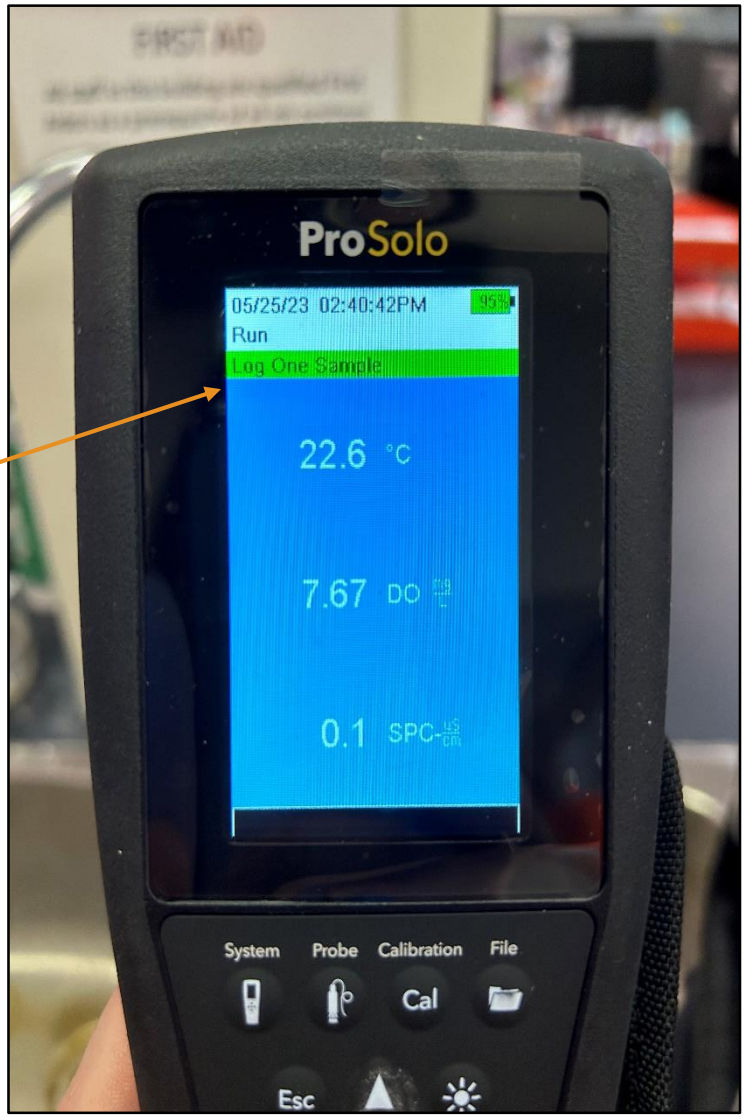
f) Record the Temperature, Dissolved oxygen and Conductivity measurements on your field sheet following the depths indicated in the 'Depth (m)' row (see Appendix: step A3 on page 13 for guide on cord depth markings)

g) You may need to wait 30-60 seconds for your dissolved oxygen readings to stabilize at each depth.

h) Continue this process until you have hit the bottom of the lake.

i) Hold the Power Button to turn off your probe.

j) Place the grey sleeve with wet sponge inside back over the metal guard. Return the probe to the warm sampling kit.



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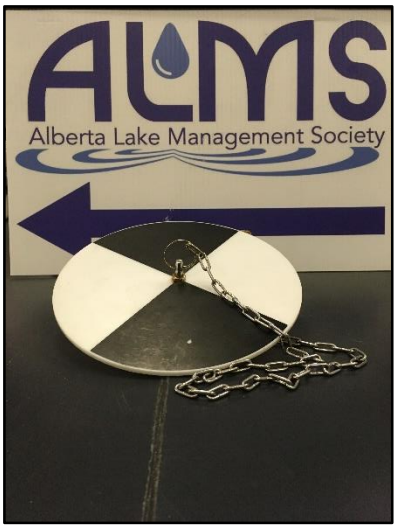
5) MEASURING SECCHI DEPTH



1. After you have measured your bottom depth, grab your secchi disk.
2. On the **shady side** of the boat with your **sunglasses removed**, lower the secchi disk until just below the surface of the water and hold here. (Note: depending on the angle of the sun, it may not be possible to locate a shady side of the boat). Record the "**Colour of Secchi**" on your field sheet. Note what colour the water appears against the white stripes on the disk.
3. Next, slowly lower the disk- make sure to keep track of your depth by looking at the different coloured zip ties, refer to the Secchi Chain Marking Guide. The chain is already marked in meters.
4. Slowly lower the disk until the white stripes are no longer visible. Record this depth on the field sheet under '**Disappears**'.
5. Slowly raise the Secchi disk back up until you can just see the white stripes again. Record this depth on the field sheet under '**Visible**'.
6. Take the Secchi disk out of the water and find the average of the above two depths you recorded, this will be your secchi disk depth. Record this on your field sheet.

