

Lake Chemistry and Physical Data For Selected North Slope, Alaska, Lakes: April 2008



Rondy Ice Road Sundog at L9817, photo by D. Reichardt

by

Kristie Holland, Jeff Derry, Dan Reichardt, Hannah Clilverd,
Jessie Cherry, Amanda Blackburn, and Michael Lilly

April 2008

North Slope Lakes Hydrologic Project

Report No. INE/WERC 08.11

Water and Environmental
Research Center



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Amanda Blackburn¹, and Michael Lilly¹

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DISCLAIMER

The contents of this report reflect the views of the authors, who are responsible for the accuracy of the data presented herein. This research was funded by the U.S. Department of Energy (DOE) and the National Energy Technology Laboratory (NETL). Funding and support was also provided by the Bureau of Land Management (BLM), BP Exploration (Alaska) Inc. (BPX), ConocoPhillips Alaska, Inc. (CPA), and Geo-Watersheds Scientific (GWS). The contents of the report do not necessarily reflect the views or policies of the DOE, NETL, BLM, BPX, CPA, GWS, or any local sponsor. This work does not constitute a standard, specification, or regulation.

The use of trade and firm names in this document is for the purpose of identification only and does not imply endorsement by the University of Alaska Fairbanks (UAF), DOE, NETL, BLM, BPX, CPA, GWS, or other project sponsors.

CONVERSION FACTORS, UNITS, WATER QUALITY UNITS, VERTICAL AND HORIZONTAL DATUM, ABBREVIATIONS AND SYMBOLS

Conversion Factors

Multiply	By	To obtain
<u>Length</u>		
inch (in.)	25.4	millimeter (mm)
inch (in.)	2.54	centimeter (cm)
foot (ft)	0.3048	meter (m)
mile (mi)	1.609	kilometer (km)
<u>Area</u>		
Acre	43559.999	square feet (ft ²)
Acre	0.405	hectare (ha)
Square foot (ft ²)	3.587e-8	square mile (mi ²)
square mile (mi ²)	2.590	square kilometer (km ²)
<u>Volume</u>		
gallon (gal)	3.785	liter (L)
gallon (gal)	3785.412	milliliter (mL)
Cubic foot (ft ³)	28.317	liter (L)
Acre-ft	1233	Cubic meter (m ³)
<u>Velocity and Discharge</u>		
foot per day (ft/d)	0.3048	meter per day (m/d)
Square foot per day (ft ² /d)	.0929	square meter per day (m ² /d)
cubic foot per second (ft ³ /s)	0.02832	cubic meter per second (m ³ /sec)
<u>Hydraulic Conductivity</u>		
foot per day (ft/d)	0.3048	meter per day (m/d)
foot per day (ft/d)	0.00035	centimeter per second (cm/sec)
meter per day (m/d)	0.00115	centimeter per second (cm/sec)
<u>Hydraulic Gradient</u>		
foot per foot (ft/ft)	5280	foot per mile (ft/mi)
foot per mile (ft/mi)	0.1894	meter per kilometer (m/km)
<u>Pressure</u>		
pound per square inch (lb/in ²)	6.895	kilopascal (kPa)

Units

For the purposes of this report, both English and Metric (SI) units were employed. The choice of “primary” units employed depended on common reporting standards for a particular property or parameter measured. Whenever possible, the approximate value in the “secondary” units was also provided in parentheses. Thus, for instance, stream flow was reported in cubic feet per second (cfs) followed by the equivalent value in cubic meters per second (m³/s) in parentheses.

Physical and Chemical Water-Quality Units:

Temperature:

Water and air temperature are given in degrees Celsius (°C) and in degrees Fahrenheit (°F).

Degrees Celsius can be converted to degrees Fahrenheit by use of the following equation:

$$^{\circ}\text{F} = 1.8(^{\circ}\text{C}) + 32$$

Specific electrical conductance (conductivity):

Conductivity of water is expressed in microsiemens per centimeter at 25°C (μS/cm). This unit is equivalent to microhms per centimeter at 25°C.

Milligrams per liter (mg/L) or micrograms per liter (μg/L):

Milligrams per liter is a unit of measurement indicating the concentration of chemical constituents in solution as weight (milligrams) of solute per unit volume (liter) of water. One thousand micrograms per liter is equivalent to one milligram per liter. For concentrations less than 7,000 mg/L, the numerical value is the same as for concentrations in parts per million.

Millivolt (mV):

A unit of electromotive force equal to one thousandth of a volt.

Vertical Datum:

In this report, "sea level" refers to the National Geodetic Vertical Datum of 1929 (NGVD of 1929), a geodetic datum derived from a general adjustment of the first-order level nets of both the United States and Canada, formerly called *Sea Level Datum of 1929*.

Horizontal Datum:

The horizontal datum for all locations in this report is the North American Datum of 1983 or North American Datum of 1927.

Abbreviations, Acronyms, and Symbols

AC	Actual conductivity
ADOT&PF	Alaska Department of Transportation and Public Facilities
ASTM	American Society for Testing and Materials
atm	atmospheres
C	Celsius
DO	Dissolved oxygen
DVM	digital voltage multi-meter
e-tape	electric tape
F	Fahrenheit (°F).
ft	feet
GWS	Geo-Watersheds Scientific
GWSI	USGS Ground-Water Site Inventory
km ²	square kilometers
kPa	kilopascal
lb/in ²	pounds per square inch
m	meters
mg/L	milligrams per liter, equivalent to ppm
µg/L	micrograms per liter
mi ²	square miles
mm	millimeters
µS/cm	microsiemens per centimeter
mV	Millivolt
NGVD	National Geodetic Vertical Datum
NTU	Nephelometric Turbidity Units
NWIS	National Water Information System
ORP	oxygen-reduction potential
ppm	parts per million, equivalent to mg/L
SC25	specific conductance at 25°C
SWE	Snow Water Equivalent
QA	quality assurance
QC	quality control
UAF	University of Alaska Fairbanks
USACE	U.S. Army Corps of Engineers, Alaska District
USGS	U.S. Geological Survey
WERC	Water and Environmental Research Center
WWW	World Wide Web
YSI	Yellow Springs Instruments

Lake Nomenclature

KDA	Kuparuk Dead Arm (Prudhoe Bay field, serves Prudhoe Bay field operations)
MSB	Mine Site B (Prudhoe Bay field, serves Milne Point and Kuparuk field operations)
L9312	Lake L9312 (Alpine field, serves Alpine field operations)
L9817	Lake L9817 (Alpine field, serves Alpine field operations)
K113	Lake K113 (Prudhoe Bay field, not currently used for field operations)

PROJECT COOPERATORS

The North Slope Lakes project covers a large area of the North Slope and benefits from a number of positive partnerships, all contributing to the overall project objectives.

- BP Exploration (Alaska) Inc.
- ConocoPhillips Alaska, Inc. (CPA)
- Bureau of Land Management
- Alaska Department of Natural Resources
- The Nature Conservancy
- Northern Alaska Environmental Center

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Lake Chemistry and Physical Data For Selected North Slope, Alaska, Lakes: April 2008

INTRODUCTION

The University of Alaska Fairbanks (UAF) Water and Environmental Research Center (WERC) and Geo-Watersheds Scientific (GWS), together with project cooperators, initiated a study in the Fall of 2002 (Phase One) to obtain baseline information about the physical and chemical characteristics of North Slope tundra lakes. The project was extended in 2005 (Phase Two). The location of the study lakes changed and was expanded to include other reservoirs so as to further develop the understanding and simulation tools necessary for water-source management. K113 is an un-pumped lake in the Kuparuk oilfield and is sampled on selected field trips during the year. L9312 is a natural lake studied in the Alpine operations area. L9817 is a natural lake in eastern NPRA, west of Nuiqsut. L9817 has been used in previous years for ice-road construction, but was not used during the 2005-06, or 2006-07 winters. Two reservoir systems (mine sites) were added to the study in 2005. Mine Site B, also known as Six-mile Lake, is located near the Milne Point facility at the intersection of the Spine Road with the Milne Point access road and has two cells connected to Milne Creek. The Kuparuk Reservoir System (Kuparuk Deadarm Lakes) has nine reservoirs. The three southernmost reservoir cells (1-3) are included in the study to observe ground-water and surface-water interactions between each cells and the adjacent Kuparuk River. Study location can be seen in Figure 1.

Water-quality and hydrologic data is collected in the field during monthly visits to the lakes and water samples are collected from priority locations for further analysis at the UAF-WERC chemistry laboratories. The purposes of this publication are to 1) report data collected for the month of April 2008, 2) summarize accomplished field trip objectives.

