Water Quality Monitoring Field Manual

Yukon River Inter-Tribal Watershed Council • Science Department • 2017

"to once again drink water directly from the Yukon as our ancestors did"

ONE PEOPLE-ONE RIVER

Yukon River Inter-Tribal Watershed Council

www.yritwc.org

Yukon River Inter-Tribal Watershed Council

The Yukon River Inter-Tribal Watershed Council (YRITWC) is an Indigenous grassroots organization, consisting of 73 First Nations and Tribes, dedicated to the protection and preservation of the Yukon River watershed. The YRITWC accomplishes this by providing Canadian First Nations and Alaskan Tribes in the Yukon watershed with technical assistance, such as facilitating the development and exchange of information, coordinating efforts between First Nations and Tribes, undertaking research, and providing training, education and awareness programs to promote the health of the watershed and its Indigenous peoples.

Manual Overview

This manual is a reference tool for technicians conducting water sampling under the Yukon River Inter-Tribal Watershed Council (YRITWC) protocols. The YRITWC protocols were developed using the United States Geological Survey (USGS) protocols as a benchmark for quality (USGS, TWR Book 9). The structure set forth here will be one that focuses on end-user functionality. Throughout the manual key points will be noted with special characters and text boxes in the body of the text. This will highlight essential material, as well as give resources for additional research.

Acknowledgements

This work would not be possible without the collaboration of many individuals, communities, government agencies and funding sources. Through this collaboration, the YRITWC has a solid database of water quality monitoring that covers the entire Yukon River Watershed. At several sites, monitoring began as early as 2001. Through consistent sampling you benefit your community and also other communities upstream and downstream. The YRITWC greatly appreciates all the hard work and dedication of the Environmental Coordinators, Lands and Resources Departments, and their staff to collect water quality samples throughout the summer and winter. Without their (your) dedication, this network would not exist. The YRITWC would also like to recognize the contribution of the Environmental Protection Agency's Indian General Assistance Program that funds many of the Environmental Programs to collect and report this data. The YRITWC also greatly appreciates the collaboration with the USGS National Research Program (NRP). For over ten years now, the USGS NRP has provided an immense contribution to this network by providing almost all of the laboratory analysis for the water quality samples. The Administration for Native Americans, Health Canada, the Yukon Government, and the National Science Foundation have all provided substantial funding to assure the sustainability of the Indigenous Observation Network (ION) and its water quality program. Finally, we would like to thank USGS and National Geographic for the development of our water quality database.

Please visit https://www.sciencebase.gov/catalog/item/573f3b8de4b04a3a6a24ae28 or http://yukon.fieldscope.org/ to access to the data. All community water quality reports and USGS factsheet and reports can be uploaded directly from YRITWC website can be accessed at https://www.yritwc.org/reports.

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Getting Started

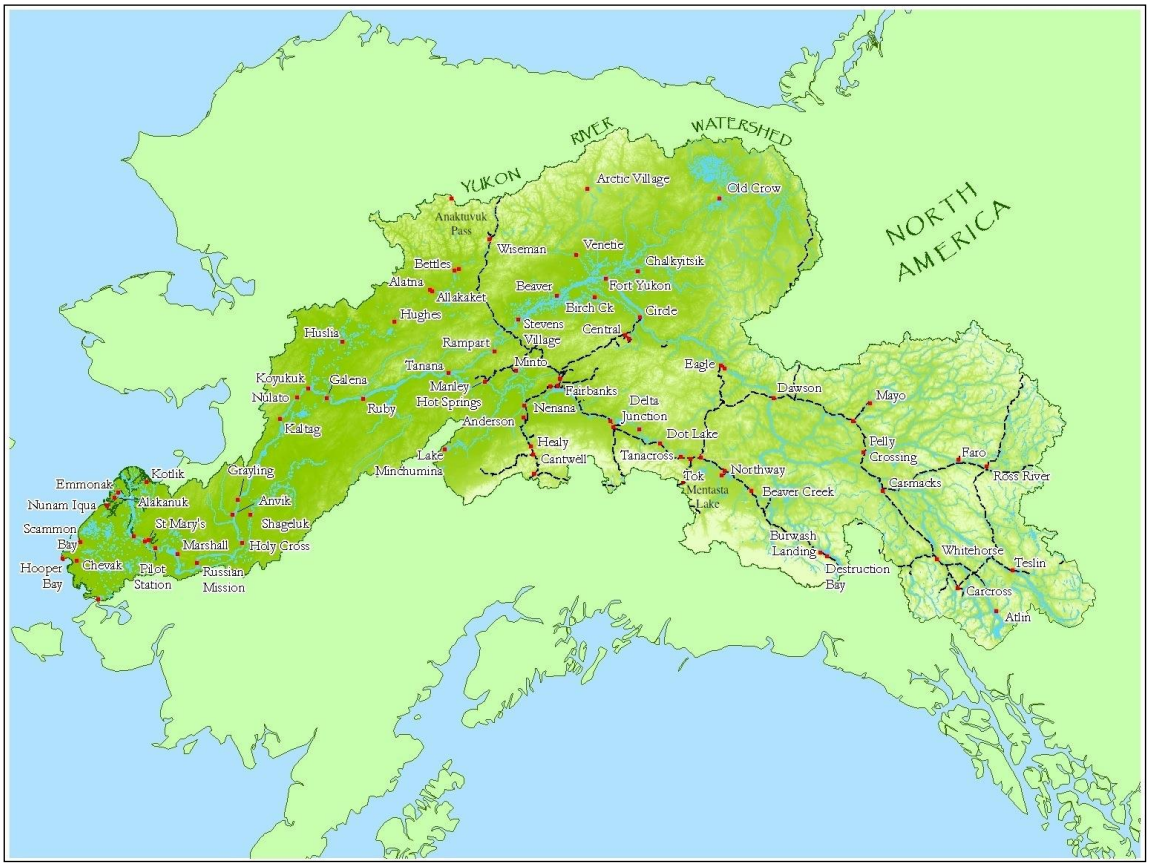
Asking a Question

All science research starts by someone asking a question. Most questions that we receive revolve around water. And if you are reading this manual the odds are that you and your community are interested in what is going on in the Yukon River watershed.

The Water Quality Monitoring Program managed by the YRITWC Science Department was started because people of the Yukon River Watershed asked questions about the water. ***What is happening to the fish? Is the water safe to drink? Why is the water changing?*** All these questions, and more, led to the development of a baseline watershed study that has been operating continuously since 2006.

Developed through collaboration and assistance by the U.S. Geological Survey (USGS), the baseline Water Quality Monitoring Project has spread over 43 communities and counting throughout the Yukon River watershed.

Map of communities in the Yukon River Watershed



Yukon River Basin Map with YRITWC signatory Tribes/First Nations highlighted

This project focuses on collecting information on basic water quality parameters (see Appendix D) that give a picture of the overall health of the water system, including fish habitat and responses to climate change. Long-term baseline studies are important for several reasons. They provide a basis for comparison against possible contaminants in the river, as well as documenting long-term trends that can be useful in highlighting natural versus unnatural changes in the water system.

If you have a question about the water around you, write it down and see what is being done that may help your community find answers to those questions. Maybe you can even help start a new initiative in the watershed. Sometimes answers take time to reveal themselves, but be patient and have fun taking observations and learning more about the environment you live in!

Contact YRITWC

Once you have asked a question and desire to pursue projects that will help to give insight to the topic, contact the YRITWC! We can assist at multiple levels to help you meet your community goals. Whether you need to develop your project or would like to take part in the Indigenous Observation Network (ION), the YRITWC will do our best to assist communities in answering their question(s).

The YRITWC office in Anchorage is staffed with knowledgeable employees who are eager to talk with you about ways your community can participate in YRITWC programs. The Science Department will assist in guiding you towards programs that will best answer the questions from your community.

Anchorage Office:

Science Staff:
Edda Mutter (emutter@yritwc.org)
Maryann Fidel (mfidel@yritwc.org)
Kari Eschenbacher (keschenbacher@yritwc.org)

Address:

725 Christensen Drive, Suite 3
Anchorage, AK 99501
Phone: (907) 258-3337
Fax: (907) 258 3339

Next Steps

Training

Once you have your question and have decided which projects best fit your community needs, it's time to attend training! The Science Department offers annual training in water quality sampling. Contact the YRITWC to find out when the next training opportunity will be. Generally, the training is held in spring. We are often able to work around schedules and provide on-site trainings in a community if necessary.

Purchasing Equipment & Supplies

Your equipment and supply needs will be met through participation in the Science Department's projects. The YRITWC can typically provide equipment and basic maintenance, as well as provide most of the necessary supplies to complete project goals. This service is entirely funded through grant opportunities, which vary from year to year. If your project budget is designed to support (even partially) the equipment, supply and shipping needs you can be assured that your project will be sustainable throughout your participation (see budget recommendation in Appendix F). We are constantly seeking new funding to support the long-term projects and goals of the YRITWC and the Science Department, so please do not let shortfalls in your budget stop you from participating.

There are several manufacturers of water quality instruments currently on the market. Manufacturers include: Hydrolab, YSI Inc., Eureka, Oakton, Hanna, Hach and Daigger. Each manufacturer produces several types of equipment, from single parameter probes to multi-parameter and sondes*. The level of sophistication of each probe depends on the type of parameters being measured and the needs of the user (see Appendix D for explanation of parameters). The type of probe selected for each project will depend on the time and frequency of data collection. This manual explains how to calibrate the meter you will be using this field season. Calibration directions begin on page 8 of this manual. Also, technical manuals can often be found online for each meter.

If you are considering buying equipment for your IGAP program please talk with the YRITWC Science Department staff and we will be glad to explore options on equipment that will fit the long term needs of your community (see Appendix E for equipment suppliers).

Choosing a Site

Site location is extremely important when collecting water samples. The flow of the river, the location relative to the community, potential contaminants, accessibility and the question(s) you are asking all need to be taken into consideration when choosing the site.

Leah Mackey, collects a water sample by canoe on the Tanana

When participating in the baseline project, YRITWC staff will assist in choosing a site that best meets all criteria. The initial site will be located above the community in the main channel of the river. This sample will provide the most accurate information on the water flowing past your community.