Example: Your disk disappears at a depth of 8.3 m and reappears at a depth of 7.7 m. Your Secchi depth would be 8 m.

Secchi Chain Marking Guide:

White: Every 0.1 m
Orange: Every 0.5 m
Pink: Every 1 m
Pink & Yellow: 5 & 15 m
Pink & Green: 10 m

In 2022, the Pigeon Lake Watershed Association made a secchi depth training video. The link for this video can be found on the ICBM webpage on the ALMS website:

https://alms.ca/icbm/

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Preservative MSDS information can be found on the ALMS website at: https://alms.ca/icbm/

Label all bottles with the same sample time

6) COLLECT WATER SAMPLE WITH G2-Preserved BOTTLE:

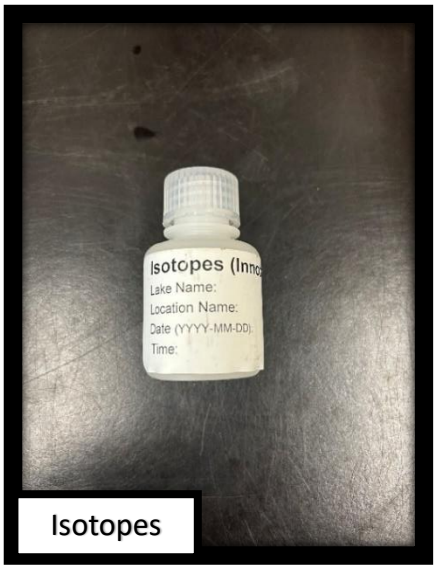
a) Using a Sharpie, label your **G2-Preserved Bottle** with the Lake Name, Location Name, Date, and Time.

b) Rinse the bottle three times with water from below the surface.

c) After rinsing, fill your **G2-Preserved Bottle** with water from below the surface.

d) Add one **yellow capped preservative** (c) to your **G2-Preserved Bottle** . Wear disposable gloves and goggles as this preservative contains sulfuric acid.

e) Place the bottle into your cooler.



7) COLLECT WATER SAMPLE WITH ISOTOPES BOTTLE:

a) Using a Sharpie, label your **Isotopes Bottle** with the Lake Name, Location Name, Date, and Time.

b) Rinse the bottle three times with water from below the surface.

c) After rinsing, fill your **Isotopes Bottle** with water from below the surface.

d) Place the sample into your cooler.

8) COLLECT WATER SAMPLE WITH G2-F BOTTLE:

a) Using a Sharpie, label your **G2-F Bottle** with the Lake Name, Location Name, Date, and Time.

b) Rinse the bottle three times with water from below the surface.

c) After rinsing, fill your **G2-F Bottle** with water from below the surface.

d) Place the sample into your cooler.

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9) COLLECT WATER SAMPLE WITH ROUTINE BOTTLE:

a) Using a Sharpie, label your **Routine Bottle** with the Lake Name, Location Name, Date, and Time.

b) Rinse the bottle three times with water from below the surface.

c) After rinsing, fill your **Routine Bottle** with water from below the surface.

d) Place the sample into your cooler.

10) COLLECT WATER SAMPLE WITH G1-TSS BOTTLE:

a) Using a Sharpie, label your **G1-TSS Bottle** with the Lake Name, Location Name, Date, and Time.

b) Rinse the bottle three times with water from below the surface.

c) After rinsing, fill your **G1-TSS Bottle** with water from below the surface.

d) Place the sample into your cooler.