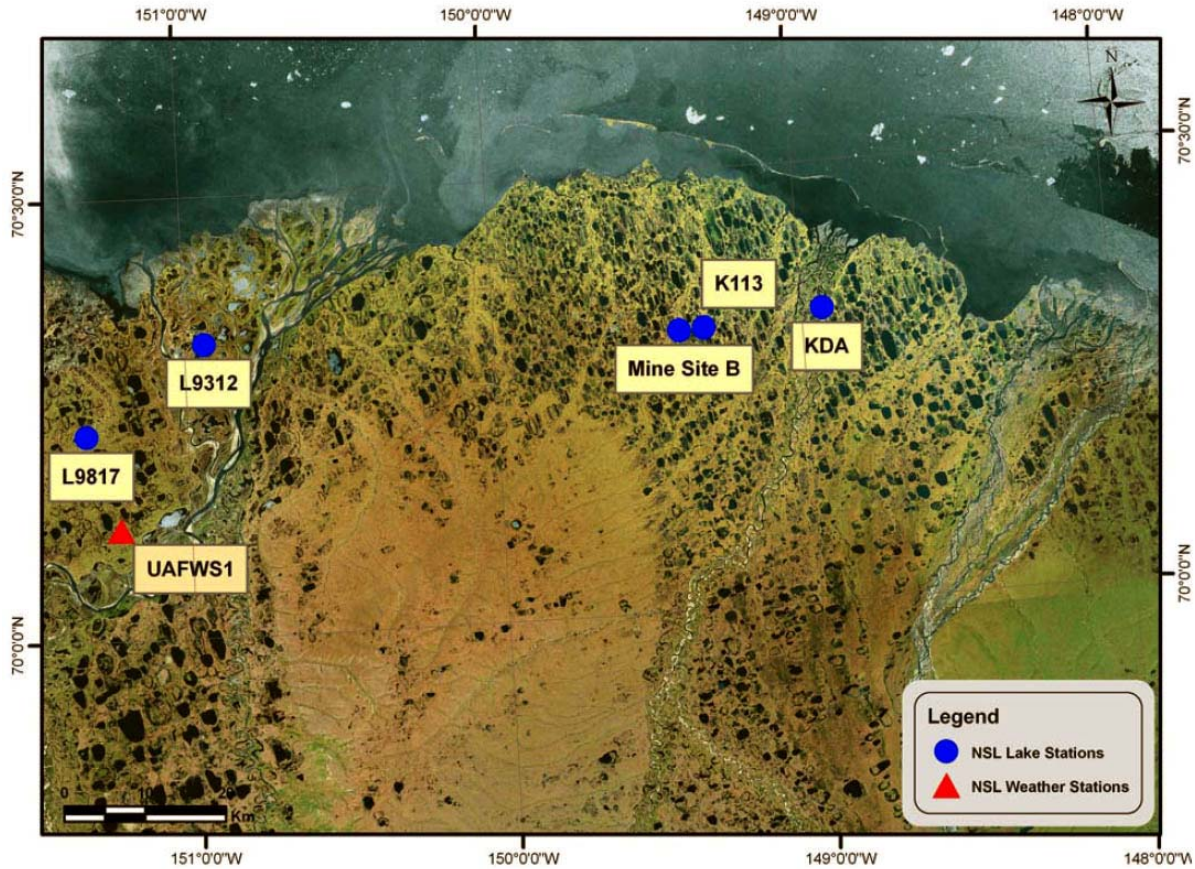


Figure 1. Location of study lakes in the NPR-A, Alpine, Kuparuk, and Prudhoe Bay field operating areas, North Slope, Alaska.

TRIP OBJECTIVES

The goal of each sampling trip is to collect physical and chemical data from each study lake. For each lake, a series of holes are drilled at designated sampling locations or a raft is taken onto the water when conditions are ice-free. Logistical, personnel, and weather constraints, can limit the amount of time available in the field for sampling. A project workplan was distributed before the trip outlining the sampling schedule (Lilly and others, 2008). In April 2008, we focused on the following locations/tasks:

1. L9312, Alpine Facility
 - Measure field water-quality parameters at standard locations.
 - Survey water levels to local elevation control.
 - Conduct snow surveys at standard locations.
 - Automated data collection and station maintenance.
2. L9817, NPR-A
 - Measure field water-quality parameters at standard locations.
 - Survey water levels to local elevation control.
 - Conduct snow survey at standard locations.
 - Automated data collection and station maintenance.
3. K113
 - Measured field water-quality parameters.
 - Automated data collection station maintenance.
 - Survey water levels to local elevation control.
4. Kuparuk Deadarm Lakes, (Cells 1-3)
 - Measure field water-quality parameters in cells 1, 2, and 3.
 - Conduct snow surveys at standard locations.
 - Automated data collection station maintenance.
5. Mine Site B, Milne-Point Operating Area
 - Measure field water-quality parameters on North and South cells.
 - Survey water levels to local elevation control.
 - Conduct snow surveys at standard locations.
6. Prudhoe Bay Operating Area, Primary Objective
 - Betty Pingo: Automated data collection station maintenance.

PROCEDURES

Water Chemistry Sampling

All field work follows the specified health, safety, and environmental guidelines outlined by BPX and CPA (White and Lilly, 2008 *a, b, c*). Physical measurements of water depth were

taken at each sampling location. Water quality parameters such as temperature, pH, turbidity, oxygen reduction potential (ORP), conductivity, and dissolved oxygen (DO) were obtained by using an In-Situ Troll 9000 (submersible meter), at multiple depths throughout the water column. The precision with which physical measurements were reported takes into account field conditions. The calibration of each parameter was checked before and after each day of sampling using the criteria in Table 1.

Table 1. In-Situ Troll 9000 calibration quality control criteria.

Parameter	Standards used	Acceptable deviation from calibration standard value
Turbidity	Factory calibrated	± 2 (NTU)
pH	4.01, 7.0, 10.0	± 0.2
Conductivity	447 ($\mu\text{s}/\text{cm}$)	within 10%
100% DO	100 % saturated	within 10%
0% DO	0 % saturated solution	within 0.3 mg/L
ORP	In-Situ Quick Cal 224 mV	within 10%



Figure 2. Dan Reichardt and Jeff Derry obtain water chemistry profiles at K113.

SELECTED RESULTS

Sampling occurred at the Kuparuk Deadarm Reservoirs, K113, Mine Site B, L9817, and L9312 during the April field campaign. Table 2 summarizes conditions at “Priority Sampling Sites”. These locations have more historical data than other locations on the lakes, and have been chosen as representative of the deeper portion of the respective lakes. All of the lakes had a decrease in water level this month with the exception of KDA-1 (increase of 2.60 ft) and KDA-3 (increase of 0.03 feet). DO concentrations were relatively high at all locations except for L9817-1, which continues to show a trend of low dissolved oxygen throughout the winter months. L9817 also exhibited extremely high conductivity levels on this sampling trip as well as others. There was an increase of over 500 $\mu\text{S}/\text{cm}$ from the previous month (the median March conductivity level at this site was 931.2 $\mu\text{S}/\text{cm}$).

Table 2. Ice thickness, Median DO Concentration, Median Actual Conductance and Monthly Water Change for North Slope lakes in mid-April.

Sampling Site	Ice Thickness [ft; (m)]	Median DO Concentration [mg/L]	Median Actual Conductivity [$\mu\text{S}/\text{cm}$]	Water level change since mid March [ft; (m)]
KDA1-CT	6.30; (1.92)	14.77	136.6	+2.60; (+0.792)
KDA2-CT	6.05; (1.84)	16.55	150.5	-1.48; (-0.451)
KDA3-CT	6.00; (1.82)	15.50	131.6	+0.03; (+0.009)
MSBS-CT	5.70; (1.73)	12.48	185.6	-0.88; (-0.268)
MSBN-CT	5.95; (1.81)	13.93	174.85	-0.68; (-0.207)
L9312-Raft B	4.80; (1.46)	11.70	95.43	-0.65; (-0.198)
L9817-1	5.50; (1.67)	0.41	1436	+0.01; (+0.003)

SUMMARY

Continuous monitoring of water quality parameters and spatial distribution of snow cover at North Slope lakes throughout the winter will help in the understanding and development of simulation tools necessary for water resource management. As water levels change during the winter, it is important to identify the existing water chemistry as well as the potential spring

recharge. This information is necessary for permitting agencies as well as the industry professionals who depend on this resource for facility use and ice road/pad construction. Through monthly hydrologic assessments, water chemistry testing, and water sample analysis, we will continue to answer some of the questions brought forth on the effects of mid-winter pumping of North Slope tundra lakes.

