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**QUALITY CONTROL/QUALITY ASSURANCE DOCUMENTATION**

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## **1.0 SCOPE AND APPLICABILITY**

This document presents the North Dakota Department of Environmental Quality, Division of Water Quality's (DWQ) Standard Operating Procedure (SOP) for performing field measurements using a handheld meter in rivers, streams, lakes, and wetlands. This SOP applies to all DWQ field staff, non-DWQ cooperators, and citizen volunteers. The following is summarized from the Field Guide for Collecting and Processing Stream Water Samples for the National Water Quality Assessment Program (Shelton 1994).

Measurements of pH can provide some of the most important limnological information pertaining to a water-body. The pH of a solution is a measure of the effective hydrogen-ion concentration. pH is in logarithmic units using a scale from 1 to 14. Water bodies with a pH of less than 7 are considered acidic, while water bodies with a pH greater than 7 are considered basic or alkaline.

Dissolved gases such as carbon dioxide, hydrogen sulfide, and ammonia appreciably affect pH. Due to this, pH must be taken in the field, as a significant change can occur within several hours or even minutes after sample collection.

Specific conductance is the reciprocal of resistance in ohms and is a measure of the capacity of water or another substance to conduct an electrical current. Specific conductance is reported in micro siemens per centimeter at 25 degrees Celsius. The specific conductance of water is determined by the types and quantities of dissolved substances in the water. Thus, specific conductance indicates the concentrations of dissolved solids in water.

The specific conductance of water may change significantly with time because of pollution, precipitation, absorption, ion exchange, oxidation, or reduction. Therefore, specific conductance should be measured in the field.

Temperature and dissolved oxygen (DO) measurements may also provide some of the most important limnological characteristics of a water body (e.g., biological and biochemical reactions). Therefore, water temperature and DO should be measured in the field.

## **2.0 SUMMARY OF METHODS**

The handheld meter is calibrated daily, or prior to each use, using manufacturer's instructions. The calibration is logged into a calibration log (Appendix A). The probes are then lowered into the water and a measurement for temperature, DO, pH, and specific conductance is recorded.

## **3.0 HEALTH AND SAFETY WARNING**

Field personnel should take appropriate precautions when operating watercraft and working on, in, or around water. All boats should be equipped with safety equipment such as personal flotation devices (PFD's), oars, air horn, etc. North Dakota's boating laws and rules shall be followed by all field personnel.

Field personnel should be aware that hazardous conditions potentially exist at every waterbody. If unfavorable conditions are present at the time of sampling, the sample visit should be rescheduled. If hazardous weather conditions arise during sampling, such as lightning or high winds, personnel should cease sampling and move to a safe location.

Field personnel should also be aware of wildlife, insects, and plants that could be harmful as well as heat stroke and hypothermia. A first aid kit should be accessible for any potential cuts, stings, bites, or contact with poisonous plants. Ensure there is access to water, sunscreen, insect repellent, and extra clothing.

## 4.0 CAUTIONS

- Watch for bubbles or wrinkles in the membrane, these will cause errors in the DO reading (membrane handheld meters).
- Calibration solutions need to be stored properly. (e.g. room temperature and not in vehicles exposed to temperature extremes).
- Use calibration checks to ensure probes are working correctly.
- Confirm guard is properly installed for every sample.
- Probes must be checked before each sampling season to ensure that they are in working condition. Send to YSI for maintenance if necessary.
- Do not use expired probes.
- Calibrate specific conductance first.
- Take surface readings in lakes prior to sample collection.
- Take readings in rivers and streams prior to sample collection or upstream of sample collection.
- If traveling and staying overnight, handheld meters should not be left in vehicles overnight and should be stored at room temperature when possible.

## 5.0 INTERFERENCES

Membrane Handheld Meters Only: The membrane of a DO electrode is permeable to additional gases other than oxygen, such as hydrogen sulfide (H<sub>2</sub>S). Caution should be taken when using the membrane electrode in low DO waters since the presence of H<sub>2</sub>S may lower the cell sensitivity. This interference can be reduced by frequently changing the membrane and calibrating the electrode. For optic DO probes, make sure that the sensor is clear of film and if a wiper is present, replace the wiper if dirty.