11) COLLECT WATER SAMPLE WITH MICROCYSTIN BOTTLE:

a) Using a Sharpie, label your **Microcystin Bottle** with the Lake Name, Location Name, Date, and Time.

b) Rinse the bottle three times with water from below the surface.

c) After rinsing, fill your **Microcystin Bottle** with water from below the surface. **Be sure to leave some head room in the bottle** (fill ¾ of the bottle). This will prevent the sample from bursting when placed in the freezer.

d) Place the sample into your cooler.

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12) COLLECT WATER SAMPLE WITH CHLOROPHYLL-A BOTTLES:

a) Using a Sharpie, label your **Chlorophyll-A Bottle** with the Lake Name, Location Name, Date, and Time.

b) Rinse the bottles three times with water from below the surface.

c) After rinsing, fill your **Chlorophyll-A Bottle** with water from below the surface.

d) Place the sample into your cooler.

e) FOR FILTERING WATER FROM CHLOROPHYLL-A BOTTLES, PROCEED TO STEP 15.

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13) WHAT TO DO AFTER SAMPLING

a) BOTTLE STORAGE

Once sampling has finished, return to the office or home. It is important to properly store the different bottles in order to preserve the sample until you are ready to ship. Please refer to the chart below for hold times and proper storage location. Please do not hesitate to contact the office if you are unsure.

Table 1. Bottle storage & shipping for ICBM Program

Bottles	Hold Times	How to Store Until Shipment
Routine, G1-TSS, G2-Preserved, G2-F, Isotopes	**3 days**	Store in fridge to keep cold, **DO NOT FREEZE**
Microcystin	**3 months when frozen**	Store in freezer after returning from the sample site
Chlorophyll-a	***Filtering must be done within 24 hours of collection time***	**Before filtering:** Store in fridge to keep cold **After filtering:** All 3 filters can be stored in a Ziploc bag in the freezer *Refer to Chlorophyll Filtering guide on page 10

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14) WHAT TO DO AFTER SAMPLING

b) Shipping Samples

1. Pack all of your bottles, including the chlorophyll filters and microcystins bottle from the freezer, into a cooler.
2. Make sure to include a frozen ice pack or two depending on the size of your cooler.
3. Please include a copy of the field sheet in a Ziploc bag or you can email it if you prefer.
4. Tape the cooler shut.
5. Refer to the **'ICBM Shipping Slip'** included with your kit when filling out the courier information. You can use our Purolator account number which will be included on the slip.
6. Please send a picture of the **tracking number** to Kurstyn.cappis@alms.ca or by text message.

ICBM SHIPPING SLIP

ALMS Purolator Account #

Alberta Lake Management Society

Attn: Kurstyn Perrin

4816 89 St

Edmonton, AB T6E 5K1

Please choose Overnight or Express shipping

PLEASE HOLD ONTO THIS SLIP AS A REFERENCE FOR THE SAMPLING SEASON

Important Reminders:

- Check with your courier for the daily cutoff times for overnight shipments. Samples must be submitted before these times if they are to arrive to our office the next day.
- Sampling any day between Sunday-Wednesday is ideal and will ensure samples are received before hold times. Thursday mornings can work as long as samples can be shipped by the afternoon and before courier cutoff time.
- Our office will be closed for holidays **July 3rd, Aug 7th & Sept 4th** and cannot receive samples.