REFERENCES

- Reichardt, D., Holland, K., Lilly, M.R. 2008. A Workplan for Meteorological Station Maintenance, Lake Chemistry Sampling, and Surveying at Study Lakes in Alpine, Kuparuk River, and Prudhoe Bay Areas: April 2008. Water and Environmental Research Center, University of Alaska Fairbanks. 14 pages.
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- White, D.M., and Lilly, M.R. 2008 *a*. BPX: Health, Safety, and Environmental Interface Document. Water and Environmental Research Center, University of Alaska Fairbanks. 4 p.
- White, D.M., and Lilly, M.R. 2008 *b*. BPX: Health, Safety, and Environmental Plan. Water and Environmental Research Center, University of Alaska Fairbanks. 6 p.
- White, D.M., and Lilly, M.R. 2008 *c*. ConocoPhillips Alaska, Inc.: Health, Safety, and Environmental Plan. Water and Environmental Research Center, University of Alaska Fairbanks. 5 p.

APPENDIX A. WATER QUALITY FIELD SAMPLING FORMS

The following forms report the data collected with the water quality meters during field sampling.

University of Alaska Fairbanks, Water and Environmental Research Center

Form F-004a: Water Quality Field-Sampling General

Project ID: North Slope Lakes Site Location/Lake ID: L9312 Raft B
 Sample Purpose: Lake Water Quality Date: 4/15/08 Time: 12:08

FIELD MEASUREMENTS

GPS Coord. Northing: N70°19.995' Easting: W150°56.918' Datum: NAD83
 Measurements By: HMC Time: n/a
 Water Depth (ft): 10.85 Ice Thickness (ft): 4.80
 Freeboard (ft): 0.3 Snow Depth (ft): 0.45
 Elev. (BPMSL +/- .02): 7.16 Survey By: DAR/JED Date: 4/13/08 Time: 13:27
 Water Sampling By: n/a Sample Depths BWS (ft): 1 n/a Date: n/a Time: n/a
 2 _____
 3 _____

WATER QUALITY METER INFORMATION

Calibration Information

Parameter (s)	Owner	Meter Make/Model	Serial No.	Pre-Sampling QAQC Check	Post-Sampling QAQC Check					
MULTI	GWS	IN-SITU Troll 9000	33033	PASS	PASS					
Parameters										
	Field Measurements									
Time:	12:18	12:22	12:28	12:31	12:44	12:54	13:00	13:04		
Depth BWS (ft):	5	6	7	8	9	10	BOT	BOT-MIX		
Temp (°C):	0.16	0.67	1.29	1.52	1.90	2.09	2.19	2.23		
pH:	6.85	6.84	6.83	6.80	6.68	6.63	6.69	7.15		
Barometric (mmHg):	757.0	757.0	757.2	757.3	757.4	757.5	757.6	757.6		
Pressure (kPa):	14.644	17.720	20.939	23.705	26.587	29.440	31.926	32.765		
Conductivity (µS/cm):	93.65	94.19	94.92	95.53	99.13	104.20	123.70	153.70		
RDO (ppm): (mg/L)	11.70	11.68	11.71	11.70	8.37	4.64	4.12	2.16		
Turbidity (NTU):	2.1	5.6	10.2	10.8	22.6	19.2	105.4	13.1		
ORP	297	296	296	296	297	282	235	139		

FIELD TESTING OF WATER SAMPLES (if small probe is used)

Probe:					
Depth (ft)					
Temp (°C)					
pH					
Eh					

NORTH SLOPE LAB CHEMISTRY ANALYSIS

Parameter	Depth BWS (ft): _____			Depth BWS (ft): _____			Depth BWS (ft): _____			Method
	rep 1	rep 2	rep 3	rep 1	rep 2	rep 3	rep 1	rep 2	rep 3	
Oxygen (mg/L)										Hach spec 0.3-15 mg/L
Alkalinity (mg/L as CaCO ₃)										Digital titrator 10-4000 mg/L as CaCO ₃
Total iron--UF (mg/L)										Hach spec 0.02-3.00 mg/L
Filtered Iron--F tot Fe (mg/L)										Hach spec 0.02-3.00 mg/L
Ammonia (mg/L NH ₃ -N)****										0.01-0.50 mg/L NH ₃ -N
Ammonia/ Iron dilution										

Remarks: INSITU CORD # 1

Field-Form Filled Out By: HMC Date: 4/15/08
 QAQC Check By: AJB Date: 4/22/08

University of Alaska Fairbanks, Water and Environmental Research Center

Form F-004a: Water Quality Field-Sampling General

Project ID: North Slope Lakes Site Location/Lake ID: L9312 SH
 Sample Purpose: Lake Water Quality Date: 4/15/08 Time: 14:48

FIELD MEASUREMENTS

GPS Coord. Northing: N70°20.017' Easting: W150°57.076' Datum: NAD83
 Measurements By: HMC Time: nr
 Water Depth (ft): 9.2 Ice Thickness (ft): 5.00
 Freeboard (ft): 0.35 Snow Depth (ft): 0.80
 Elev. (BPMSL +/- .02): 7.16 Survey By: DAR/JED Date: 4/13/08 Time: 13:27
 Water Sampling By: n/a Sample Depths BWS (ft): 1 n/a Date: n/a Time: n/a
 2 _____
 3 _____

WATER QUALITY METER INFORMATION

Calibration Information

Parameter (s)	Owner	Meter Make/Model	Serial No.	Pre-Sampling QAQC Check	Post-Sampling QAQC Check				
MULTI	GWS	IN-SITU Troll 9000	33033	PASS	PASS				
Parameters									
	Field Measurements								
Time:	14:54	14:59	15:04	15:09	15:16	15:20	15:25		
Depth BWS (ft):	5	6	7	8	9	BOT	BOT-MIX		
Temp (°C):	0.28	0.43	0.88	1.27	1.58	1.67	1.55		
pH:	6.76	6.73	6.71	6.69	6.67	6.66	6.65		
Barometric (mmHg):	758.0	758.1	758.2	758.2	758.3	758.3	758.3		
Pressure (kPa):	14.779	18.306	20.938	23.623	26.719	26.800	27.242		
Conductivity (µS/cm):	97.26	97.27	98.11	99.06	100.70	101.00	111.10		
RDO (ppm): (mg/L)	7.93	7.47	6.73	6.28	4.79	3.58	2.70		
Turbidity (NTU):	2.0	3.5	4.0	4.9	7.7	10.8	98.0		
ORP	151	154	156	158	161	159	156		

FIELD TESTING OF WATER SAMPLES (if small probe is used)					
Probe:					
Depth (ft)					
Temp (°C)					
pH					
Eh					

NORTH SLOPE LAB CHEMISTRY ANALYSIS

Parameter	Depth BWS (ft): _____			Depth BWS (ft): _____			Depth BWS (ft): _____			Method
	rep 1	rep 2	rep 3	rep 1	rep 2	rep 3	rep 1	rep 2	rep 3	
Oxygen (mg/L)										Hach spec 0.3-15 mg/L
Alkalinity (mg/L as CaCO ₃)										Digital titrator 10-4000 mg/L as CaCO ₃
Total iron--UF (mg/L)										Hach spec 0.02-3.00 mg/L
Filtered Iron--F tot Fe (mg/L)										Hach spec 0.02-3.00 mg/L
Ammonia (mg/L NH ₃ -N)****										0.01-0.50 mg/L NH ₃ -N
Ammonia/ Iron dilution										

Remarks: INSITU CORD # 1

Field-Form Filled Out By: HMC Date: 4/15/08
 QAQC Check By: AJB Date: 4/22/08

University of Alaska Fairbanks, Water and Environmental Research Center

Form F-004a: Water Quality Field-Sampling General

Project ID: North Slope Lakes
 Sample Purpose: Lake Water Quality

Site Location/Lake ID: L9817-1
 Date: 4/16/08 Time: 13:30

FIELD MEASUREMENTS

GPS Coord. Northing: N70°14.070' Easting: W151°20.121' Datum: NAD83
 Measurements By: HMC Time: n/a
 Water Depth (ft): 7.1 Ice Thickness (ft): 5.50
 Freeboard (ft): 0.35 Snow Depth (ft): 0.70
 Elev. (BPMSL +/- .02): 51.85 Survey By: DAR/JED Date: 4/16/08 Time: 14:19
 Water Sampling By: n/a Sample Depths BWS (ft): 1 n/a Date: n/a Time: n/a
 2 _____
 3 _____