Naming the Site

Each site is assigned a unique name based on the river, community and location relative to the community (see Appendix B for list of current sites). The naming convention was developed as a method to efficiently identify the river, the community, and the site through a single reference. The structure of the system is in four distinct parts. First, the river is identified using the first two letters of the river from which the sample was taken. Second, the community is identified by the three-letter airport code from where the sample will be shipped. Third, the site number is identified using chronological numbers starting at 1. The forth **component is the letter "a" or "b", which identifies the site as being <u>above</u> the community, "a", or <u>below</u> the community, "b", from where the sample was taken.**

> An example of the naming convention would be: Tanana River (ta), Fairbanks (fai), site number (1), above Fairbanks (a). This site would be written on the field sheet as: **tafai1a**.

Quality Assurance Project Plan (QAPP)

The YRITWC has developed a Quality Assurance Project Plan (QAPP) for the water quality baseline project that covers the sampling conducted by communities and YRITWC staff. A QAPP is specifically required by projects funded through the Environmental Protection Agency (EPA) to ensure that the project and tasks are documented and reviewed before work is started.

The QAPP describes the quality assurance procedures, quality control specifications and other technical activities that must be implemented to ensure that the results of the project or task to be performed will meet project specifications (https://www.epa.gov/quality/managing-quality-environmental-data-epa-region-10 or https://www.epa.gov/quality/quality-assurance-project-plan-development-tool).

If your project is addressing additional questions or sampling protocols, you will need to develop your own QAPP or amend the existing one to include all the criteria within your project. Feel free to contact YRITWC with questions or for assistance (See Appendix G for contact information).

Calibration

Introduction

Calibration is the act of comparing the readings of an instrument with those of a known standard to check the instrument's accuracy. Adequate documentation of standards and procedures cannot be understated! Correctly following the calibration procedures and providing accurate documentation, allows the data to be checked using quality assurance methods. Instrument calibration data is essential to assuring high quality data.

Calibration of the meters will occur **once per day** before using the meter to collect the readings from the river or water source. Documenting the calibration is equally important as going through the calibration procedures. A field sheet is provided with all samples that has a section for recording the calibration data (see Appendix C). Carefully follow the instructions described in the following pages! While calibration and documentation are essential to collecting and demonstrating accurate readings, basic care is required to keep the meters working at peak performance.

The equipment we use are top-of-the-line scientific instruments that will display high quality data points when calibrated correctly and cared for respectfully. Meters should be stored inside a heated building and care should be taken to protect and preserve all working parts. Further details will be outlined for each instrument in the following sections.

Hazel Lolnitz, Koyukuk Tribal Council, calibrates a YSI 63 during a water quality training in Fairbanks.

The calibration of equipment is essential to collecting field measurements accurately!

Bad Calibration = Bad Data

Instruments

YSI 63

The YSI 63 is a handheld multi-parameter instrument that will measure pH and Conductivity as well as providing a water temperature reading.

The YSI 63 will be stored in the small white probe bottle with a **small amount of pH 4** solution. If this setup is not available, keep the probe stored in the compartment provided on side of the meter.

Always use clean, properly stored calibration solutions (~ 25℃ or room temp).

Calibrating Conductivity - YSI 63

You will need: Conductance Standard 1413 µs or 1412 µs, calibration bottle, distilled water.

1. Place at least 7 inches of 1413 or 1412 Conductance solution in the plastic container (provided with the Model 63) or a clean glass beaker.

2. Use the **MODE** key to advance the instrument to display specific conductivity. *Look for the "µs" and flashing °C on right corner of the screen.*

3. Insert the probe into the solution deep enough to completely cover the probe. Both conductivity ports must be submerged.

4. Move the probe vigorously from side to side to dislodge any air bubbles from the electrodes.

5. Allow at least 60 seconds for the temperature reading to become stable.

6. Press and release the **UP ARROW** and **DOWN ARROW** keys simultaneously. The "**CAL"** symbol will appear at the bottom left of the display to indicate that the instrument is now in calibration mode.

7. Use the **UP ARROW** or **DOWN ARROW** key to adjust the reading on the display until it matches the value of the calibration solution you are using. Typically, this will be the 1413 Conductance solution. **Record the conductivity standard used on the field sheet.**

8. Once the display reads the exact value of the calibration solution being used press the **ENTER** key (the instrument will make the appropriate compensation for temperature variation from 25°C).

9. The word **"SAVE"** will flash across the display for a second, indicating that the calibration has been accepted. **Record the displayed conductivity and temperature values on the "Conductance Calibration" section of the field sheet**.

Calibrating pH - YSI 63

You will need: pH 7, pH 10, distilled water, 2 graduated cylinders.

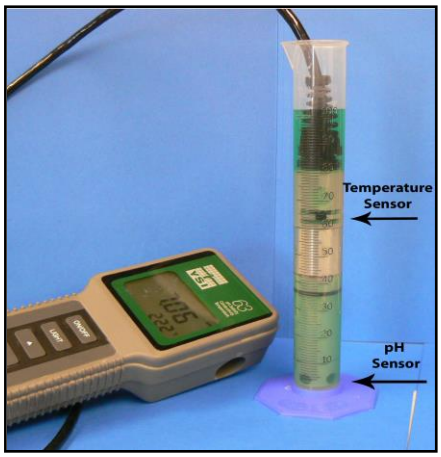
*Before starting your calibration, rinse the pH 7 graduated cylinder twice with distilled water, making sure to rotate the cylinder as you discard the water each time. Use a small amount of pH 7 to do a final rinse of the cylinder. Discard rinse solution. Repeat the same procedure for the pH 10 graduated cylinder, using distilled water and the pH 10 solution.

1. Turn the instrument on by pressing the **ON/OFF** key. Press the **MODE** key until pH is displayed.

2. Rinse the probe with distilled or deionized water. Next, rinse the probe with a small amount of pH 7 buffer.

3. Place 30-35 mL of the pH 7 buffer in the 100 mL graduated cylinder (make sure to follow the prior rinse steps for each cylinder). The graduated cylinder minimizes the amount of

solution needed. Immerse the probe *making sure that both the pH and temperature sensors are covered by the solution*.



4. Use two fingers to press and release both the **UP ARROW** and **DOWN ARROW** keys simultaneously to enter the calibration menu. The Model 63 display will show **"CAL"** at the bottom, **"STAND"** will be flashing and the pH reading will show "7.00".

5. Press the **ENTER** key. The display will show **"CAL"** at the bottom, **"STAND"** will stop flashing and the pH calibration value is shown with the middle decimal point flashing.

6. When the reading is stable, the decimal point will stop flashing. **Record this pH value in the "pH 7 buffer reading" section of the field sheet. Record the solution temperature on the field sheet** (bottom right hand corner of screen). Press and hold the **ENTER** key to save the calibration point. The display will flash **"SAVE"** on the screen along with **"OFS"** to indicate that the offset value has been saved.

7. **"SLOPE"** will now appear on the screen and be flashing. This indicates that the slope is ready to be set using a second pH buffer. The system is now calibrated at a single point.

8. Rinse the probe with distilled or deionized water. Next, rinse the probe with a small amount of pH 10 buffer.

9. Fill the pH 10 cylinder with 30-35mL of the pH 10 buffer and immerse the probe into the solution. Make sure that the temperature sensor is immersed.

10. Press the **ENTER** key. The screen should now show **"CAL"** at the bottom, **"SLOPE"** will stop flashing and the next pH calibration value is shown with one of the decimal points flashing. The right decimal point will flash, indicating the second buffer is greater than the first. If the second pH buffer is less than the first buffer, the left decimal point will flash. If there is an error, start over at the beginning of pH calibration.

11. When the reading is stable (no change in 10 seconds), the decimal point will stop flashing. **Record this pH value in the "pH 10 buffer reading" section. Record the solution temperature on the field sheet** (see example below)**.** Press and hold the **ENTER** key to save the calibration. The display will flash **"SAVE"** on the screen along with **"SLP"** to indicate that the first slope value has been saved.

12. **"SLOPE"** will start flashing again indicating that the slope is ready to be set using a third pH buffer, if necessary.

13. The system is now calibrated at two points. For our purposes a 2-point calibration using pH 7 and pH 10 is sufficient*. Press the **MODE** key to return to normal operation.

14. Rinse the probe with distilled water or deionized, then carefully store in the chamber.

Example:

Calibration Data

pH Calibration *(YSI 63, YSI Pro, YSI 650, and Hanna)* *pH 7 and 10 need to be within 0.1 of buffer values, if not RECALIBRATE!*

pH 7 Buffer Reading: 7.01 pH 10 Buffer Reading: 10.00

pH 7 Buffer Temperature (°C): 24.7°C pH 10 Buffer Temperature (°C): 25.0°C

Dissolved Oxygen (DO) Calibration *(YSI Pro, YSI 650, 550A)*

Barometric Pressure (inHg *or* kPa): _____ DO Reading (%) Saturation: _____

In US, visit ***www.weather.gov*** *for air pressure in inHg.* *DO % needs to be between 95 - 105%, if not RECALIBRATE!*

In Canada, visit ***www.weather.gc.ca*** *for air pressure in kPa.* DO Reading (mg/L): _____

Conductivity Calibration *(YSI 63, YSI 650, Hanna)*

Conductivity Standard Used (µS/cm): 1413 us/cm Conductivity Solution Temperature (°C): 25.0°C

Conductivity Reading (µS/cm): 1414 us/cm

*A third calibration point can be calculated using the pH 4 buffer, following the steps outlined above. This would be necessary if the general range of pH in the sample is not known (YSI Operations Manual, pg.31 online). For our studies in the Yukon River Basin, the general range will be between 6 and 10.

YSI 550A

The YSI 550A is a handheld instrument that provides a dissolved oxygen (DO) reading, as well as a water temperature reading. The probe will be stored in the attached meter chamber with a small sponge moistened in water. Take precautions not to damage the membrane over the tip of the probe.

Before you calibrate: To accurately calibrate the YSI 550A, you will need to know the following information:

1) The approximate salinity of the water you will be analyzing. Fresh water has a salinity of approximately zero. At this time, the YRITWC ION program only is using this DO meter for completely fresh water systems.

2) **For calibration in % saturation mode**, the approximate altitude (in feet) of the region where you are located is required. This information can be obtained over the Internet or from a local airport or weather station (e.g. www.weather.gov). To convert from meters to feet, divide by 0.3048.

Calibrating DO - YSI 550A

Calculation in % Saturation

You will need: A moist sponge.

Dissolved oxygen calibration must be done in an environment with known oxygen content. The YSI 550A DO Instrument can be calibrated in either mg/L or % saturation. Sections below include instructions on how to calibrate in % saturation for simplicity.

1. Ensure that the sponge inside the instrument's calibration chamber is moist. Insert the probe into the calibration chamber.

2. Power the instrument on and allow readings to stabilize. This may take 5 to 15 minutes, depending on the age of the instrument and condition of the probe.