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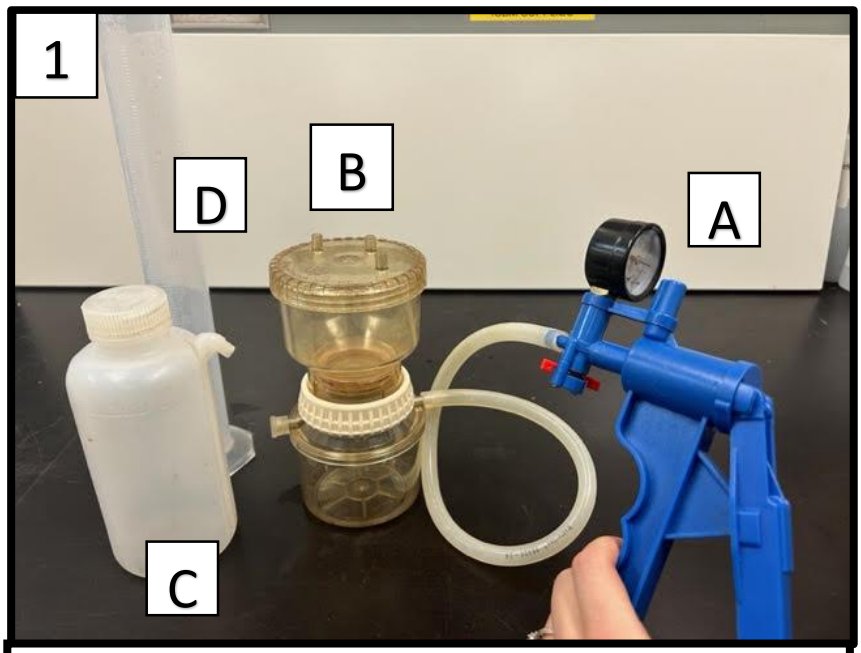
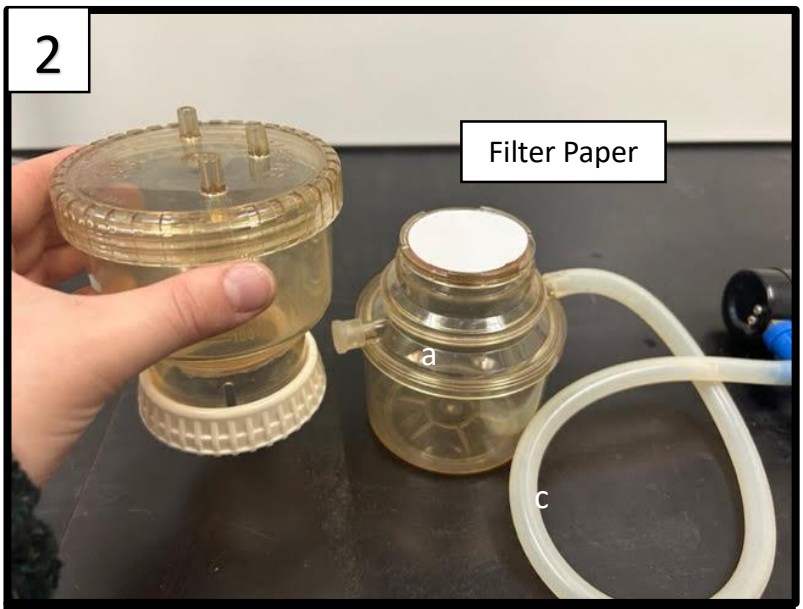
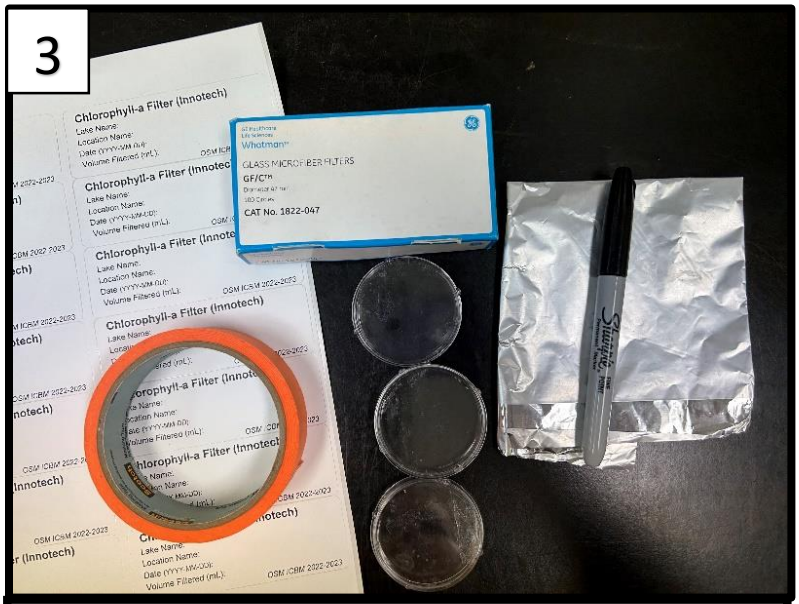
15a) CHLOROPHYLL-A FILTERING



A. Hand pump connected with rubber tubing to filtration system
B. Filtration system
C. Wash bottle
D. Graduated cylinder



1. Unscrew filter top
2. Place filter paper on filter bottom
3. Screw top back on
4. Begin filtering process (page 11)



1. Label petri dishes with provided labels
2. Tape petri dishes closed
3. Wrap petri dishes in aluminum foil
4. Put into freezer until ready to ship