WATER QUALITY METER INFORMATION

Calibration Information

Parameter (s)	Owner	Meter Make/Model	Serial No.	Pre-Sampling QAQC Check	Post-Sampling QAQC Check
MULTI	GWS	IN-SITU Troll 9000	33033	PASS	PASS
Parameters					
	Field Measurements				
Time:	13:46	13:50	13:55	13:58	
Depth BWS (ft):	6	7	BOT (7.1')	BOT-MIX	
Temp (°C):	0.11	0.22	0.37	0.30	
pH:	6.88	6.91	6.92	6.92	
Barometric (mmHg):	763.6	763.6	763.7	763.8	
Pressure (kPa):	17.803	20.564	20.946	20.979	
Conductivity (µS/cm):	1428	1436	1471	1422	
RDO (ppm): (mg/L)	0.43	0.41	0.41	0.26	
Turbidity (NTU):	3.4	118.5	89.2	267.9	
ORP	83	68	43	34	

FIELD TESTING OF WATER SAMPLES (if small probe is used)

Probe:

Depth (ft)				
Temp (°C)				
pH				
Eh				

NORTH SLOPE LAB CHEMISTRY ANALYSIS

Parameter	Depth BWS (ft): _____			Depth BWS (ft): _____			Depth BWS (ft): _____			Method
	rep 1	rep 2	rep 3	rep 1	rep 2	rep 3	rep 1	rep 2	rep 3	
Oxygen (mg/L)										Hach spec 0.3-15 mg/L
Alkalinity (mg/L as CaCO ₃)										Digital titrator 10-4000 mg/L as CaCO ₃
Total iron--UF (mg/L)										Hach spec 0.02-3.00 mg/L
Filtered Iron--F tot Fe (mg/L)										Hach spec 0.02-3.00 mg/L
Ammonia (mg/L NH ₃ -N)****										0.01-0.50 mg/L NH ₃ -N
Ammonia/ Iron dilution										

Remarks: INSITU CORD # 1

Field-Form Filled Out By: HMC Date: 4/16/08
 QAQC Check By: DAR Date: 4/21/08

University of Alaska Fairbanks, Water and Environmental Research Center

Form F-004a: Water Quality Field-Sampling General

Project ID: North Slope Lakes
 Sample Purpose: Lake Water Quality

Site Location/Lake ID: L9817-2
 Date: 4/16/08 Time: 14:15

FIELD MEASUREMENTS

GPS Coord. Northing: N70°14.046' Easting: W151°20.079' Datum: NAD83
 Measurements By: HMC Time: n/a
 Water Depth (ft): 5.9 Ice Thickness (ft): 5.60
 Freeboard (ft): 0.45 Snow Depth (ft): 0.45
 Elev. (BPMSL +/- .02): 51.85 Survey By: DAR/JED Date: 4/16/08 Time: 14:19
 Water Sampling By: n/a Sample Depths BWS (ft): 1 n/a Date: n/a Time: n/a
 2 _____
 3 _____

WATER QUALITY METER INFORMATION

Calibration Information

Parameter (s)	Owner	Meter Make/Model	Serial No.	Pre-Sampling QAQC Check	Post-Sampling QAQC Check
MULTI	GWS	IN-SITU Troll 9000	33033	PASS	PASS
Parameters					
Field Measurements					
Time:	14:29				
Depth BWS (ft):	BOT (5.9')				
Temp (°C):	0.10				
pH:	6.86				
Barometric (mmHg):	763.9				
Pressure (kPa):	17.171				
Conductivity (µS/cm):	1423				
RDO (ppm): (mg/L)	1.02				
Turbidity (NTU):	21.2				
ORP	61				

FIELD TESTING OF WATER SAMPLES (if small probe is used)

Probe:

Depth (ft)					
Temp (°C)					
pH					
Eh					

NORTH SLOPE LAB CHEMISTRY ANALYSIS

Parameter	Depth BWS (ft): _____			Depth BWS (ft): _____			Depth BWS (ft): _____			Method
	rep 1	rep 2	rep 3	rep 1	rep 2	rep 3	rep 1	rep 2	rep 3	
Oxygen (mg/L)										Hach spec 0.3-15 mg/L
Alkalinity (mg/L as CaCO ₃)										Digital titrator 10-4000 mg/L as CaCO ₃
Total iron--UF (mg/L)										Hach spec 0.02-3.00 mg/L
Filtered Iron--F tot Fe (mg/L)										Hach spec 0.02-3.00 mg/L
Ammonia (mg/L NH ₃ -N)****										0.01-0.50 mg/L NH ₃ -N
Ammonia/ Iron dilution										

Remarks: INSITU CORD # 1

Field-Form Filled Out By: HMC Date: 4/16/08
 QAQC Check By: DAR Date: 4/21/08

University of Alaska Fairbanks, Water and Environmental Research Center

Form F-004a: Water Quality Field-Sampling General

Project ID: North Slope Lakes
 Sample Purpose: Lake Water Quality

Site Location/Lake ID: L9817-20
 Date: 4/16/08 Time: 16:20

FIELD MEASUREMENTS

GPS Coord. Northing: N70°14.079' Easting: W151°19.969' Datum: NAD83
 Measurements By: HMC Time: n/a
 Water Depth (ft): 8.6 Ice Thickness (ft): 5.55
 Freeboard (ft): 0.55 Snow Depth (ft): 0.80
 Elev. (BPMSL +/- .02): 51.85 Survey By: DAR/JED Date: 4/16/08 Time: 14:19
 Water Sampling By: n/a Sample Depths BWS (ft): 1 n/a Date: n/a Time: n/a
 2 _____
 3 _____

WATER QUALITY METER INFORMATION

Calibration Information

Parameter (s)	Owner	Meter Make/Model	Serial No.	Pre-Sampling QAQC Check	Post-Sampling QAQC Check
MULTI	GWS	IN-SITU Troll 9000	33033	PASS	PASS
Parameters					
	Field Measurements				
Time:	16:25	16:28	16:31	16:34	
Depth BWS (ft):	6	7	8	BOT(8.6')	
Temp (°C):	0.26	0.27	0.49	0.61	
pH:	6.91	6.95	6.96	7.28	
Barometric (mmHg):	764.7	764.7	764.8	764.8	
Pressure (kPa):	17.731	20.847	23.941	26.460	
Conductivity (µS/cm):	1423	1457	1541	1652	
RDO (ppm): (mg/L)	1.63	0.83	0.52	0.15	
Turbidity (NTU):	0.7	0.7	1.2	674.6	
ORP	74	67	58	-20	

FIELD TESTING OF WATER SAMPLES (if small probe is used)

Probe:					
Depth (ft)					
Temp (°C)					
pH					
Eh					

NORTH SLOPE LAB CHEMISTRY ANALYSIS

Parameter	Depth BWS (ft): _____			Depth BWS (ft): _____			Depth BWS (ft): _____			Method
	rep 1	rep 2	rep 3	rep 1	rep 2	rep 3	rep 1	rep 2	rep 3	
Oxygen (mg/L)										Hach spec 0.3-15 mg/L
Alkalinity (mg/L as CaCO ₃)										Digital titrator 10-4000 mg/L as CaCO ₃
Total iron--UF (mg/L)										Hach spec 0.02-3.00 mg/L
Filtered Iron--F tot Fe (mg/L)										Hach spec 0.02-3.00 mg/L
Ammonia (mg/L NH ₃ -N)****										0.01-0.50 mg/L NH ₃ -N
Ammonia/ Iron dilution										

Remarks: INSITU CORD # 1

Field-Form Filled Out By: HMC Date: 4/16/08
 QAQC Check By: DAR Date: 4/21/08

University of Alaska Fairbanks, Water and Environmental Research Center

Form F-004a: Water Quality Field-Sampling General

Project ID: North Slope Lakes Site Location/Lake ID: KDA1
 Sample Purpose: Lake Water Quality Date: 4/19/08 Time: 13:26

FIELD MEASUREMENTS

GPS Coord. Northing: N70° 19.868' Easting: W148° 56.768' Datum: NAD83
 Measurements By: HMC Time: nr
 Water Depth (ft): 20.1 Ice Thickness (ft): 6.30
 Freeboard (ft): 0.60 Snow Depth (ft): 0.05
 Elev. (BPMSL +/- .02): 8.05 Survey By: DAR/ JED Date: 4/19/08 Time: 12:52
 Water Sampling By: n/a Sample Depths BWS (ft): 1 n/a Date: n/a Time: n/a
 2 _____
 3 _____