## 6.0 PERSONNEL QUALIFICATIONS/RESPONSIBILITIES

All personnel taking field measurements using a handheld meter must read this SOP annually and acknowledge they have done so via a signature page (see Appendix B). New field personnel must also demonstrate successful performance of the method. The signature page will be signed by both trainee and trainer to confirm that training was successfully completed and that the new personnel is competent in carrying out this

SOP. The signature page will be kept on-file at DWQ along with the official hard copy of this SOP.

## 7.0 EQUIPMENT AND SUPPLIES

- Handheld meter(s)
- Maintenance kit (Potassium chloride/KCl solution (membrane meters only), spare membranes (membrane meters only), batteries, battery charger)
- Site Map
- Bathymetric lake map for lake sampling, if available
- Field report form
- Pens or pencils
- pH 7 and pH 10 calibrating buffer
- Specific conductance 1,413  $\mu\text{S cm}^{-1}$  calibration solution
- pH 9 calibration check
- Specific conductance 1,008  $\mu\text{S cm}^{-1}$  calibration check
- Power ice auger (winter sampling)
- Ice skimmer (winter sampling)
- Meter stick (winter sampling)
- Sled (winter sampling)
- Personal Flotation Device
- Boat or canoe, if needed

## 8.0 PROCEDURE

### Streams and Rivers

1. Calibrate the meter using a solution with known specific conductance (1,413  $\mu\text{S cm}^{-1}$  preferred), pH buffer solutions of 7.0 and 10.0, and calibrate dissolved oxygen according to barometric pressure following manufacturer's instructions.
2. Confirm calibration effectiveness using calibration check solutions.
3. Record calibration information in the equipment calibration log (Appendix A).  
Note: Calibration logs are meter specific.
4. Locate the main current of the stream or river. Note: When drilling a hole through the ice, be sure not to disturb the sediment with undue agitation.
5. Place the guard over the exposed probes and lower the probe to that depth which is approximately 60% the total water depth below the surface. For example, if the stream is five feet deep, take the measurement three feet below the surface.
6. Read temperature, dissolved oxygen, pH, and specific conductance if using a multi-probe meter and record. If using a single probe meter wait for the temperature reading to stabilize (30 seconds minimum), record the temperature reading on the stream and river sampling field log (Appendix A), switch the display to read dissolved oxygen, allow the dissolved oxygen reading to stabilize and record the dissolved oxygen concentration on the field report form. NOTE: To achieve an

accurate reading some units require a stirring unit or for the sampler to gently move the probe up and down two to three inches to circulate water across the membrane (membrane handheld meters only).

### **Lakes and Wetlands**

1. Locate the desired sampling location and anchor boat or drill a hole through ice. Note: When drilling a hole through the ice do not disturb the water column with undue agitation.
2. Calibrate to manufacturer's instructions and record calibration information in the equipment calibration log (meter specific).
3. Fill in the station identification information on the field report form. Also, measure and record ice thickness and snow depth in the comments section (winter sampling) (Appendix A).
4. Remove the storage cup and replace it with a protective guard. Lower the probe to 0.5 meters depth, or just below the ice.
5. Read the temperature, DO, specific conductance, and pH concentrations and record on lake or wetland sample record form (Appendix A). If using a single probe meter wait for the temperature reading to stabilize (30 seconds minimum), record the temperature reading on the field report form, switch the display to read dissolved oxygen, allow the dissolved oxygen reading to stabilize and record the dissolved oxygen concentration on the field report form. NOTE: To achieve an accurate reading some units require a stirring unit or for the sampler to gently move the probe up and down two to three inches to circulate water across the membrane (membrane handheld meters only).
6. Lower the probe to the next depth interval and repeat step 5. Readings should be taken at every meter (i.e. 0.5, 1, 2, 3...) if greater than three meters deep. Every half meter (i.e. 0.5, 1, 1.5, 2, 2.5...) if three meters depth or less.
7. Repeat step 6 until 0.5 meters of the bottom.
8. Retrieve probe from bottom of water body, rinse thoroughly and replace the storage cup. Recheck the surface reading to ensure the reading is within  $0.2 \text{ mg L}^{-1}$  of initial reading, following profile measurements to ensure the precision and accuracy of the measurements. If the reading is not within  $0.2 \text{ mg L}^{-1}$ , re-calibrate the meter and measure the profile again, repeating steps 5 through 7.