3. Press and release both the **UP ARROW** and **DOWN ARROW** keys at the same time to enter the calibration menu.

4. Press the Mode key until **"%"** is displayed on the right side of the screen for oxygen units. Press **ENTER**.

5. The LCD screen will prompt you to enter the local altitude in hundreds of feet. Use the arrow keys to increase or decrease the altitude. When the proper altitude appears on the LCD, press the **ENTER** key.

   EXAMPLE: Entering the number 12 here indicates 1200 feet.

6. **"CAL"** will now display in the lower left corner of the screen, the calibration value in the lower right corner and the current **"DO"** reading (before calibration) will be the main display. Once the current **"DO"** reading is stable, press the **ENTER** button.

7. The LCD will prompt you to enter the approximate salinity of the water you are about to analyze. The salinity of your water should be zero. You can enter any number from 0 to 70 parts per thousand (PPT) of salinity. Use the arrow keys to increase or decrease the salinity setting to ZERO. When the correct salinity appears on the LCD, press the **ENTER** key. The instrument will return to normal operation. Record the values for **%DO** and **DO mg/L** in the calibration section of the field sheet (see example).

Example of field sheet with calibration section completed

Technician(s): Tom Minnow

Meter Type(s) (circle): Hanna **YSI Pro** **YSI 63/550A** **YSI 650** **Meter ID(s) #:** 05

Calibration Data

pH Calibration *(YSI 63, YSI Pro, YSI 650, and Hanna)* *pH 7 and 10 need to be within 0.1 of buffer values, if not RECALIBRATE!*

pH 7 Buffer Reading: 7.01 pH 10 Buffer Reading: 10.00

pH 7 Buffer Temperature (°C): 24.7°C pH 10 Buffer Temperature (°C): 25.0°C

Dissolved Oxygen (DO) Calibration *(YSI Pro, YSI 650, 550A)*

Barometric Pressure (inHg *or* kPa): 29.51 inHg DO Reading (%) Saturation: 97.5%

In US, visit ***www.weather.gov*** *for air pressure in inHg.* *DO % needs to be between 95 - 105%, if not RECALIBRATE!*

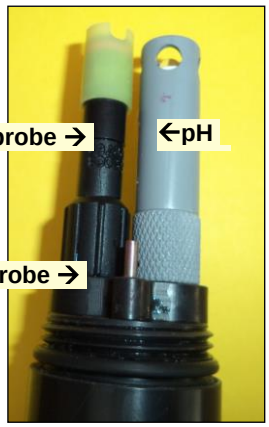
In Canada, visit ***www.weather.gc.ca*** *for air pressure in kPa.* DO Reading (mg/L): 8.57 mg/L

YSI Professional Plus (YSI Pro)

YSI Professional Plus handheld multi-parameter instrument will measure pH, Dissolved Oxygen (DO) and water temperature.

The YSI Pro meter will be stored with the calibration cup attached with a small amount of pH 4. Be sure to rinse and replace the calibration cup with a small amount of pH 4 when you finish sampling for the day. This protects the sensors from drying out.

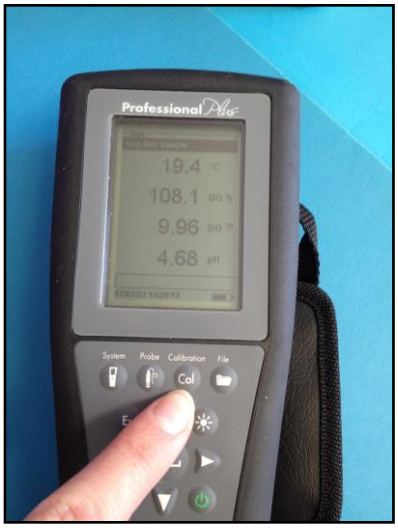
Always use clean, properly stored calibration solutions (~25℃ or room temp.). Check expiry date before first use.



Calibrating pH

You will need: pH 7, pH 10, distilled water and the calibration cup.

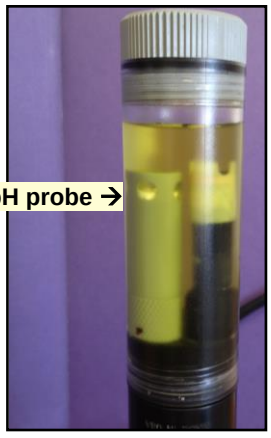
1. Power on by pressing green button. 
2. Rinse calibration cup twice with distilled water.
3. Rinse calibration cup with small amount of pH 7.
4. Fill calibration cup with pH 7 to the “fill line” marked on the cup or just over half of the calibration cup.



5. Screw calibration cup onto probe and invert so gray cap is pointing up. (Be sure the pH probe is completely covered in solution.)

6. Press **CAL** and select **“ISE1 (pH)”** and press the Enter button.

7. Check the “Calibration value” on your screen with the Buffer Solution Temperature Chart (found in Appendix A ***OR*** on the side of the pH buffer solution bottle). If value needs adjusted proceed to step 8. If value is accurate skip to step 12.



8. Select **“Calibration value”** and press **Enter**. The screen will display a number pad.

9. Using the solution temperature (found on the screen under **"Actual Reading"**) find the corresponding pH 7 value in the chart. Using the arrow pad and enter button to put in the correct pH value. *Note: Select the decimal point as well. It can be difficult to see.

10. Once the value is correct, select **"Enter"** on the screen and press the **Enter** button on the keypad.

11. Allow value under **"Actual Reading"** to stabilize. Select **"Accept Calibration"** on the screen and press the **Enter** button.

12. Press **CAL** to finish. Once the display returns to the main screen record the pH and temperature values on the pH 7 section of the field sheet.

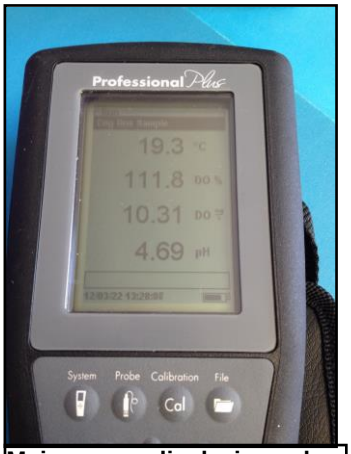
13. Discard pH 7 solution from calibration cup. Rinse cup twice with distilled water.

14. Rinse calibration cup with small amount of pH 10.

15. Fill calibration cup with pH 10 to the fill line or just over half of the calibration cup.

16. Follow steps 5 - 12 outlined above using the pH 10 temperature chart and values found in Appendix A.

17. Press **CAL** to finish. Once display returns to main screen **record the pH and temperature values on the pH 10 section of the field sheet** (see example below, in the DO calibration section).



Main screen displaying values to record from calibration.

18. Discard solution and rinse calibration cup with distilled water.

Calibrating the Barometer

The barometer of the YSI Pro will need to be calibrated to your location/elevation before the first sample. This is typically done only one time at the beginning of the season.

You will need: The barometric pressure in your location. This can be found online through a local weather report or by visiting ***www.weather.gov*** and type in your zip code for your community's air pressure in inches of mercury (inHg).

1. With power on, press **CAL**.

2. Select **"DO"** and press **Enter**. Then Select **"DO%"** and press **Enter**.

3. Highlight **"Barometer"** on the screen and press **Enter**. Manually enter the barometric pressure you obtained online for your location. This will mostly likely be shown as a value of **"inHg"** (inches of Mercury). Select **"Enter"** and press **Enter**.

4. Continue with Steps 4 - 8 listed below in the Calibrating DO% to complete calibration.

Calibrating Dissolved Oxygen (DO%)

You will need: small amount of distilled water, and calibration cup.

1. With power on, press **CAL**.

2. Select **"DO"** and press **Enter**.

3. Select **"DO%"** and press **Enter**.

4. Fill clean calibration cup with a small amount of water (about a 1/2 inch).

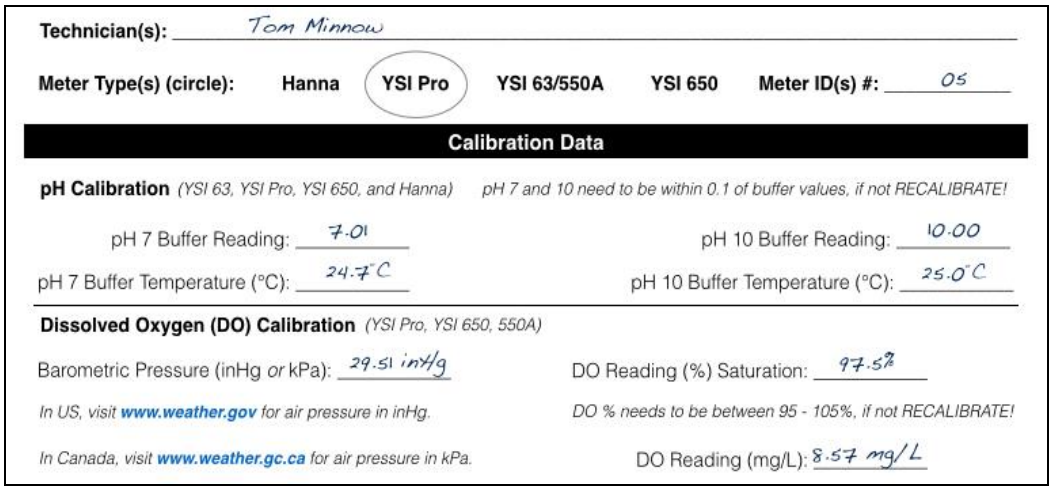
5. Screw calibration cup onto probe and shake for a few seconds. Unscrew the cap a few times, so that it is threaded loosely, but still connected.

6. When **"Actual Reading"** values are stable on the screen press **Enter**.

7. Screen says **"Calibrating channel"** at the bottom and returns to main screen display when complete.

8. Record the Barometer value inHg, **DO%** value and the **DO mg/L** value in the DO calibration section of the field sheet (see example below).