WATER QUALITY METER INFORMATION

Calibration Information

Parameter (s)	Owner	Meter Make/Model	Serial No.	Pre-Sampling QAQC Check	Post-Sampling QAQC Check							
Multi	GWS	INSITU/ Troll 9000	33033	PASS	PASS							
Parameters												
	Field Measurements											
Time:	13:32	13:36	13:38	13:41	1:43	13:45	13:49	13:51	13:54	13:57	14:00	14:03
Depth BWS (ft):	7	8	9	10	11	13	15	17	18	19	20	BOT
Temp (°C):	0.92	2.02	2.22	2.26	2.27	2.29	2.29	2.31	2.31	2.31	2.31	2.30
pH:	7.59	7.58	7.57	7.56	7.57	7.57	7.56	7.55	7.57	7.55	7.56	7.56
Barometric (mmHg):	769.3	769.4	769.4	769.5	769.5	769.6	769.7	769.7	769.7	769.8	769.7	769.7
Pressure (kPa):	19.352	22.248	25.220	28.580	31.072	37.060	43.080	49.116	51.944	54.988	57.917	59.540
Conductivity (µS/cm):	133.5	135.8	135.9	136.1	136.2	136.5	136.7	136.7	136.7	136.6	136.5	136.4
RDO (ppm): (mg/L)	14.09	14.53	14.56	14.61	14.64	14.69	14.85	14.90	14.95	14.96	14.93	14.96
Turbidity (NTU):	4.1	4.7	8.1	5.3	5.7	5.3	4.9	4.5	4.0	3.4	3.3	6.1
ORP	315	314	314	314	314	314	313	313	313	313	312	312

FIELD TESTING OF WATER SAMPLES (if small probe is used)					
Probe:					
Depth (ft)					
Temp (°C)					
pH					
Eh					

NORTH SLOPE LAB CHEMISTRY ANALYSIS

Parameter	Depth BWS (ft): _____			Depth BWS (ft): _____			Depth BWS (ft): _____			Method
	rep 1	rep 2	rep 3	rep 1	rep 2	rep 3	rep 1	rep 2	rep 3	
Oxygen (mg/L)										Hach spec 0.3-15 mg/L
Alkalinity (mg/L as CaCO ₃)										Digital titrator 10-4000 mg/L as CaCO ₃
Total iron--UF (mg/L)										Hach spec 0.02-3.00 mg/L
Filtered Iron--F tot Fe (mg/L)										Hach spec 0.02-3.00 mg/L
Ammonia (mg/L NH ₃ -N)****										0.01-0.50 mg/L NH ₃ -N
Ammonia/ Iron dilution										

Remarks: BOT_DIST was at the bottom, and bobbed up and down to disturb sample.

Field-Form Filled Out By: HMC Date: 4/19/08
 QAQC Check By: AJB Date: 4/25/08

University of Alaska Fairbanks, Water and Environmental Research Center

Form F-004a: Water Quality Field-Sampling General

Project ID: North Slope Lakes Site Location/Lake ID: KDA2
 Sample Purpose: Lake Water Quality Date: 4/19/08 Time: 12:05

FIELD MEASUREMENTS

GPS Coord. Northing: N70° 19.948' Easting: W148° 56.368' Datum: NAD83
 Measurements By: HMC Time: nr
 Water Depth (ft): 15.8 Ice Thickness (ft): 6.05
 Freeboard (ft): 0.55 Snow Depth (ft): 0.00
 Elev. (BPMSL +/- .02): 3.97 Survey By: DAR/ JED Date: 4/19/08 Time: 12:52
 Water Sampling By: n/a Sample Depths BWS (ft): 1 n/a Date: n/a Time: n/a
 2 _____
 3 _____

WATER QUALITY METER INFORMATION

Calibration Information

Parameter (s)	Owner	Meter Make/Model	Serial No.	Pre-Sampling QAQC Check	Post-Sampling QAQC Check							
Multi	GWS	INSITU/ Troll 9000	33033	PASS	PASS							
Parameters												
	Field Measurements											
Time:	12:17	12:24	12:27	12:33	12:37	12:40	12:44	12:49	12:53	12:56	13:00	13:10
Depth BWS (ft):	6	7	8	9	10	11	12	13	14	15	BOT	6
Temp (°C):	1.58	2.16	2.63	3.01	3.07	3.09	3.10	3.12	3.14	3.16	3.18	0.83
pH:	7.79	7.77	7.76	7.74	7.75	7.75	7.76	7.76	7.77	7.78	7.76	7.78
Barometric (mmHg):	769.8	769.8	769.8	769.8	769.8	769.8	769.8	769.8	769.9	769.9	769.9	769.6
Pressure (kPa):	16.524	19.425	22.309	25.366	28.259	31.320	34.314	37.228	40.218	43.219	46.668	16.528
Conductivity (µS/cm):	144.3	147.8	148.7	149.9	150.4	150.5	150.9	151.1	151.3	151.4	152.7	144.9
RDO (ppm): (mg/L)	14.70	16.30	16.50	16.37	16.54	16.55	16.80	16.92	17.10	17.28	17.31	15.29
Turbidity (NTU):	0.3	0.3	0.4	0.6	0.7	0.9	0.9	0.9	0.8	0.9	19.2	0.9
ORP	284	284	283	282	282	282	281	281	280	280	280	283

FIELD TESTING OF WATER SAMPLES (if small probe is used)					
Probe:					
Depth (ft)					
Temp (°C)					
pH					
Eh					

NORTH SLOPE LAB CHEMISTRY ANALYSIS

Parameter	Depth BWS (ft): _____			Depth BWS (ft): _____			Depth BWS (ft): _____			Method
	rep 1	rep 2	rep 3	rep 1	rep 2	rep 3	rep 1	rep 2	rep 3	
Oxygen (mg/L)										Hach spec 0.3-15 mg/L
Alkalinity (mg/L as CaCO ₃)										Digital titrator 10-4000 mg/L as CaCO ₃
Total iron--UF (mg/L)										Hach spec 0.02-3.00 mg/L
Filtered Iron--F tot Fe (mg/L)										Hach spec 0.02-3.00 mg/L
Ammonia (mg/L NH ₃ -N)****										0.01-0.50 mg/L NH ₃ -N
Ammonia/ Iron dilution										

Remarks: BOT_DIST was at the bottom, and bobbed up and down to disturb sample.

Field-Form Filled Out By: HMC Date: 4/19/08
 QAQC Check By: AJB Date: 4/25/08

University of Alaska Fairbanks, Water and Environmental Research Center

Form F-004a: Water Quality Field-Sampling General

Project ID: North Slope Lakes Site Location/Lake ID: KDA3
 Sample Purpose: Lake Water Quality Date: 4/19/08 Time: 14:30

FIELD MEASUREMENTS

GPS Coord. Northing: N70°20.025' Easting: W148°56.204' Datum: NAD83
 Measurements By: HMC Time: nr
 Water Depth (ft): 21.5 Ice Thickness (ft): 6.00
 Freeboard (ft): 0.53 Snow Depth (ft): 0.40
 Elev. (BPMSL +/- .02): 5.87 Survey By: DAR/ JED Date: 4/19/08 Time: 12:52
 Water Sampling By: n/a Sample Depths BWS (ft): 1 n/a Date: n/a Time: n/a
 2 _____
 3 _____

WATER QUALITY METER INFORMATION

Calibration Information

Parameter (s)	Owner	Meter Make/Model	Serial No.	Pre-Sampling QAQC Check	Post-Sampling QAQC Check							
Multi	GWS	INSITU/ Troll 9000	33033	PASS	PASS							
Parameters												
	Field Measurements											
Time:	14:36	14:39	14:42	14:45	14:47	14:50	14:52	14:54	15:56	14:59	15:01	15:13
Depth BWS (ft):	6	7	8	9	11	13	15	17	19	20	21	BOT
Temp (°C):	0.72	1.24	2.29	2.59	2.74	2.77	2.79	2.79	2.79	2.79	2.79	2.80
pH:	7.76	7.71	7.68	7.66	7.64	7.63	7.63	7.63	7.61	7.63	7.62	7.63
Barometric (mmHg):	769.0	769.0	769.0	769.0	769.0	769.1	769.2	769.2	769.3	769.3	769.3	769.4
Pressure (kPa):	16.352	19.262	22.212	25.278	31.125	37.096	43.037	49.038	54.944	57.893	60.849	63.540
Conductivity (µS/cm):	131.6	129.7	130.6	131.0	131.5	131.6	131.6	131.6	131.6	131.5	131.6	131.7
RDO (ppm): (mg/L)	15.49	15.75	15.82	15.76	15.61	15.52	15.48	15.49	15.52	15.62	15.67	16.16
Turbidity (NTU):	0.8	0.7	0.8	1.0	1.0	0.9	1.1	0.8	0.9	0.6	0.7	1.1
ORP	301	300	300	300	300	301	301	301	301	301	301	300

FIELD TESTING OF WATER SAMPLES (if small probe is used)

Probe:					
Depth (ft)					
Temp (°C)					
pH					
Eh					

NORTH SLOPE LAB CHEMISTRY ANALYSIS

Parameter	Depth BWS (ft): _____			Depth BWS (ft): _____			Depth BWS (ft): _____			Method
	rep 1	rep 2	rep 3	rep 1	rep 2	rep 3	rep 1	rep 2	rep 3	
Oxygen (mg/L)										Hach spec 0.3-15 mg/L
Alkalinity (mg/L as CaCO ₃)										Digital titrator 10-4000 mg/L as CaCO ₃
Total iron--UF (mg/L)										Hach spec 0.02-3.00 mg/L
Filtered Iron--F tot Fe (mg/L)										Hach spec 0.02-3.00 mg/L
Ammonia (mg/L NH ₃ -N)****										0.01-0.50 mg/L NH ₃ -N
Ammonia/ Iron dilution										

Remarks: BOT_DIST was at the bottom, and bobbed up and down to disturb sample.