## **9.0 DATA AND RECORDS MANAGEMENT**

Handheld meter measurements will be recorded on the field form (Appendix A). Once personnel reach the office, data recorded on the field form are entered into the DWQ Sample Identification Database (SID). Field notes should be used to record any quality control activity performed such as measurements taken by more than one sampler, or to record any sampling conditions that may have interfered with the reading such as high



winds/wave action, cattle in water, observed flow, water surface, water clarity, water color, water odor, visual algae cover, number of dead fish, present weather, estimated inches of rain fall in past 72 hours, and any comments. Field forms and notes should be stored in the appropriate project folder at DWQ.

## **10.0 QUALITY ASSURANCE AND QUALITY CONTROL**

The meter(s) should be calibrated before sampling trip following the manufacturer's instructions and the calibrations should be recorded. Additionally, temperature probes will be checked annually against a certified NIST thermometer.

## **11.0 ANS DECONTAMINATION**

In waters that have been classified as ANS infested, the meter must be decontaminated (Decon). To decon the meter pH 4.00 solution will be used. Triple rinse probes using pH 4.00 solution and then store the probes in pH 4.00 solution.

## **11.0 REFERENCES**

Gibs, Jacob, et al. "Use of Multiparameter Instruments for Routine Field Measurements." *USGS*, USGS, Mar. 2012, [https://pubs.usgs.gov/twri/twri9a6/twri9a68/twri9a6\\_6.8.pdf](https://pubs.usgs.gov/twri/twri9a6/twri9a68/twri9a6_6.8.pdf).

Shelton, Larry R. "Field Guide for Collecting and Processing Stream-Water Samples for the National Water-Quality Assessment Program." *USGS*, USGS, 1994, <https://pubs.usgs.gov/of/1994/0455/report.pdf>.

**APPENDIX A**  
Field Reporting Forms



**River and Stream Sampling Field Log**  
**North Dakota Department of Environmental Quality**  
**Division of Water Quality - Watershed Management Program**  
**Telephone: 701-328-6140**  
**Fax: 701-328-6280**

Sample #:		Site ID:	Site Description:		Comments:
Dup	Blk	Date: / /	Temperature	DO	
		Time: :	SC	pH	
Sample #:		Site ID:	Site Description:		Comments:
Dup	Blk	Date: / /	Temperature	DO	
		Time: :	SC	pH	
Sample #:		Site ID:	Site Description:		Comments:
Dup	Blk	Date: / /	Temperature	DO	
		Time: :	SC	pH	
Sample #:		Site ID:	Site Description:		Comments:
Dup	Blk	Date: / /	Temperature	DO	
		Time: :	SC	pH	
Sample #:		Site ID:	Site Description:		Comments:
Dup	Blk	Date: / /	Temperature	DO	
		Time: :	SC	pH	
Sample #:		Site ID:	Site Description:		Comments:
Dup	Blk	Date: / /	Temperature	DO	
		Time: :	SC	pH	
Sample #:		Site ID:	Site Description:		Comments:
Dup	Blk	Date: / /	Temperature	DO	
		Time: :	SC	pH	







**Wadable Wetland Field Sampling Form**  
**North Dakota Department of Environmental Quality**  
**Division of Water Quality – Watershed Management Program**  
**Telephone: 701-328-6140**  
**Fax: 701-328-6280**

Site ID:	Wetland Name or description:			County:				
Observer:		Date:		Time:				
Aquatic Zone Description:								
Ambient Temp:		Wind Speed:		Wind Direction:				
Cloud Cover	% of 100	Secchi	(m)	chlorophyll-a=( y / n )	Phytoplankton=( y / n )			
Comments:								
Water Chemistry Taken At		Meters,		Meters,		Meters,		Meters,

Depth (m) or Location	Temp. (C)	D.O. (mg/L)	pH	Conductivity (umhos/cm)	Comments

**Site Drawing:**

**APPENDIX B**  
SOP Acknowledgement and Training Form