Example of field sheet with calibration section completed



Technician(s): Tom Minnow

Meter Type(s) (circle): Hanna (YSI Pro) YSI 63/550A YSI 650 **Meter ID(s) #:** 05

Calibration Data

pH Calibration *(YSI 63, YSI Pro, YSI 650, and Hanna)* *pH 7 and 10 need to be within 0.1 of buffer values, if not RECALIBRATE!*

pH 7 Buffer Reading: 7.01 pH 10 Buffer Reading: 10.00

pH 7 Buffer Temperature (°C): 24.7°C pH 10 Buffer Temperature (°C): 25.0°C

Dissolved Oxygen (DO) Calibration *(YSI Pro, YSI 650, 550A)*

Barometric Pressure (inHg *or* kPa): 29.51 inHg DO Reading (%) Saturation: 97.5%

In US, visit ***www.weather.gov*** *for air pressure in inHg.* *DO % needs to be between 95 - 105%, if not RECALIBRATE!*

In Canada, visit ***www.weather.gc.ca*** *for air pressure in kPa.* DO Reading (mg/L): 8.57 mg/L

Hanna Pocket Meter

Calibrating Conductivity

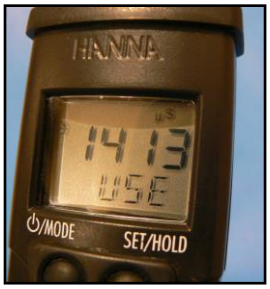
You will need: 1 small jar, distilled/DI water and 1413 solution.

1. Rinse the jar twice with distilled water and once with a small amount of Conductance standard - 1413µS*. After rinsing is complete, fill the jar halfway with the conductance standard.

2. Press the **Set/Hold** to change modes. In the upper right hand corner of the display "µS"** will appear; indicating the specific conductance mode.

3. Rinse the tip of the meter with a small amount of conductance standard 1413.

4. Hold down the **Power/Mode** button until **"CAL"** appears. Release the button immediately when **"CAL"** appears.



5. The screen will display **"1413 USE"**

6. Place the tip of the meter in the conductance standard 1413.

7. When the screen <u>does not</u> display **"USE"** the calibration is complete. **Record the displayed conductance and temperature values on the Hanna meter section of the field sheet** (see example below pH section).

8. Rinse the tip of the meter with water and replace the cap.

** The Hanna Meter will always use the 1413 conductivity standard.*
*** Microsemens (µS) are a unit of measurement for the electrical conductance of water. It is essentially a measure of the total amount of solutes in the water.*

Calibrating pH

You will need: 2 small jars, pH 7, pH 10 and distilled/DI water.

1. Rinse the 2 jars that will be used for pH calibration. Rinse one jar with a small amount of pH 7. Rinse the other jar with small amount of pH 10.

2. Place about 2 inches of pH 7 solution in the pH 7 jar. Place about 2 inches of pH 10 solution in the pH 10 jar.

3. Power on the unit by pressing the **Power/Mode** button. Wait for the unit to fully power on.

4. Press the **Set/Hold** button to change the display to **"pH"**. In the upper right corner of the display a **"pH"** will appear.

5. Remove cap from meter

6. Press and hold down the **Power/Mode** button. **"OFF"** will appear on the screen, keep holding down the button until **"CAL"** appears on the screen. Release the button immediately when **"CAL"** appears. **"USE"** will appear at the bottom of the screen.

7. Rinse the meter tip with a small amount of pH 7, place the meter in the pH 7 when **"USE"** is displayed on the bottom of the screen.

8. When the screen displays **"4.01 USE"** rinse the tip of the meter with a small amount of pH 10.

9. Place the tip of the meter in the pH 10 jar. The meter will automatically calibrate to pH 10. After a few seconds the display will read **"10.03"** or **very close to this number**. Record this number under the Hanna meter calibration section of the field sheet. The pH calibration is now complete (see example).

Example of field sheet with calibration section completed

Calibration Data

pH Calibration *(YSI 63, YSI Pro, YSI 650, and Hanna)* *pH 7 and 10 need to be within 0.1 of buffer values, if not RECALIBRATE!*

pH 7 Buffer Reading: 7.01 pH 10 Buffer Reading: 10.00

pH 7 Buffer Temperature (°C): 24.7°C pH 10 Buffer Temperature (°C): 25.0°C

Dissolved Oxygen (DO) Calibration *(YSI Pro, YSI 650, 550A)*

Barometric Pressure (inHg *or* kPa): _____ DO Reading (%) Saturation: _____

In US, visit ***www.weather.gov*** *for air pressure in inHg.* *DO % needs to be between 95 - 105%, if not RECALIBRATE!*

In Canada, visit ***www.weather.gc.ca*** *for air pressure in kPa.* DO Reading (mg/L): _____

Conductivity Calibration *(YSI 63, YSI 650, Hanna)*

Conductivity Standard Used (µS/cm): 1413 us/cm Conductivity Solution Temperature (°C): 25.0°C

Conductivity Reading (µS/cm): 1414 us/cm

Field Sample

Introduction

After successfully calibrating your instrument you are ready to go collect your water sample! There are several steps to take to ensure you are collecting the best sample possible.

Elli Matkin records sampling information on the field sheet.

Field Sheet (Appendix C)

Field Sheet Documentation:

Filling out the field sheet completely is very important. The field sheet serves as a quality assurance method by documenting the calibration and is also a hard copy documentation of the data collection. Keeping consistent and reliable records are important in long-term data collection. If you make any mistakes, remember not to erase, just draw a line through the mistake and write the correction as close as possible.

Date and Time:

To work toward the standardization of protocols across the watershed, the YRITWC Science Department uses the International Standards Organization (ISO) standard for date and time records. This standard is accepted as the format for international trade. In our application, Indigenous peoples of the Yukon Basin are engaging in the trade of information to sustain their traditional way of life.

The international standard for recording the date, as set by the ISO, ranks the priority of information from the most important to least important; the year being the most important, the month being second in priority, and the day being of the lowest priority. The format for the date would be: yyyy-mm-dd. This format should be used when recording the date on the field sheet and sample bottles.

The use of 24-hour time is standard practice in scientific data collection. Using 24-hour time reduces the potential for transmission error when recording field data into a database and allows for accurate record keeping when samples are taken at multiple times in a single day. On the field sheet record, the time you collected the water sample from your site. Use this same time for documentation throughout the duration of your samples (i.e., labeling bottles).

Site Naming Convention:

The naming convention was developed as a method to efficiently identify the river, the community, and the site with a single reference. This method is described earlier in the manual under the “Next Steps” section (for list of all existing sites see Appendix B).

An example of the naming convention would be: Yukon River (yu), Eagle (eaa), site number (1), above Eagle (a). This site would be written on the field sheet as: yueaa1a.

General Information: Technicians, Waterbody Name, Meter and Elevation:

Fill out these sections of the field sheet completely. It is important to know who is taking the sample. The technicians are *you* and any volunteers, assistants, youth or boat drivers. The water body name refers to the name of the river, lake or slough that the sample is being taken from. In the example below, the sample is from the Tanana River. The meter type is important for us to know for many reasons, largely because the YRITWC has multiple kinds of meters that samplers use and different ones are capable of measuring different parameters. After you circle which type of meter you are using, locate the number written on the side of the meter with a permanent marker. This is the meter number. Every YRITWC meter has a different number; this helps us keep track of which specific meter is in what location in the watershed.

Site Coordinates: Latitude, Longitude, and Elevation:

Before you put your meter in the water, write down the coordinates and elevation of your site at each visit. The latitude, longitude and elevation for each site are listed in Appendix B. If you have a GPS (sorry, the YRITWC does not provide one) we recommend that you check the accuracy of the coordinates listed in the appendix, this way we can be sure that you are sampling in exactly the same place week after week, year after year. Fill out the Lat/Long section on your field sheet - especially if you are sampling a new location, adding a site or need to alter your location for any reason. If you sample from the riverbank once or twice (due to weather, boat problems, etc.) it is also helpful for us to know the GPS coordinates of that shore location since it is different than your usual sample site.

Calibration:

The calibration section of the field sheet is explained in more detail for each meter in the Calibration section of the manual (starting on page 8). Your field sheet will look like one below:

Field Measurements:

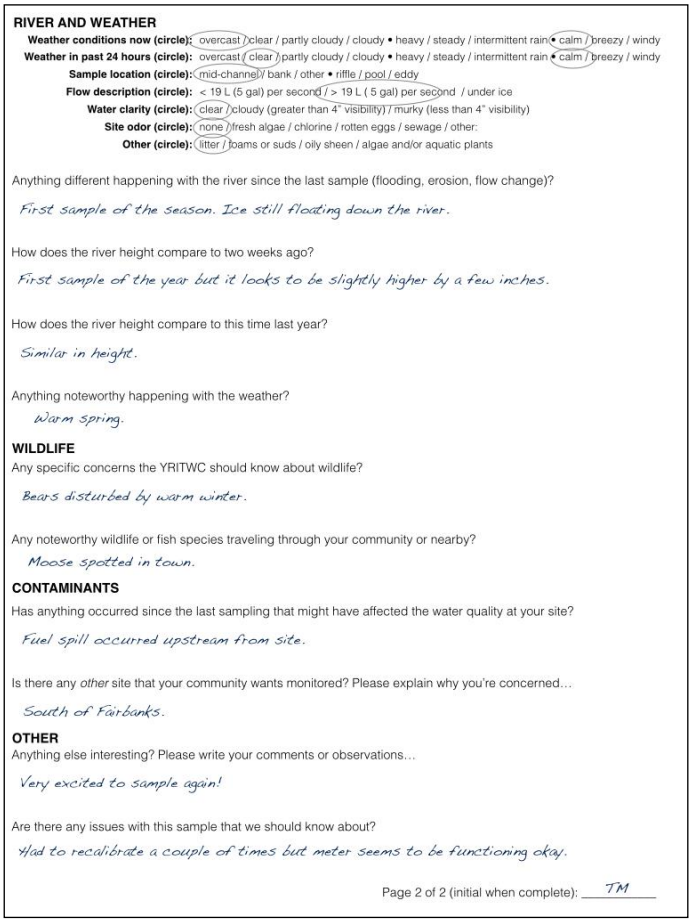
The field measurements are the reward for all your work calibrating and collecting the samples. These measurements provide real-time information to supplement the water sample you collect.

Field Data

pH: 8.24	Air Temperature (°C): 15.3°C	Latitude: N 64.7828
Dissolved Oxygen (%): n/a	Water Temperature (°C): 11.4°C	Longitude: W 141.1767
Dissolved Oxygen (mg/L): n/a	Ice Thickness (cm): n/a	Elevation (m): 268 m
Conductivity (µS/cm): 172 us/cm		

Comments & Observations:

The reverse side of the field sheet provides an opportunity for you to write any additional comments or observations that you have during your sample trip. There are some guided questions that you may find useful. Documenting observations alongside instrument data helps in explaining or understanding the numbers produced from the meters and laboratory analysis. Your firsthand experience, knowledge and observations are a very important part of the documentation process. To the right is an example of answers for questions on the field sheet.