Field-Form Filled Out By: HMC Date: 4/19/08
 QAQC Check By: AJB Date: 4/25/08

University of Alaska Fairbanks, Water and Environmental Research Center

Form F-004a: Water Quality Field-Sampling General

Project ID: North Slope Lakes
 Sample Purpose: Lake Water Quality

Site Location/Lake ID: MSBN-CT (page 1 of 2)
 Date: 4/18/08 Time: 12:54

FIELD MEASUREMENTS

GPS Coord. Northing: N70°19.181' Easting: W149°24.315' Datum: NAD83
 Measurements By: HMC Time: 12:54
 Water Depth (ft): 32.5 Ice Thickness (ft): 5.95
 Freeboard (ft): 0.30 Snow Depth (ft): 0.40
 Elev. (BPMSL +/- .02): 92.74 Survey By: DAR/ JED Date: 4/18/08 Time: 14:00
 Water Sampling By: n/a Sample Depths BWS (ft): 1 n/a Date: n/a Time: n/a
 2 _____
 3 _____

WATER QUALITY METER INFORMATION

Calibration Information

Parameter (s)	Owner	Meter Make/Model	Serial No.	Pre-Sampling QAQC Check	Post-Sampling QAQC Check							
Multi	GWS	INSITU/ Troll 9000	33033	PASS	PASS							
Parameters												
	Field Measurements											
Time:	13:02	13:10	13:15	13:19	13:23	13:26	13:31	13:37	13:42	13:47	13:53	14:01
Depth BWS (ft):	6	7	8	9	11	13	15	17	19	21	23	25
Temp (°C):	0.52	0.77	1.12	1.35	1.49	1.52	1.55	1.56	1.57	1.66	1.74	1.72
pH:	7.71	7.74	7.77	7.73	7.69	7.71	7.72	7.73	7.74	7.59	7.47	7.31
Barometric (mmHg):	772.5	772.6	772.7	772.7	772.7	772.7	772.8	772.8	772.9	773.0	772.9	773.0
Pressure (kPa):	16.193	19.283	n/a	25.384	31.275	37.142	43.080	49.366	54.989	61.019	66.895	72.815
Conductivity (µS/cm):	172.3	172.1	173.9	173.5	173.3	173.5	173.9	174.2	174.3	175.4	179.4	191.5
RDO (ppm): (mg/L)	13.82	14.28	14.48	14.37	14.00	14.00	14.18	14.29	14.33	13.52	11.38	7.63
Turbidity (NTU):	1.6	1.1	0.7	1.2	0.5	0.5	0.3	0.3	0.1	0.3	1.0	2.3
ORP	272	268	265	264	265	264	262	261	260	263	265	269

FIELD TESTING OF WATER SAMPLES (if small probe is used)					
Probe:					
Depth (ft)					
Temp (°C)					
pH					
Eh					

NORTH SLOPE LAB CHEMISTRY ANALYSIS

Parameter	Depth BWS (ft): _____			Depth BWS (ft): _____			Depth BWS (ft): _____			Method
	rep 1	rep 2	rep 3	rep 1	rep 2	rep 3	rep 1	rep 2	rep 3	
Oxygen (mg/L)										Hach spec 0.3-15 mg/L
Alkalinity (mg/L as CaCO ₃)										Digital titrator 10-4000 mg/L as CaCO ₃
Total iron--UF (mg/L)										Hach spec 0.02-3.00 mg/L
Filtered Iron--F tot Fe (mg/L)										Hach spec 0.02-3.00 mg/L
Ammonia (mg/L NH ₃ -N)****										0.01-0.50 mg/L NH ₃ -N
Ammonia/ Iron dilution										

Remarks: Sheet 1 of 2. No pressure reading at 8 ft.

Field-Form Filled Out By: DAR Date: 4/18/08
 QAQC Check By: AJB Date: 4/22/08

University of Alaska Fairbanks, Water and Environmental Research Center

Form F-004a: Water Quality Field-Sampling General

Project ID: North Slope Lakes
 Sample Purpose: Lake Water Quality

Site Location/Lake ID: MSBN-CT (page 2 of 2)
 Date: 4/18/08 Time: 12:54

FIELD MEASUREMENTS

GPS Coord. Northing: N70°19.181' Easting: W149°24.315' Datum: NAD83
 Measurements By: HMC Time: 12:54
 Water Depth (ft): 32.5 Ice Thickness (ft): 5.95
 Freeboard (ft): 0.30 Snow Depth (ft): 0.40
 Elev. (BPMSL +/- .02): 92.74 Survey By: DAR/ JED Date: 4/18/08 Time: 14:00
 Water Sampling By: n/a Sample Depths BWS (ft): 1 n/a Date: n/a Time: n/a
 2 _____
 3 _____

WATER QUALITY METER INFORMATION

Calibration Information

Parameter (s)	Owner	Meter Make/Model	Serial No.	Pre-Sampling QAQC Check	Post-Sampling QAQC Check	
Multi	GWS	INSITU/ Troll 9000	33033	PASS	PASS	
Parameters						
	Field Measurements					
Time:	14:09	14:15	14:17	14:21	14:24	14:26
Depth BWS (ft):	27	29	30	31	32	BOT(32.5')
Temp (°C):	1.71	1.72	1.70	1.69	1.67	1.67
pH:	7.26	7.27	7.32	7.38	7.39	7.40
Barometric (mmHg):	772.9	772.9	773.0	773.0	773.0	773.0
Pressure (kPa):	78.679	84.728	87.689	90.885	93.825	96.401
Conductivity (µS/cm):	212.1	266.9	313.9	390.3	501.4	600.3
RDO (ppm): (mg/L)	4.69	2.33	1.56	1.10	0.82	0.49
Turbidity (NTU):	2.7	1.4	1.3	1.3	6.4	28.4
ORP	270	224	169	112	86	68

FIELD TESTING OF WATER SAMPLES (if small probe is used)

Probe:					
Depth (ft)					
Temp (°C)					
pH					
Eh					

NORTH SLOPE LAB CHEMISTRY ANALYSIS

Parameter	Depth BWS (ft): _____			Depth BWS (ft): _____			Depth BWS (ft): _____			Method
	rep 1	rep 2	rep 3	rep 1	rep 2	rep 3	rep 1	rep 2	rep 3	
Oxygen (mg/L)										Hach spec 0.3-15 mg/L
Alkalinity (mg/L as CaCO ₃)										Digital titrator 10-4000 mg/L as CaCO ₃
Total iron--UF (mg/L)										Hach spec 0.02-3.00 mg/L
Filtered Iron--F tot Fe (mg/L)										Hach spec 0.02-3.00 mg/L
Ammonia (mg/L NH ₃ -N)****										0.01-0.50 mg/L NH ₃ -N
Ammonia/ Iron dilution										

Remarks: Sheet 2 of 2.

Field-Form Filled Out By: DAR Date: 4/18/08
 QAQC Check By: AJB Date: 4/25/08

University of Alaska Fairbanks, Water and Environmental Research Center

Form F-004a: Water Quality Field-Sampling General

Project ID: North Slope Lakes
 Sample Purpose: Lake Water Quality

Site Location/Lake ID: MSBS-CT (page 2 of 2)
 Date: 4/18/08 Time: 14:45

FIELD MEASUREMENTS

GPS Coord. Northing: N70°19.214' Easting: W149°24.020' Datum: NAD83
 Measurements By: HMC Time: nr
 Water Depth (ft): 26.3 Ice Thickness (ft): 5.70
 Freeboard (ft): 0.40 Snow Depth (ft): 0.80
 Elev. (BPMSL +/- .02): 93.70 Survey By: DAR/ JED Date: 4/18/08 Time: 14:00
 Water Sampling By: n/a Sample Depths BWS (ft): 1 n/a Date: n/a Time: n/a
 2 _____
 3 _____