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15b) FILTER WATER FROM CHLOROPHYLL-A BOTTLES:

a) Filtering must be done away from direct light and on a level surface **within 24hrs of collecting water**. Keep the chlorophyll bottle cold in the fridge until ready to filter. Put on disposable gloves to avoid contamination.

b) Set up the chlorophyll filtering apparatus as shown on page 9. Make sure the tubing is connected tightly. You will need the following pieces: 500 mL filter apparatus, hand pump, filter paper, graduated cylinder, pure water poured into your squirt bottle and tweezers.

c) Unscrew the top piece of the filter apparatus and use the tweezers to place one filter paper on the funnel **covering all the holes**. Screw the top back on.

d) Wet the filter paper with **pure water**, provided in the kit.

e) Use the hand pump to gently increase pressure and allow water to filter through to the flask underneath.

f) Shake the **Chlorophyll-a bottle** to mix the water, measure 50 mL of lake water using the graduated cylinder and pour onto filter paper. **Maintain pressure while pouring lake water onto the filter paper.** Pump until all the water has drained.

g) Repeat step **f** until there is only a SLIGHT green colour visible on the filter paper. Do not filter more than **300mL** (since you only have 1L of water in the bottle). If you can't tell if the paper is green, gently pick it up with tweezers and look at it. Record the **colour observed on the first filter paper** on the back side of the field sheet under the 'Chlorophyll-A Filter Volumes' table.

i) Once enough lake water has been filtered, triple rinse the graduated cylinder and inside filter apparatus with **pure water** onto the filter paper. Pump as you go.

j) If the filter flask becomes too full, remove the top piece, discard the lake water, and continue filtering. **Make sure the flask doesn't get full enough to reach the pump tubing.**

k) Once you are done filtering and rinsing, fill in total volume of filtered sample water on ChlA filter section on the backside of the field sheet (Filter #1,2 ,3).

l) Add three drops of magnesium carbonate onto the filter paper, pumping as you go.

m) Using tweezers, fold the filter paper in half twice. Avoid touching any portion of the paper that has chlorophyll.

n) Finally, place the folded filter paper into a petri dish using tweezers. Using a sharpie, and the provided filter labels, label the dish with the lake name, location, date, and total volume of lake water filtered.

o) Wrap the petri dish in aluminum foil to protect it from light.

p) Place a new filter paper on the apparatus and repeat steps (c) to (o) **two more times to obtain three filter papers total.**

q) Excess water at the end of filtering can be discarded back into the lake, or outside; **not down the drain**.

r) Store in a **Ziploc baggie** within a **freezer** until ready to ship out with other bottles.

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APPENDIX

A1) GPS Coordinates Instructions & Documentation

1. **Go to https://www.googlemaps.com/maps, and find your lake (search its name).**
2. **Using your mouse, right click on the location of the lake where you collected your sample.**
3. **Choose "*What's Here?*"**
4. **The GPS coordinates will appear at the bottom of your screen in the format of: 55.217876, -113.252806. Record these coordinates exactly as they appear from your device, onto the field sheet.**

IF YOU PLAN ON SAMPLING THE SAME SITE MORE THAN ONCE IN THE SUMMER, USE THE TABLE BELOW TO RECORD YOUR SITE GPS FROM THE FIRST SAMPLING EVENT TO BE USED FOR THE NEXT SAMPLING EVENTS. USE BOTTOM DEPTH AS ANOTHER REFERENCE FOR LOCATING SAME APPROXIMATE SITE LOCATION.

Table 2. Site GPS log (reference for subsequent sampling events)

SITE (Lake, Location Name) Eg. Moose Lake, Vezeau Bay	Latitude	Longitude	Bottom Depth (m)

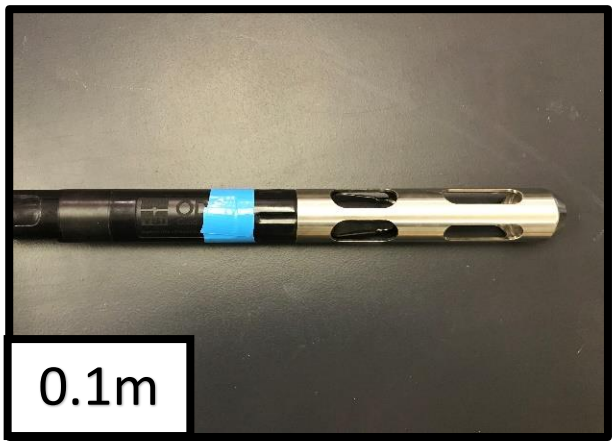
[1]Degree Minutes Seconds example: 53°29'06.5"N 113°27'54.6"W
[2]Decimal Degrees example: 53.485127, -113.465178
[3]Degree Decimal Minutes example: 53°29.1076'N, 113°27.9107'W