RIVER AND WEATHER

Weather conditions now (circle): overcast / clear / partly cloudy / cloudy • heavy / steady / intermittent rain • calm / breezy / windy
Weather in past 24 hours (circle): overcast / clear / partly cloudy / cloudy • heavy / steady / intermittent rain • calm / breezy / windy
Sample location (circle): mid-channel / bank / other • riffle / pool / eddy
Flow description (circle): < 19 L (5 gal) per second / > 19 L (5 gal) per second / under ice
Water clarity (circle): clear / cloudy (greater than 4" visibility) / murky (less than 4" visibility)
Site odor (circle): none / fresh algae / chlorine / rotten eggs / sewage / other:
Other (circle): litter / foams or suds / oily sheen / algae and/or aquatic plants

Anything different happening with the river since the last sample (flooding, erosion, flow change)?

First sample of the season. Ice still floating down the river.

How does the river height compare to two weeks ago?

First sample of the year but it looks to be slightly higher by a few inches.

How does the river height compare to this time last year?

Similar in height.

Anything noteworthy happening with the weather?

Warm spring.

WILDLIFE

Any specific concerns the YRITWC should know about wildlife?

Bears disturbed by warm winter.

Any noteworthy wildlife or fish species traveling through your community or nearby?

Moose spotted in town.

CONTAMINANTS

Has anything occurred since the last sampling that might have affected the water quality at your site?

Fuel spill occurred upstream from site.

Is there any *other* site that your community wants monitored? Please explain why you're concerned…

South of Fairbanks.

OTHER

Anything else interesting? Please write your comments or observations…

Very excited to sample again!

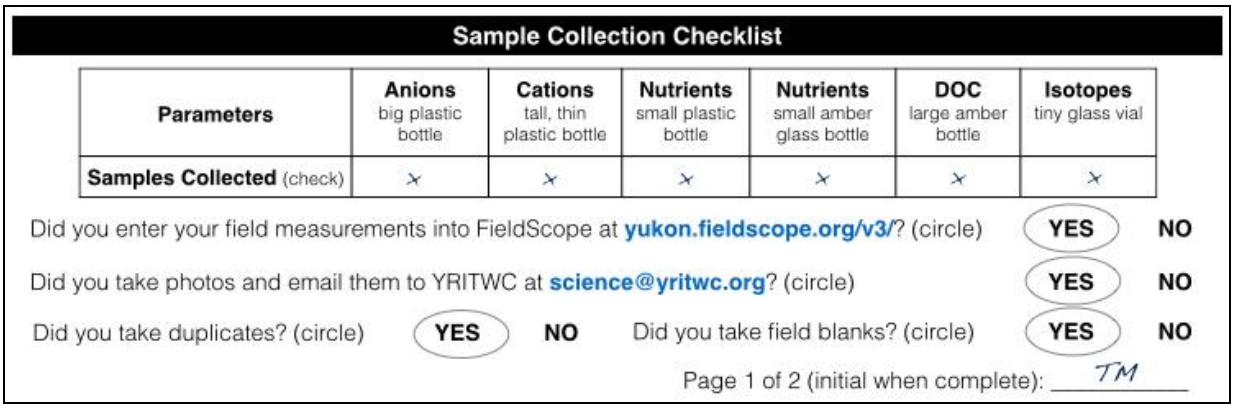
Are there any issues with this sample that we should know about?

Had to recalibrate a couple of times but meter seems to be functioning okay.

Page 2 of 2 (initial when complete): TM

Bottle Check List:

The final section of the field sheet provides a space to double check that all the sample bottles were filtered and filled correctly. The checklist provides a description and the volume of each sample bottle, whether to filter the sample, and the parameter to be analyzed in the lab. Check off each bottle as you complete the filtering process. If you encounter any issues during your sampling, please make a note on the field sheet.



Sample Collection Checklist

Parameters	Anions big plastic bottle	Cations tall, thin plastic bottle	Nutrients small plastic bottle	Nutrients small amber glass bottle	DOC large amber bottle	Isotopes tiny glass vial
Samples Collected (check)	✓	✓	✓	✓	✓	✓

Did you enter your field measurements into FieldScope at **yukon.fieldscope.org/v3/**? (circle) **YES** **NO**

Did you take photos and email them to YRITWC at **science@yritwc.org**? (circle) **YES** **NO**

Did you take duplicates? (circle) **YES** **NO** Did you take field blanks? (circle) **YES** **NO**

Page 1 of 2 (initial when complete): TM

FieldScope:

The YRITWC would like to introduce National Geographic's FieldScope program, an interactive online map. This new database stores your water quality field data and observations. This exciting tool allows you to add your site's pH, dissolved oxygen, conductivity, temperatures, photos, videos, field observations, and local knowledge. We hope FieldScope will be a very useful tool for samplers to share water quality data in the Yukon River watershed. You can choose to make your community's information private or open to all public viewers. Tell us what you think of FieldScope. We would love your feedback! Visit the Yukon River watershed at yukon.fieldscope.org/v3/.

Pictures:

Please take pictures while you are out in the field and email them to Science staff at emutter@yritwc.org. We love to see you in action! If you are open to letting us use your pictures for reporting and publication purposes, please clarify that in your email. We can send you a consent form. We hope to continue assisting the Indigenous Observation Water Quality Monitoring Network for years to come, and for funders, pictures are powerful evidence of the program's success! Feel free to add your photos to FieldScope as well.

Field blanks and Duplicates:

Once or twice a season you will have to fill field blanks and duplicates. This will usually happen at the very beginning of the open water sampling season and the very end. See section "Open Water", below, for specific instructions on how to complete this task.

Field Measurements

Open Water:

Gear Check List

- ✓ Meter
- ✓ Sample kit (cooler, bottles & frozen ice pack)
- ✓ Thermometer
- ✓ Field sheet
- ✓ Nitrile Gloves
- ✓ Clip board with pencil
- ✓ Holding bottles
- ✓ Syringe
- ✓ 3-way valve & rubber tubing (optional)
- ✓ Sampling Rod (optional – for safety and convenience)
- ✓ Filters
- ✓ Life jacket
- ✓ GPS (highly recommended if you have one!)
- ✓ Camera

From Boat:

The ideal location to collect a water sample is from the main flow, typically in the middle of the river. If you have access to a boat to collect your water sample, your site will be located in the main channel and flow of the river. Position the boat as close to center of the river as possible pointing the bow upstream and holding the same position. If the river velocity is high, you may have to let the boat drift with the current. Make all field measurements upstream from the boat and away from the motor, if the boat is equipped with one.

Once you have your boat or body positioned correctly and have recorded your latitude, longitude and elevation on your field sheet, you are ready to collect meter measurements.

From the Riverbank:

If you are unable to sample from the main flow of the river, a sample is better than no sample, so collecting from the riverbank is acceptable (make sure to note the location on your field sheet). Pick a location where river flow is not affected by eddies (straight river reach) or contaminated by upstream point source

pollution (sewage effluent, docks, boat landings, bridges, etc.). Wearing a life jacket, wade out into current as far, but as safely as possible. Always make field measurements with probes positioned upstream of you! This avoids influencing the water samples and field readings.

YSI 63 and 550A Meter Measurements:

1) Remove the probes from the storage area on the instrument.

2) Place probe in the water upstream from where you are standing; hold on to the handheld portion of the meter.

3) Power **"On"** the meter. This should take you to the main screen display and you will see values under each parameter.

4) Allow values to stabilize for at least 60 seconds. Record the values on the screen in the **"Field Sample"** section of the field sheet.

YSI Pro Meter Measurements:

1. Remove instrument from the pelican case.

2. Remove calibration cup from the end of the probe and carefully replace with the sampling cover.

3. Place probe in the water on the upstream side of the boat or your body (if sampling from shore); hold onto the handheld portion of the meter.

4. Power **On** the meter. This should take you to the main screen display and you will see values under each parameter.

5. Allow values to stabilize for at least 60 seconds.

6. Record the values from the screen in the **"Field Sample"** section of the field sheet (see page13 for example).

Hanna Meter Measurements:

1) Remove the casing that covers the end of the meter. Since the Hanna meter does not have a separate probe attachment to stick into the river, it is safest and easiest to collect water in your glass holding jar and take the measurements from the jar. Make sure to rinse both your jar and the meter before taking the measurements (see "Water Sample Collection" section).

2) Power **On** the meter. Press **Mode** until **"pH"** shows up in the upper right hand corner of the screen. Allow values to stabilize for at least 60 seconds.

3) Record the value on the screen in the **"Field Sample"** section of the field sheet.

4) Press **Mode** until **"µS"** shows up in the upper right hand corner of the screen. Allow value to stabilize for at least 60 seconds.

5. Record the value on the screen in the **"Field Sample"** section of the field sheet.

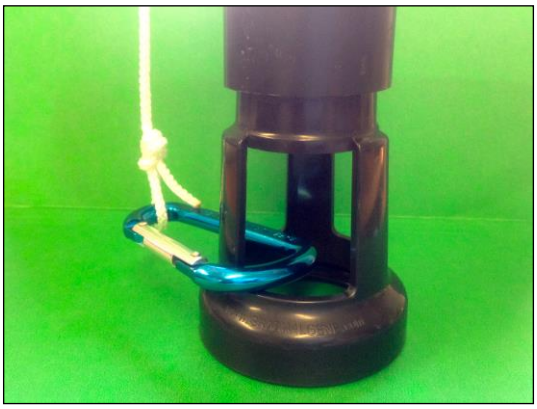
Water Sample Collection:

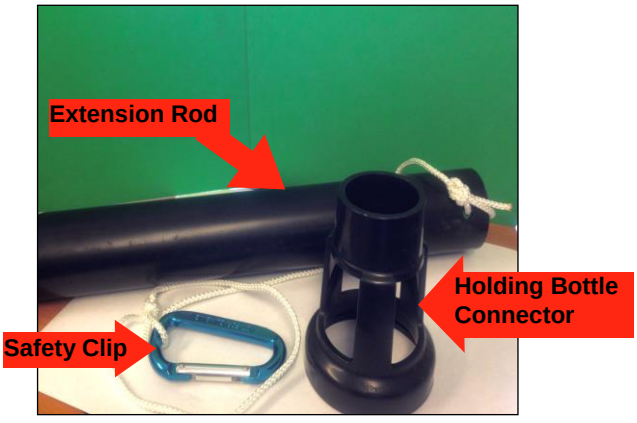
Wear Latex or Nitrile disposable gloves during water sample collection. Avoid touching the boat or anything besides sampling equipment. If the gloves become compromised, dispose and put on a new pair. The sample should be taken in the same location and similar manner as the meter values (see meter measurement descriptions from the boat and shore). Always collect the sample upstream from you and/or the boat engine.