WATER QUALITY METER INFORMATION

Calibration Information

Parameter (s)	Owner	Meter Make/Model	Serial No.	Pre-Sampling QAQC Check	Post-Sampling QAQC Check
Multi	GWS	INSITU/ Troll 9000	33033	PASS	PASS
Parameters					
Field Measurements					
Time:	15:21	15:49	15:57		
Depth BWS (ft):	25	26	BOT(26.3')		
Temp (°C):	2.01	2.03	1.98		
pH:	7.46	7.22	7.29		
Barometric (mmHg):	772.6	772.3	772.3		
Pressure (kPa):	72.847	75.968	78.020		
Conductivity (µS/cm):	186.4	194.3	210.3		
RDO (ppm): (mg/L)	11.33	5.69	2.36		
Turbidity (NTU):	2.4	13.8	38.4		
ORP	129	119	76		

FIELD TESTING OF WATER SAMPLES (if small probe is used)					
Probe:					
Depth (ft)					
Temp (°C)					
pH					
Eh					

NORTH SLOPE LAB CHEMISTRY ANALYSIS

Parameter	Depth BWS (ft): _____			Depth BWS (ft): _____			Depth BWS (ft): _____			Method
	rep 1	rep 2	rep 3	rep 1	rep 2	rep 3	rep 1	rep 2	rep 3	
Oxygen (mg/L)										Hach spec 0.3-15 mg/L
Alkalinity (mg/L as CaCO ₃)										Digital titrator 10-4000 mg/L as CaCO ₃
Total iron--UF (mg/L)										Hach spec 0.02-3.00 mg/L
Filtered Iron--F tot Fe (mg/L)										Hach spec 0.02-3.00 mg/L
Ammonia (mg/L NH ₃ -N)****										0.01-0.50 mg/L NH ₃ -N
Ammonia/ Iron dilution										

Remarks: Sheet 2 of 2. Log start 15:57. Log stop 16:38.. pH/ ORP probe sensor covered therefore reading inaccurate and thrown out.

Field-Form Filled Out By: DAR Date: 4/18/08
 QAQC Check By: AJB Date: 4/25/08

APPENDIX B. WATER QUALITY METER CALIBRATION FORMS

The following forms report the pre- and post-calibration checks for the water quality meters used during field sampling.

University of Alaska Fairbanks, Water and Environmental Research Center

Form F-004e: Water Quality Meter Calibration Form

Project ID: North Slope Lakes Site Location/Lake ID: L9312
 Sample Purpose: Lake Water Quality

WATER QUALITY METER INFORMATION

Meter Make: InSitu Make: Troll 9000
 Owner: UAF S/N: 33025

CALIBRATION AND QUALITY ASSURANCE INFORMATION

Pre-Sampling QA

Parameter	Date	Time	Standard	Lot No.	Exp.	Meter Reading	Pass/Fail
pH 4.01	4/15/08	8:45	Oakton 4.01	2709256	Aug-09	4.01 @ 18.66	Pass
ph 7.00	4/15/08	8:39	Oakton 7.00	2709203	Aug-09	7.03 @ 18.43	Pass
ph 10.00	4/15/08	8:59	Oakton 10.00	2707084	Jan-09	10.02 @ 18.66	Pass
Conductivity 84 µS/cm	4/15/08	8:48	Oakton 84	2801686	Jun-08	136.3 @ 20.05	Fail
Conductivity 447 µS/cm	4/15/08	8:55	Oakton 447	2803011	Feb-09	400.2 @ 19.42	Pass
ORP	4/15/08	8:33	Zobell's	2709340	Jun-08	234 @ 18.75	Pass
Saturated O ₂	4/15/08	9:17	Bubbled Nanopure	--	--	9.46 @ 19.33	Pass
Zero O ₂	4/15/08	nr	Oakton	2706384	Jun-08	nr	n/a

Post-Sampling QA

Parameter	Date	Time	Standard	Lot No.	Exp.	Meter Reading	Pass/Fail
pH 4.01	4/18/08	nr	Oakton 4.01	2709256	Aug-09	4.06 @ 18.34	Pass
ph 7.00	4/18/08	21:08	Oakton 7.00	2709203	Aug-09	7.02 @ 19.17	Pass
ph 10.00	4/18/08	22:20	Oakton 10.00	2707084	Jan-09	10.00 @ 18.80	Pass
Conductivity 84 µS/cm	4/18/08	nr	Oakton 84	2801686	Jun-08	nr	n/a
Conductivity 447 µS/cm	4/18/08	21:59	Oakton 447	2803011	Feb-09	426.7 @ 19.0	Pass
ORP	4/18/08	21:56	Zobell's	2709340	Jun-08	247 @ 16.34	Pass
Saturated O ₂	4/18/08	21:50	Bubbled Nanopure	--	--	11.93 @ 17.06	Pass
Zero O ₂	4/18/08	21:54	Oakton	2706384	Jun-08	0.01 @ 14.5	Pass

Remarks: _____

Field-Form Filled Out By: AJB Date: 4/25/2008
 QAQC Check By: KMH Date: 6/11/2008

University of Alaska Fairbanks, Water and Environmental Research Center

Form F-004e: Water Quality Meter Calibration Form

Project ID: North Slope Lakes Site Location/Lake ID: L9312
 Sample Purpose: Lake Water Quality

WATER QUALITY METER INFORMATION

Meter Make: InSitu Make: Troll 9000
 Owner: GWS S/N: 33033

CALIBRATION AND QUALITY ASSURANCE INFORMATION

Pre-Sampling QA

Parameter	Date	Time	Standard	Lot No.	Exp.	Meter Reading	Pass/Fail
pH 4.01	4/15/08	8:57 AM	Oakton 4.01	2709256	Aug-09	4.08 @ 18.66	Pass
ph 7.00	4/15/08	9:01 AM	Oakton 7.00	2709203	Aug-09	7.08 @ 18.80	Pass
ph 10.00	4/15/08	9:03 AM	Oakton 10.00	2707084	Jan-09	10.04 @ 19.00	Pass
Conductivity 84 µS/cm	4/15/08	8:55 AM	Oakton 84	2801686	Jun-08	84.99 @ 19.90	Pass
Conductivity 447 µS/cm	4/15/08	8:53 AM	Oakton 447	2803011	Feb-09	399.2 @ 19.38	Pass
ORP	4/15/08	9:21 AM	Zobell's	2709340	Jun-08	237 @ 19.02	Pass
Saturated O ₂	4/15/08	9:28 AM	Bubbled Nanopure	--	--	8.84 @ 19.64	Pass
Zero O ₂	4/15/08	nr	Oakton	2706384	Jun-08	nr	n/a

Post-Sampling QA

Parameter	Date	Time	Standard	Lot No.	Exp.	Meter Reading	Pass/Fail
pH 4.01	4/15/08	8:02 PM	Oakton 4.01	2709256	Aug-09	4.06 @ 19.60	Pass
ph 7.00	4/15/08	8:05 PM	Oakton 7.00	2709203	Aug-09	7.09 @ 19.07	Pass
ph 10.00	4/15/08	8:08 PM	Oakton 10.00	2707084	Jan-09	10.04 @ 19.26	Pass
Conductivity 84 µS/cm	4/15/08	nr	Oakton 84	2801686	Jun-08	nr	n/a
Conductivity 447 µS/cm	4/15/08	7:55 PM	Oakton 447	2803011	Feb-09	404.3 @ 19.07	Pass
ORP	4/15/08	7:50 PM	Zobell's	2709340	Jun-08	237 @ 19.31	Pass
Saturated O ₂	4/15/08	7:46 PM	Bubbled Nanopure	--	--	9.2 @ 18.74	Pass
Zero O ₂	4/15/08	nr	Oakton	2706384	Jun-08	nr	n/a

Remarks: _____

Field-Form Filled Out By: AJB Date: 4/25/2008
 QAQC Check By: KMH Date: 6/11/2008

University of Alaska Fairbanks, Water and Environmental Research Center

Form F-004e: Water Quality Meter Calibration Form

Project ID: North Slope Lakes Site Location/Lake ID: L9817
 Sample Purpose: Lake Water Quality

WATER QUALITY METER INFORMATION

Meter Make: InSitu Make: Troll 9000
 Owner: GW Scientific S/N: 33033

CALIBRATION AND QUALITY ASSURANCE INFORMATION

Pre-Sampling QA

Parameter	Date	Time	Standard	Lot No.	Exp.	Meter Reading	Pass/Fail
pH 4.01	4/15/08	8:02	Oakton 4.01	2709256	Aug-09	4.06 @ 19.60	Pass
ph 7.00	4/15/08	8:05	Oakton 7.00	2709203	Aug-09	7.09 @ 19.07	Pass
ph 10.00	4/15/08	8:08	Oakton 10.00	2707084	Jan-09	10.04 @ 19.26	Pass
Conductivity 84 µS/cm	4/15/08	nr	Oakton 84	2801686	Jun-08	nr	n/a
Conductivity 447 µS/cm	4/15/08	7:55	Oakton 447	2803011	Feb-09	404.3 @ 19.07	Pass
ORP	4/15/08	7:50	Zobell's	2709340	Jun-08	237 @ 19.31	Pass
Saturated O ₂	4/15/08	7:46	Bubbled Nanopure	--	--	9.2 @ 18.74	Pass
Zero O ₂	4/15/08	nr	Oakton	2706384	Jun-08	nr	n/a