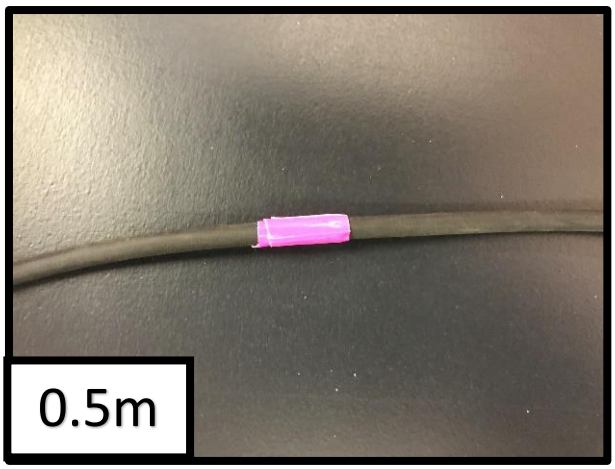
A2) USE THIS TABLE TO MAKE SURE YOU HAVE EVERYTHING YOU NEED FOR SAMPLING

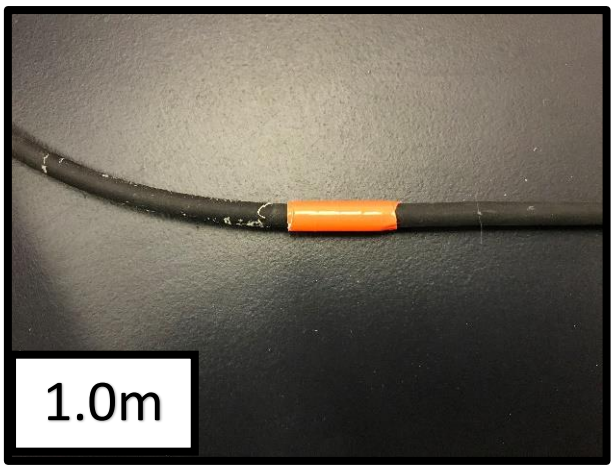
Table 3. Summer Equipment & Material List

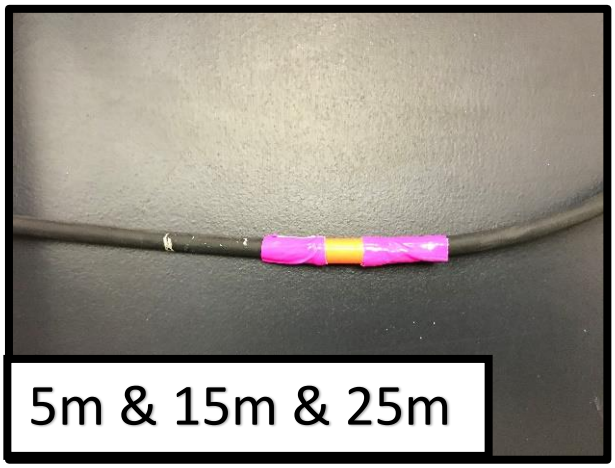
Field Equipment	Bottle Set	Chlorophyll-a Filtering Supplies
YSI Pro Solo Probe (with marked cable)	G2-Preserved Bottle + yellow cap preservative (2mL sulfuric acid)	500 mL Filter Apparatus
Secchi Disk (with marked chain)	G2-F Bottle	Hand pump & tube
Field Sheets	Routine Bottle	250 mL graduated cylinder
Coolers & ice packs for shipping	1L Chlorophyll-a bottle	Squirt bottle & pure water
Clipboard	Isotope Bottle	Tweezers
Charging cord for probe	Microcystin Bottle	Filter paper
Extra disposable gloves	G1-TSS Bottle	Magnesium Carbonate (and pipette)
Kimwipes (tissues)		Aluminum foil
Tape and Weight		Petri dishes & baggies
Safety goggles		Chlorophyll-a filter & bottle labels