Sample Rod Assembly:

If a sample rod is provided with your equipment, use this to collect a sample. By attaching the holding bottle to this extension you will be able to more easily collect the sample below the surface level. This method also allows for safer sample collection by reducing the amount of reach required over the side of the boat. The set-up with the 4-foot extension is also very useful for under-ice sampling.

To assemble the sample rod, slide the extension rod onto the holding bottle connector. ***Press firmly to secure the attachment. Attach the safety clip to the holding bottle connector (see picture below). The holding bottle will screw directly to the holding bottle connector.***





Collecting Water Sample from a Boat or Riverbank:

The sample will be collected using the holding bottle attached to a 4-ft plastic rod. It is important that the bottle fills with water from below the ice level.

1. Connect bottle to the sample rod (see picture and description on 27).

2) Rinse the holding bottle/jar with river water and discard water three (3) times.

3) Connect bottle to the sample rod (if provided) (See picture and description above). Not applicable for glass jar.

4) To fill the bottle/jar, submerge below the surface of the water (approximately 12 inches if possible) and allow the bottle to completely fill with water (large bubbles will stop rising to the surface when it is full).

5) Disconnect holding bottle/jar from the sample rod (if applicable).

6) Replace lid and get ready to transfer water into sample bottles (See "Filling Sample Bottles" section on page 31).

The water sample is now ready to be filtered into the sample bottles. If the weather is below freezing, this will be easier to complete inside. Take the sample back to a warm place and immediately filter and fill the sample bottles. Keep the sample refrigerated or chilled at all times.

**** This is a good time to rinse your syringe too! It must be rinsed three (3) times with river water before using it to fill your sample bottles. For detailed description on how to rinse your syringe see page 31.***

Under Ice:

Collecting samples in the winter only adds a few more steps (and several more layers of clothing!), but generally follows the same procedures as open water sampling. Safety is a top priority any time during sampling, but be especially careful when traveling on the ice. Be aware of ice conditions and safe routes to the sample location. If in doubt, don't go out!

Gear Check List

- ✓ Meter
- ✓ Sample kit (cooler, bottles & frozen ice pack)
- ✓ Thermometer
- ✓ Field sheet
- ✓ Nitrile Gloves
- ✓ Clip board with pencil
- ✓ Holding bottle
- ✓ Long Rod
- ✓ Syringe
- ✓ 3-way valve & rubber tubing (optional)
- ✓ Sampling Rod (optional – for safety and convenience)
- ✓ Filters
- ✓ Life jacket
- ✓ GPS (highly recommended if you have one!)
- ✓ Camera
- ✓ Ice Auger with spare blades
- ✓ Auger fuel (Most augers take mixed fuel. Read instructions carefully)
- ✓ Warm Clothing

Drilling the Ice Hole:

1) Using an ice auger, drill a hole in the ice until you reach water.

2) Use the auger to **"clean the hole"** by dipping it into the water and pulling out several times. This pulls water up and out onto the ice and helps remove some of the ice chunks from the open hole.

Dave Pelunis-Messier collects an under ice sample on the Tanana River.

Brendan Mulligan drills an ice hole on the Tanana River.

Meter Measurements:

The under ice measurement will be taken in the same location as the open water sample. Use a GPS or landmarks to find the sample location in the winter. You still want to be in the general location of the main flow of the river, even though it is under ice. Take care not to let the sensors on the instruments freeze! Ice build-up will cause inaccurate readings and has the potential to break the sensors.

Ice Thickness Measurements:

The thickness of the ice is important data to collect in the winter and it allows us to see if there are variations year after year. We are still perfecting the best method to measure how thick the ice is so you may be equipped with any number of measuring tools. However, the following instructions apply to all measuring rods.

1. You should have a long rod (up to 7 meters in length) with centimeters marked out. On one end of the rod there is a nail protruding outward. Lower this end down into your ice hole.

2. Hook the protruding nail under the bottom of the ice. Make sure it doesn't move.

3. Look at where the top of the ice (the surface on which you are standing) meets the rod. Using this as a reference, mark on your field sheet how many centimeters thick the ice is.

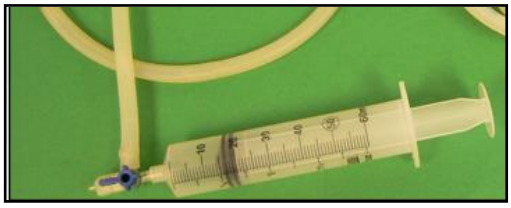
Filling Sample Bottles

Now that you have collected the water sample in the holding bottle, you are ready to transfer the water into the individual sample bottles. This can be done immediately on-site or as soon as possible in another location that may be more convenient (i.e. office, vehicle, riverbank, etc.).

The following method for filling the sample bottles will be the same for under-ice and open water sampling. Always wear Latex or Nitrile disposable gloves when handling and filling sample bottles.

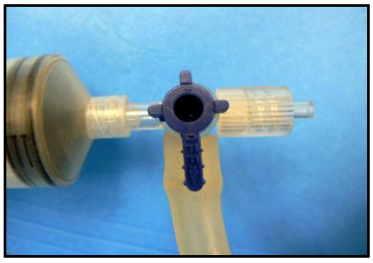
Rinsing the Syringe:

The syringe and connecting tube should be rinsed at the beginning of each new sample location. Do not stick the syringe directly into the holding bottle. If this is your only option (i.e., no tubing or valve), make sure the syringe is rinsed (inside and out) before proceeding.

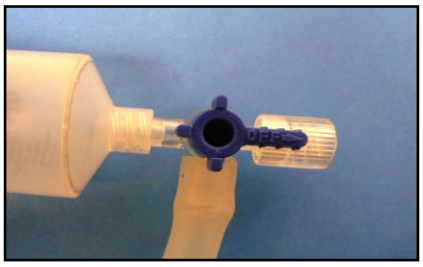


1) Connect the syringe to the 3-way valve & hose.

2) To rinse, place the end of the rubber tube into the river or holding bottle. Turn the 3-way valve position so that "off" is in-line with the dispensing tip.



When the "off" position is pointing towards the tube, water can be expelled through the dispensing tip.

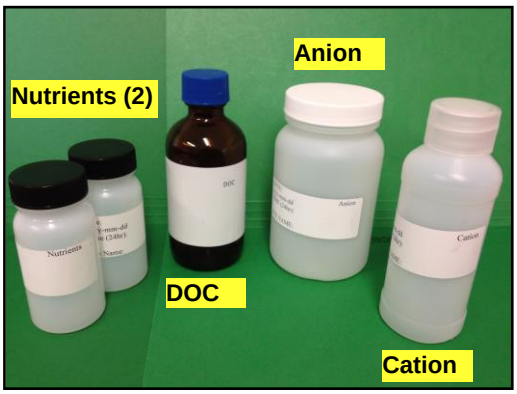


With the 3-way valve in this position, the syringe will draw water through the tube and into the syringe.

3) Draw a small amount of water (about 25 mL) into the syringe. Turn the valve position so that "off" is pointing towards the tube.

4) Continue to draw the syringe end all the way out. At this point only air should be entering the syringe. Shake to rinse the syringe, and then squirt all of the water out the dispensing tip. Repeat 2 more times.

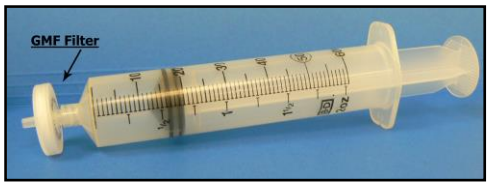
Filtered Bottles:



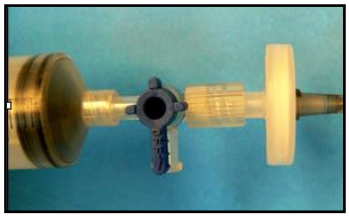
~ Nutrient, DOC, Anion and Cation

All of the sample bottles will be filled with filtered water. The water is filtered using a GMF (glass microfiber) filter that is connected to the end of the syringe. The filter can either be connected directly to the syringe or to the 3-way valve connected to the syringe.

1) Fill the syringe completely from the holding bottle of sample water using the 3-way valve connection (if applicable).



OR



2) Place the GMF filter onto the syringe.

3) Remove cap from bottle and place face-up in a safe place.

4) One at a time, fill each bottle with filtered water up to the shoulder (Anion, Cation, 2 Nutrients, DOC). Securely replace the cap on the bottle.

5) Re-fill the syringe as needed throughout the filtering process. Each filter can be used until it is too difficult to filter water through. Always use new filters at a new site location.

6) Record any observations or procedural mishaps in the comment section of the field sheet.

The "shoulder" of the bottle is where it starts to curve at the top.

Isotopes ~ O18:

The isotopes glass vial is filtered, but is filled completely to the top until a meniscus forms (round curve of water). There should be no air bubbles in the vial.

1) Using the 3-way valve (if applicable), fill the syringe with sample water from the holding bottle.

2) Place a GMF filter on the syringe.

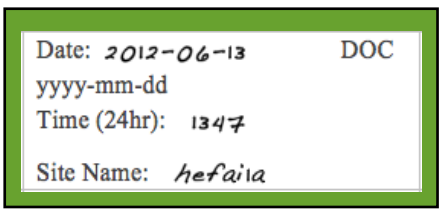
3) Remove cap from the vial and place face-up in a safe place.

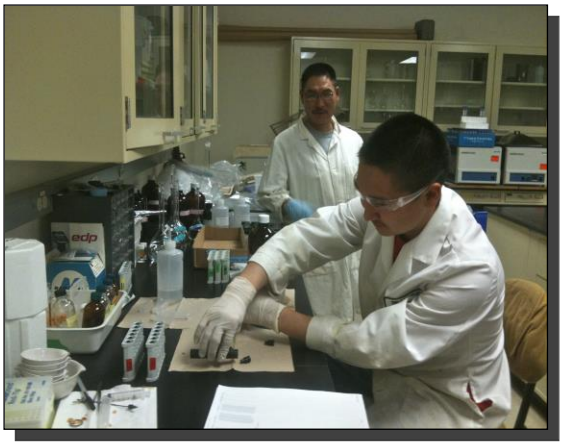
4) Fill with filtered water completely to the top. Replace the cap carefully and securely. (There should be no air bubbles in this sample once the cap is in place; you can check by turning the bottle upside-down. No air bubbles should appear.)

5) Record any observations or procedural mishaps in the comments section of the field sheet.

Labeling Sample Bottles:

Labeling each bottle in the sample is very important. The bottles have white labels that need to be filled out with the Date, Time and Site Name. This label will be identical to the information on the top right hand corner of the field sheet. When the bottles are sent to the USGS lab they are split up and sent with hundreds of other bottles to different labs to be analyzed. The label is an important part of the tracking and identification of your sample, so writing clear and consistent information on each bottle is extremely helpful.





Jay Hootch & Earl Alstrom, Yupiit of Andreafski, assist with lab work at USGS Boulder, CO.

Quality Control

When we collect water samples, we always work to reduce any sources of error that might affect our measurements. There are two types of error that we work to reduce: **bias** and **variability**.

Bias is systematic, directional error. We can work to reduce bias by calibrating our field meters with reference materials (such as pH buffers and conductivity standard solutions) and by collecting blank samples.

Variability is random error. We can work to reduce variability by standardizing our methods and by collecting replicate samples.

The goal of quality control (QC) sampling is to identify, quantify, and document bias and variability in data that result from the collection, processing, shipping, and handling of samples. The bias and variability associated with environmental data must be known for the data to be interpreted properly and to be scientifically defensible!

Blank Samples

The primary purpose of a blank sample **("blank")** is to measure the concentration of anything that might have been introduced into the sample as a result of sampling-related activities: collection, processing, shipping, and handling. Blank water is specially prepared in a quality-controlled laboratory and always carries a special certificate. It is not the same as the distilled/deionized water we use to rinse our sampling equipment. It is really important to wear gloves and to use caution when working with blanks: blank water is expensive!

Blank Samples should be collected the first and last time we visit our sampling sites every season.

How to collect a Blank Samples?

1) Ensure that you're wearing gloves!

2) Rinse your sampling equipment (holding bottle, syringe, three-way valve, and tubing) three times with DI water.

3) Rinse your sampling equipment (holding bottle, syringe, three-way valve, and tubing) once with blank water.

4) Fill the holding bottle with blank water.

5) Follow the normal procedure for filtering water outlined on Page 32. Before filling your sample bottles, be sure to push some blank water through the filter.

Replicate Samples:

The primary purpose of replicate samples is to identify and/or quantify the variability associated with sample collection and processing. Replicate samples are collected simultaneously or close in time with the associated water sample, using identical procedures.

Replicate Samples should be collected from each sampling site once every season. Replicate samples should be collected twice from a site only if more than 10 samples are collected at the site in a single season.

How to collect a Replicate Samples?

1) Use identical sampling procedures and supplies to collect two samples, one immediately after the other, using the normal sampling procedure. Remember to rinse your sampling equipment (holding bottle, syringe, three-way valve, and tubing) before collecting the second sample, just as you did before you collected the first sample.

2) Label the samples using the site name you always use, but add **"REP 1"** to the first sample collected and **"REP 2"** to the second sample collected. It's that easy!

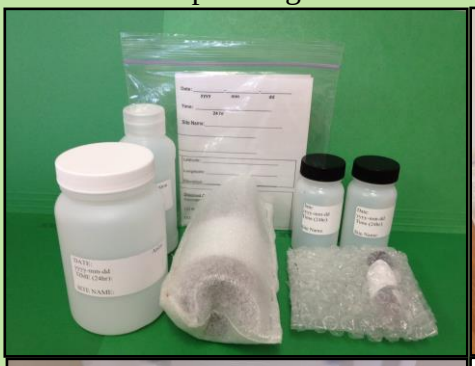
Shipping Samples

Pack samples **CAREFULLY**! Use foam sleeves for glass vials and place all bottles in the large Ziploc bag. Field sheets should be folded in quarters with the date, time, and site name facing out. Place the folded field sheet in the small Ziploc bag and place the small Ziploc bag inside the large Ziploc bag so the date, time, and site name is visible through the bags. Place a frozen ice pack in the bottom of the cooler with the sample! Turn the shipping label over so it reads **"TO: YRITWC Science Program"**. Tape the cooler shut and drop the sample off for the flight out. Give the YRITWC Science staff a call or email to let them know the sample is on the way and what flight it was sent on.

**** If you are unable to ship the sample the same day you collect it, please keep the sample refrigerated!***

***** Plan your field day so that you are sampling at the beginning of the week and shipping out your sample(s) by the middle of the week or early in the week for Yukon communities***.

1. Double check field sheet & bottle labels. Place glass bottles in protective sleeves & field sheet in Ziploc bag.



2. Pack gallon size bag with sample bottles and field sheet. Gather cooler and frozen ice pack.

3. Place frozen ice pack in bottom of the cooler. Place sample kit in cooler with field sheet facing out.

4. Secure shipping label to cooler and send via freight collect to YRITWC staff in Fairbanks. Notify staff of shipment.

Appendices

Appendix A: Solution Temperature Chart

Conductance

Temp °C	Temp °F	µS
5	41	896
10	50	1020
15	59	1147
16	60.8	1173
17	62.6	1199
18	64.4	1225
19	66.2	1251
20	68	1276
21	69.8	1305
22	71.6	1332
23	73.4	1359
24	75.2	1386
25	77	1413
26	78.8	1440
27	80.6	1467
28	82.4	1494
29	84.2	1521
30	86	1548
31	87.8	1575

pH 10

Temp °C	Temp °F	pH
0	32	10.33
5	41	10.25
10	50	10.18
15	59	10.11
20	68	10.05
25	77	10.00
30	86	9.95
35	95	9.92
40	104	9.88
45	113	9.85
50	122	9.82
55	131	9.9
60	140	9.77
70	158	9.73
80	176	9.69
90	194	9.66

pH 7

Temp °C	Temp °F	pH
0	32	7.12
5	41	7.09
10	50	7.06
15	59	7.04
20	68	7.02
25	77	7.00
30	86	6.99
35	95	6.98
40	104	6.98
45	113	6.97
50	122	6.97
55	131	6.98
60	140	6.98
70	158	6.99
80	176	7.00
90	194	7.02

Appendix B: Water Quality Sites

Water Quality Sites (Alphabetical Order)

Site ID	Water body Name	Lat. (DD)	Long. (DD)	Elevation (m)	Location
akhpb1a (ukhpb1a)	Akuliqutaq Slough	61.538	-166.1118	0	AK
ananv1a	Anvik River	62.6667	-160.2816	30	AK
anksm1a	North Fork Andreafski River	62.0521	-156.4067	20	AK
atysq1a	Atlin Lake above Atlin	59.4383	-133.6704	670.6	BC
atysq1b	Atlin Lake below Atlin	59.5988	-133.8151	671	BC
becfa1a	Bennett Lake Outlet	60.1629	-134.7150	671	YT
bihpb1a	Big Lake at Hooper Bay	61.5046	-166.1255	0	AK
bohpb1a	Bone Pond at Hooper Bay	61.5004	-166.1102	1.55	AK
chfai1b	Chena River mouth	64.8024	-147.9155	137	AK
chfai5a	Upper Chena River at Doug's	64.8458	-147.3306	138.99	AK
chfai6a	Upper Chena River above FAI	64.8470	-147.4073	136.55	AK
chvee1a	Chandlar River above Venetie	67.0191	-146.4303	174.95	AK
clsmk1a	Clear Lake at St.Michaels	63.4934	-162.1697	3.41	AK
cld661a (cldbb1a)	Clear water creek	64.0537	-145.4306	320	AK
clwbb1a	Clear Lake at Stebbins	63.4982	-162.2311	1.83	AK
hefai1a	Hess Creek	65.6657	-149.0966	137	AK

Site ID	Water body Name	Lat. (DD)	Long. (DD)	Elevation (m)	Location
hohsl1a	Hog River	65.9998	-155.3455	67	AK
kohsl1a	Koyukuk River above Huslia	65.7012	-156.4111	161	AK
kohsl2a	Koyukuk River above Huslia	65.9936	-155.3995	61	AK
kokyu1a (kogal1a)	Koyukuk River	64.9221	-157.5413	36	AK
nahpb1a	Naparyaraq Slough	61.542	-166.079	0	AK
nivak1a	Ninglivvak River	61.5461	-165.5738	9.1	AK
pofyu1a	Porcupine River	66.5927	-145.2786	419	AK
pofyu2a	Porcupine River at Hubert Camp	66.9902	-143.1405	164	AK
styma1a	Stewart River	63.5865	-135.8597	549	YT
tacfa1b	Tagish River	60.2934	-134.2624	653	YT
tafai1b	Tanana River below FAI	64.7895	-147.9593	137	AK
tafai2a	Tanana River above FAI	64.3692	-147.0239	188	AK
tafai3a	Tanana River above Eilson	64.3378	-147.8682	337	AK
tanen1a	Tanana River at Nenana	64.5662	-149.0914	112	AK
teyzw1a	Teslin Lake	60.0866	-132.6006	688	YT
teyzw1b	Teslin River	60.4819	-133.5917	681	YT
whyda1a	White River	63.1917	-139.5917	366	YT
yuanv1a	Yukon River above Anvik	61.7038	-160.1043	36	AK

Site ID	Water body Name	Lat. (DD)	Long. (DD)	Elevation (m)	Location
yubri1a	Yukon River at the Bridge	65.8760	-149.7179	80	AK
yucex1a	Yukon River at Carmacks	62.1176	-136.2626	652	YT
yucrc1a	Yukon River at Circle	65.7609	-144.0141	211	AK
yueaa1a	Yukon River at Eagle	64.7828	-141.1767	268	AK
yuemn1a	Yukon River at Emmonak	62.7587	-162.479	0	AK
yufyu1a	Yukon River at Fort Yukon	66.5588	-145.2776	130	AK
yugal1a	Yukon River at Galena	64.7197	-156.7526	142	AK
yukot1a	Yukon River at Kotlik	63.0413	-163.6697	3	AK
yuksm1a	Yukon River at St. Marys	62.0298	-163.2391	7	AK
yumll1a	Yukon River at Marshall	61.8387	-162.1418	4	AK
yupqs1a	Yukon River at Pilot Station	61.9450	-162.992	7	AK
yurby1a	Yukon River at Ruby	64.7454	-155.4887	42	AK
yursh1a	Yukon River at Russian Mission	61.8419	-161.3052	8	AK
yuyda1a	Yukon River at Dawson	64.0283	-139.4781	320	YT
yuyxy1a	Yukon River above Whitehorse	60.5735	-134.6696	652	YT
yuyxy1b	Yukon River below Whitehorse	60.8391	-135.1801	633	YT