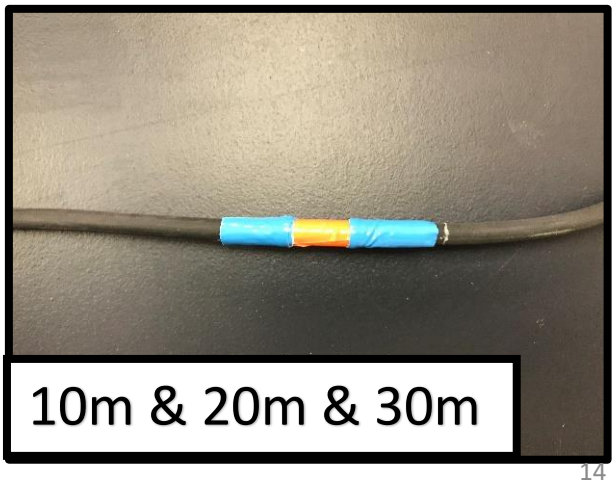
A3) YSI PROBE DEPTH MEASUREMENT MARKING GUIDE











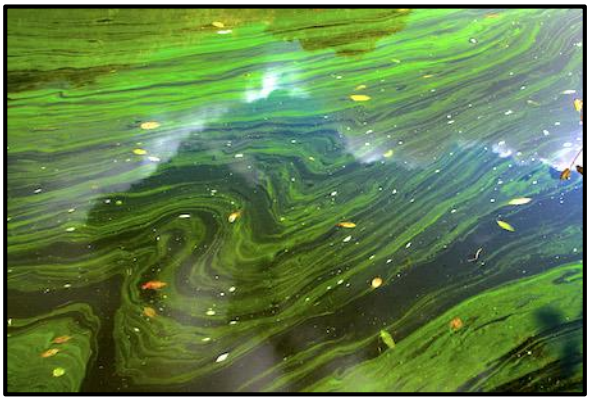
This program supported with funding from

A4) CYANOBACTERIA BLOOM IDENTIFICATION

Cyanobacteria or blue-green algae blooms often occur during the summer months due to warmer water and higher nutrient content in Alberta lakes. The most common genera of cyanotoxins in Canada are Microcystis, Anabaena, Aphanizomenon, Planktothrix and Gleotrichia. They can appear blue-green, brown or pinkish-red in colour and will usually smell grassy or musty. They will produce cyanotoxins and can be harmful to human, livestock and pet health at certain concentrations. Blooms can appear in different ways depending on the type of cyanobacteria present. It can look like grass clippings or appear foamy.

Particles

Streaks



Scums

A5) DATA COLLECTION BACKGROUND

Below are descriptions of what the data and samples collected through the ICBM Program will be used for, and how they relate to better understandings lakes in the summer. Also provided is where the data will eventually be used and reported.

- **Environmental Observations:** 'Air Temperature', 'Wind Speed', 'Wind Direction', 'Percent Cloud Cover' and '24 Hour Rain Fall' are all collected to put the data collected in context of the summer environment in which they were collected. Most of these can all be collected through a weather app or radar when you are on the boat. Regarding 'Percent Cloud Cover', this can be estimated by observing the whole lake and giving a general percentage of cloud cover over it. Cyanobacteria blooms are also recorded for the summer as they are common and affect water clarity and pose health risks. Refer to Appendix (A4) for more information. Also unique to summer sampling is measuring 'Secchi Depth' which relates to water clarity or transparency. When you double the secchi depth, you get the Euphotic Depth of the lake which refers to the euphotic zone, where enough light is received for photosynthesis to occur. Refer to Page 4 for measuring steps.
- **GPS Coordinates:** Very important to collect, since the particular location on the lake where the sample is collected is used to contextualize all other data collected. These will be used to makes maps for presentations and reporting about the ICBM Program.
- **Probe Calibration:** Used to ensure probes are reading accurately given local environmental conditions.
- **Lake Measurements:** Temperature readings from the top to bottom of the lake (lake profile) are used to understand lake mixing, dissolved oxygen levels, and for evaluating habitat for plants and animals. Dissolved oxygen readings are also taken through the lake profile to understand fish habitat. Low oxygen levels are can impact nutrient levels, as lake sediments will release phosphorus into the lake if oxygen is absent – seasonal oxygen levels may contextualize seasonal nutrient changes. Conductivity readings helps determine water quality, identify impurities in a lake and can indicate changes in water levels over time.
- **G2-Preserved:** Water from this bottle is used to determine total phosphorus and total nitrogen levels, which are important nutrients for algae, cyanobacteria, and aquatic plant growth. High levels of these nutrients may indicate pollution, and contextualize the amount and type of algae and cyanobacteria present. Preserved with sulfuric acid.