Appendix C: Field Sheet (YSI 63 and YSI 550)

Page 1 of 2

Yukon River Inter-Tribal Watershed Council
Fairbanks: 907-451-2530 • Whitehorse: 867-393-2199

Date (yyyy-mm-dd): _____ - _____ - _____

Sample Time (24 hrs): _____

Site Name ID: _____

Waterbody Name: _____

Technician(s): _____

Meter Type(s) (circle): **Hanna** **YSI Pro** **YSI 63/550A** **YSI 650** **Meter ID(s) #:** _____

Calibration Data

pH Calibration *(YSI 63, YSI Pro, YSI 650, and Hanna)* *pH 7 and 10 need to be within 0.1 of buffer values, if not RECALIBRATE!*

pH 7 Buffer Reading: _____ pH 10 Buffer Reading: _____

pH 7 Buffer Temperature (°C): _____ pH 10 Buffer Temperature (°C): _____

Dissolved Oxygen (DO) Calibration *(YSI Pro, YSI 650, 550A)*

Barometric Pressure (inHg): _____ DO Reading (%) Saturation: _____

*Visit **www.weather.gov** and type in your community's zip code.* *DO % needs to be between 95 - 105%, if not RECALIBRATE!*

DO Reading (mg/L): _____

Conductivity Calibration *(YSI 63, YSI 650, Hanna)*

Conductivity Standard Used (µS/cm): _____ Conductivity Solution Temperature (°C): _____

Conductivity Reading (µS/cm): _____

Field Data

pH: _____ Air Temperature (°C): _____ Latitude: _____

Dissolved Oxygen (%): _____ Water Temperature (°C): _____ Longitude: _____

Dissolved Oxygen (mg/L): _____ Ice Thickness (cm): _____ Elevation (m): _____

Conductivity (µS/cm): _____

Sample Collection Checklist

Parameters	**Anions** big plastic bottle	**Cations** tall, thin plastic bottle	**Nutrients** small plastic bottle	**Nutrients** small amber glass bottle	**DOC** large amber bottle	**Isotopes** tiny glass vial
Samples Collected (check)						

Did you enter your field measurements into FieldScope at **yukon.fieldscope.org/v3/**? (circle) **YES** **NO**

Did you take photos and email them to YRITWC at **science@yritwc.org**? (circle) **YES** **NO**

Did you take duplicates? (circle) **YES** **NO** Did you take field blanks? (circle) **YES** **NO**

Page 1 of 2 (initial when complete): _____

Appendix C: Field Sheet cont.
Page 2 of 2

RIVER AND WEATHER

Weather conditions now (circle): overcast / clear / partly cloudy / cloudy • heavy / steady / intermittent rain • calm / breezy / windy
Weather in past 24 hours (circle): overcast / clear / partly cloudy / cloudy • heavy / steady / intermittent rain • calm / breezy / windy
Sample location (circle): mid-channel / bank / other • riffle / pool / eddy
Flow description (circle): < 5 gallons per second / > 5 gallons per second / under ice
Water clarity (circle): clear / cloudy (greater than 4" visibility) / murky (less than 4" visibility)
Site odor (circle): none / fresh algae / chlorine / rotten eggs / sewage / other:
Other (circle): litter / foams or suds / oily sheen / algae and/or aquatic plants

Anything different happening with the river since the last sample (flooding, erosion, flow change)?

How does the river height compare to two weeks ago?

How does the river height compare to this time last year?

Anything noteworthy happening with the weather?

WILDLIFE

Any specific concerns the YRITWC should know about wildlife?

Any noteworthy wildlife or fish species traveling through your community or nearby?

CONTAMINANTS

Has anything occurred since the last sampling that might have affected the water quality at your site?

Is there any *other* site that your community wants monitored? Please explain why you're concerned…

OTHER

Anything else interesting? Please write your comments or observations…

Are there any issues with this sample that we should know about?

Page 2 of 2 (initial when complete): _____

Appendix D: General Explanation of the Water Quality Parameters

Water Quality Parameters: Definitions along with Environmental, Human, and Drinking Water Impacts

pH

Definition: pH is a measure of the basic or acidic nature of a solution and varies with the amount of hydrogen ions present in water.

Drinking Water and Human Health: The pH level of drinking water does not have human health impacts. However, the Environmental Protection Agency (EPA) does *recommend* pH levels between 6.5 and 8.5 for drinking water.

Environmental Impact: Animals have a pH range that they thrive in. If their living environment fluctuates outside of that range they could die or become ill. A pH range of 6.0 to 9.0 provides a healthy environment for freshwater fish and invertebrates.

Dissolved Oxygen

Definition: An analysis of dissolved oxygen tests the amount of oxygen is in the water. Oxygen gets into water by aeration (rapid movement), by diffusion from the air, and as a product of photosynthesis.

Drinking Water and Human Health: A high level of dissolved oxygen in drinking water is good because it makes the water taste better. However, high levels of dissolved oxygen speed up corrosion of water pipes.

Environmental Impact: If the concentration levels of total dissolved gas in water go over 110% it is harmful to aquatic life. Fish and aquatic invertebrates can -however rarely - experience “gas bubble disease” and die. Even though *too* much can be bad, some dissolved oxygen is entirely necessary for good water quality because life depends on oxygen. The amount of DO that an aquatic organism needs is dependent on the species of the animal, the water temperatures, the animals physical state, and the pollutants present in the water. At higher temperatures fish use more oxygen because their metabolic rate increases. Research suggests that 4-5 mg/l is the minimum amount of DO that can support a large and diverse fish population. Good fish habitat generally averages around 9 mg/l of DO. Fish die when DO levels fall below 3 mg/l.

Conductivity

Definition: Water’s conductivity refers to its ability to conduct electricity. Electrical current is transported by the ions that are present in the water. The concentration of ions in a water source is commonly called *total dissolved solids* or *TDS*. All of the dissolved solids in water are either negatively charged ions - **anions** (such as bicarbonate, sulfate, chloride, silica, nitrate, carbonate, fluoride, and boron) or

positively charged ions - **cations** (such as sodium, calcium, magnesium, potassium, iron, strontium). The conductivity of water increases as the number of ions increases, therefore a higher TDS reading, or conductivity reading, means that there are more anions and cations present in the water.

Drinking Water and Human Health: Total Dissolved Solids are not known to cause many human health problems, but are more likely to have aesthetic influences; they can contribute to the corrosion of plumbing. TDS can cause drinking water to taste unpleasant and/or to look murky in appearance. Water becomes saline at extremely high levels of TDS, therefore, water is not recommended for drinking when the TDS reads above 500 mg/l or when specific conductance is above 750 μS/cm. Occasionally high levels of TDS cause gastrointestinal irritation.

Environmental Impact: Excess TDS can destroy food necessary for certain plants and animals. Also, high levels of dissolved solids can cause metallic surfaces to corrode or become encrusted.

Nutrients

Definition: There is a whole list of the different kinds of nutrients that can exist in a body of water. Phosphorus and Nitrogen are often closely tested for because they are good indicators of the health of a watershed.

Environmental Impact: Most nutrient tests will look for total oxidized nitrogen (NO_2 + NO_3) because NO_2 is poisonous to fish and is known to contribute to the overgrowth of algae. Ammonium (NH_4) is also measured because in high concentrations it can be toxic to fish and other animals.

Oxygen-18 (O18)

Definition: O18 is a stable isotope of Oxygen.

Environmental Impact: It is important in water quality testing because it can be used to trace the origin of water due to the way it fluctuates based on factors such as amount of precipitation, altitude, geothermal activity, snow melt, tree presence, location (018 levels tend to decrease farther from the coast), temperature, and much more.

Dissolved Organic Carbon (DOC)

Definition: DOC or dissolved organic carbon merely refers a wide range of organic molecules that exist in a water system. In general, organic carbon compounds come from the decomposition of plants and other dead organic matter.

Drinking Water and Human Health: DOC attaches to metals when it comes in contact with them. Some heavy metals like cadmium and mercury are toxic. When fish eat

the DOC that has toxic metals attached, these toxins are carried onto the consumer…us!

Environmental Impact: The source of DOC varies in every body of water. A stable presence of DOC often acts as food for microorganisms. Most DOC occurs naturally, but sometimes high concentrations are a result of human influence. What is important to note about DOC measurements are large or sudden changes. Such changes could be signaling to a bigger problem.

Appendix E: Resources

Equipment Retailers:

TTT Environmental, LLC
4201 B St.
Anchorage, AK 99503
Phone: 907-770-9041
Fax: 907-770-9046
Website: www.tttenviro.com
Email: info@tttenviro.com

TTT Environmental, LLC
915 – 30th Ave., Unit 103
Fairbanks, AK 99701
Phone: 907-374-9040
Fax: 907-374-9045

Instrumentation Northwest
19026 72nd Ave. S
Kent, WA 98032
Phone: 253-872-0284
Fax: 253-872-0285
Website: www.inwusa.com
Email: sales@inwusa.com

YSI Inc.
Integrated Systems & Services
Phone: 1-877-392-9950
Website: www.ysi.com/system
Website: system@ysi.com

Online Tools:

www.yritwc.org/science

- Field Manual
- Published Open File Reports
- USGS-YRITWC Fact Sheet
- Link to water quality database

Appendix F: Budget Recommendations

	Item	Cost		Description
		Open Water (11 samples)	**Year-round (14 samples)**	
Sampling Cost:	Bottles	$50.00	$75.00	7 bottles per sample at 0.50/bottle
	Filters	$120.00	$192.00	4 per sample at $3 ea
	Calibration Solution	$45.00	$90.00	$10 per liter (pH 7, pH 10)
	Cooler	$48.00	$48.00	$12 per cooler, 4 used in rotation
	Freezer Packs	$12.00	$12.00	$3 each, 4 used in rotation
	Baggies	$5.00	$5.00	hold samples
	Shipping	$300.00	$480.00	$30 per sample (This is a current estimate. Your location does dictate exact cost)
	YSI meters	$50.00	$50.00	to borrow for season, this cost covers maintenance
	YSI meter purchase			$1,600 - call if you would like to purchase
	TOTAL	$630.00	$952.00	
Training Cost Anchorage:	Item	Cost		Description
	Transportation	$1,200.00		Round trip ticket *please adjust according to location
	Per diem	$375.00	$75/day	
	Lodging	$580.00	$145/night	
On-site visit:	Transportation			covers trainer's travel to your location *adjust to location
	TOTAL (est.)	$2,155.00		