- **Isotopes:** Isotopes of hydrogen and oxygen are used to understand lake – groundwater connectivity. Groundwater connectivity can contextualize lake water chemistry, and overall lake water quality or quantity. Samples will be sent to Alberta Innotech, where the isotope data will be used in their ongoing research about groundwater in Alberta.
- **Microcystins:** Microcystin is a group of toxins produced by cyanobacteria (blue-green algae) which, when ingested, can cause liver damage in mammals. Microcystin is produced by many species of cyanobacteria which are common to Alberta's lakes and are thought to be one of the most common cyanobacteria toxins. In Alberta, recreational guidelines for microcystin are set at 10 µg/L.
- **G2-F:** Water from this bottle is used to determine total dissolved phosphorus and dissolved organic carbon levels, which are important nutrients for algae, cyanobacteria, and aquatic plant growth. High levels of these nutrients may indicate pollution, and contextualize the amount and type of algae and cyanobacteria present.
- **Routine:** Water from this bottle is used to determine pH, a parameter that is used to understand the acidity of water, and is important for evaluating fish habitat and general lake water chemistry. Conductivity and chloride are also determined from the Routine sample bottle, and are parameters that help understand the levels of salts in lake water. Salt levels are an important aspect of habitat for algae, cyanobacteria, aquatic invertebrates and fish. Levels can indicate groundwater connectivity, road salt pollution, and may also increase in lakes with large surface areas during times of low rainfall and snowmelt.
- **Chlorophyll-a:** Water from this bottle is used to determine the levels of chlorophyll-a in lake water. Chlorophyll-a is a green pigment found in all algae and cyanobacteria, and is used in photosynthesis. Chlorophyll-a levels are used to understand the amount of algae and cyanobacteria in lake water. Higher levels, in conjunction with high nutrient levels, may indicate nutrient pollution, or reflect the lake's natural ability to support high levels of algal and cyanobacterial growth. Chlorophyll-a levels compared with temperature change will also improve the understanding of what influences algae and cyanobacteria growth in Alberta lakes in the summer.

- **G1-TSS:** Water from this bottle is used to measure the amount of Total Suspended Solids (TSS) in the lake. High TSS can have a negative affect on dissolved oxygen and temperature levels within the water, which can lead to a negative impact on fish habitat and plant growth. TSS is related to turbidity, but where turbidity measures how well light can pass through the water, TSS is a more quantitative measure of the amount of suspended particles in the water.

- **Metals:** Metals can be introduced into freshwater systems naturally through weathering of rocks and soils, or from human activities such as mining or refining processes. Common metals that can be found are arsenic, nickel, zinc, lead and chromium. Metals can bioaccumulate within aquatic organisms, which can lead to a potential risk to human health. The water in this bottle will analyzed for any presence of metal contaminants in the lake.

- **Mercury:** Mercury is a pollutant which can cause neurological damage to fish, wildlife and humans at higher concentrations. Mercury can enter freshwater systems through atmospheric deposition (rain or snow), but also can enter directly from industrial and mining wastes nearby. It can easily be absorbed into the food chain and will lead to bioaccumulation of more toxic levels within fish populations. This is why it is important to test for mercury levels within a lake or stream.

- **Polycyclic Aromatic Hydrocarbons (PAHs):** Water from this bottle will be analyzed to look for any presence of PAH concentrations in the lake. PAHs are a class of chemicals that naturally occur in coal, crude oil and gasoline and are released by the burning of fossil fuels and carbon-containing materials (eg, wood and coal). PAHs do not dissolve or break down easily, but will bind to sediment particles and can enter water bodies through atmospheric deposition, surface runoff, petroleum spills, storm water runoff and industrial discharges. In high concentrations, certain compounds of PAHs can be toxic to fish, wildlife and humans.