Post-Sampling QA

Parameter	Date	Time	Standard	Lot No.	Exp.	Meter Reading	Pass/Fail
pH 4.01	4/16/08	7:46	Oakton 4.01	2709256	Aug-09	4.06 @ 19.33	Pass
ph 7.00	4/16/08	7:48	Oakton 7.00	2709203	Aug-09	7.04 @ 19.14	Pass
ph 10.00	4/16/08	7:54	Oakton 10.00	2707084	Jan-09	10.01 @ 18.93	Pass
Conductivity 84 µS/cm	4/16/08	nr	Oakton 84	2801686	Jun-08	nr	n/a
Conductivity 447 µS/cm	4/16/08	7:42	Oakton 447	2803011	Feb-09	406.0 @ 19.31	Pass
ORP	4/16/08	7:39	Zobell's	2709340	Jun-08	232 @ 19.47	Pass
Saturated O ₂	4/16/08	7:35	Bubbled Nanopure	--	--	9.7 @ 18.45	Pass
Zero O ₂	4/16/08	nr	Oakton	2706384	Jun-08	0.04 @ 16.7	Pass

Remarks: _____

Field-Form Filled Out By: AJB Date: 4/25/2008
 QAQC Check By: KMH Date: 6/11/2008

University of Alaska Fairbanks, Water and Environmental Research Center

Form F-004e: Water Quality Meter Calibration Form

Project ID: North Slope Lakes Site Location/Lake ID: Mine Site B
 Sample Purpose: Lake Water Quality

WATER QUALITY METER INFORMATION

Meter Make: InSitu Make: Troll 9000
 Owner: GW Scientific S/N: 33033

CALIBRATION AND QUALITY ASSURANCE INFORMATION

Pre-Sampling QA

Parameter	Date	Time	Standard	Lot No.	Exp.	Meter Reading	Pass/Fail
pH 4.01	4/16/08	7:46	Oakton 4.01	2709256	Aug-09	4.06 @ 19.33	Pass
ph 7.00	4/16/08	7:48	Oakton 7.00	2709203	Aug-09	7.04 @ 19.14	Pass
ph 10.00	4/16/08	7:54	Oakton 10.00	2707084	Jan-09	10.01 @ 18.93	Pass
Conductivity 84 µS/cm	4/16/08	nr	Oakton 84	2801686	Jun-08	nr	n/a
Conductivity 447 µS/cm	4/16/08	7:42	Oakton 447	2803011	Feb-09	406.0 @ 19.31	Pass
ORP	4/16/08	7:39	Zobell's	2709340	Jun-08	232 @ 19.47	Pass
Saturated O ₂	4/16/08	7:35	Bubbled Nanopure	--	--	9.7 @ 18.45	Pass
Zero O ₂	4/16/08	nr	Oakton	2706384	Jun-08	0.04 @ 16.7	Pass

Post-Sampling QA

Parameter	Date	Time	Standard	Lot No.	Exp.	Meter Reading	Pass/Fail
pH 4.01	4/18/08	21:01	Oakton 4.01	2709256	Aug-09	4.08 @ 17.97	Pass
ph 7.00	4/18/08	22:04	Oakton 7.00	2709203	Aug-09	7.07 @ 18.89	Pass
ph 10.00	4/18/08	22:00	Oakton 10.00	2707084	Jan-09	10.09 @ 18.15	Pass
Conductivity 84 µS/cm	4/18/08	nr	Oakton 84	2801686	Jun-08	nr	n/a
Conductivity 447 µS/cm	4/18/08	nr	Oakton 447	2803011	Feb-09	414.0 @ 19.02	Pass
ORP	4/18/08	21:49	Zobell's	2709340	Jun-08	240 @ 15.95	Pass
Saturated O ₂	4/18/08	21:39	Bubbled Nanopure	--	--	11.20 @ 16.92	Pass
Zero O ₂	4/18/08	21:43	Oakton	2706384	Jun-08	0.05 @ 15.42	Pass

Remarks: _____

Field-Form Filled Out By: AJB Date: 4/25/2008
 QAQC Check By: KMH Date: 6/11/2008

University of Alaska Fairbanks, Water and Environmental Research Center

Form F-004e: Water Quality Meter Calibration Form

Project ID: North Slope Lakes
 Sample Purpose: Lake Water Quality

Site Location/Lake ID: Kuparuk Deadarm Lakes

WATER QUALITY METER INFORMATION

Meter Make: InSitu Make: Troll 9000
 Owner: GW Scientific S/N: 33033

CALIBRATION AND QUALITY ASSURANCE INFORMATION

Pre-Sampling QA

Parameter	Date	Time	Standard	Lot No.	Exp.	Meter Reading	Pass/Fail
pH 4.01	4/18/08	21:01	Oakton 4.01	2709256	Aug-09	4.08 @ 17.97	Pass
ph 7.00	4/18/08	22:04	Oakton 7.00	2709203	Aug-09	7.07 @ 18.89	Pass
ph 10.00	4/18/08	22:00	Oakton 10.00	2707084	Jan-09	10.09 @ 18.15	Pass
Conductivity 84 µS/cm	4/18/08	nr	Oakton 84	2801686	Jun-08	nr	n/a
Conductivity 447 µS/cm	4/18/08	nr	Oakton 447	2803011	Feb-09	414.0 @ 19.02	Pass
ORP	4/18/08	21:49	Zobell's	2709340	Jun-08	240 @ 15.95	Pass
Saturated O ₂	4/18/08	21:39	Bubbled Nanopure	--	--	11.20 @ 16.92	Pass
Zero O ₂	4/18/08	21:43	Oakton	2706384	Jun-08	0.05 @ 15.42	Pass

Post-Sampling QA

Parameter	Date	Time	Standard	Lot No.	Exp.	Meter Reading	Pass/Fail
pH 4.01	4/19/08	21:00	Oakton 4.01	2709256	Aug-09	4.09 @ 18.42	Pass
ph 7.00	4/19/08	21:04	Oakton 7.00	2709203	Aug-09	7.12 @ 18.70	Pass
ph 10.00	4/19/08	21:06	Oakton 10.00	2707084	Jan-09	10.08 @ 17.27	Pass
Conductivity 84 µS/cm	4/19/08	nr	Oakton 84	2801686	Jun-08	nr	n/a
Conductivity 447 µS/cm	4/19/08	20:31	Oakton 447	2803011	Feb-09	403.0 @ 18.30	Pass
ORP	4/19/08	20:48	Zobell's	2709340	Jun-08	241 @ 18.40	Pass
Saturated O ₂	4/19/08	21:00	Bubbled Nanopure	--	--	9.59 @ 17.85	Pass
Zero O ₂	4/19/08	20:58	Oakton	2706384	Jun-08	0.02 @ 16.85	Pass

Remarks: _____

Field-Form Filled Out By: AJB Date: 4/25/2008
 QAQC Check By: KMH Date: 6/11/2008

APPENDIX C. ELEVATION SURVEY FORMS

The following form reports the elevation survey information obtained during field sampling.

University of Alaska Fairbanks, Water and Environmental Research Center
Form F-011: Elevation Survey Form

Project ID: North Slope Lakes Site Location/Lake ID: L9312
 Survey Purpose: Water-Level Elevations Date: 4/13/2008 Time: 13:27

Location: Lake L9312, located southeast of Alpine pad, survey by pump house benchmarks								
Survey objective: Determine FWS Elevation.				Weather Observations:				
Instrument Type: Leica NA720		Instrument ID: 5482372 (GWS owned)		-27°F, Strong Winds. Overcast and blowing snow				
Rod Type: Fiberglass		Rod ID: Crane Fiber Glass						
Bench Mark Information:						Survey Team Names		
Name	Agency Responsible	Elevation (ft)	Latitude (dd-	Longitude (ddd-mm.mmm)		Reichardt, Derry		
L9312"P"	CP	11.73	na	na				
Station	BS (ft)	HI (ft)	FS (ft)	Elevation (fasl)	Distance (ft)	Horizontal Angle	Vertical Angle	Remarks
TBM "P"	1.27	13.00		11.73				Top of inlet pipe support
TBM "O"		13.00	1.50	11.50				Top of inlet pipe support. BM Elev=11.46'
99-32-59		13.00	1.59	14.59				Top of Pumphouse SE VSM. BM Elev = 14.57
L9312 WL		13.00	5.83	7.17				
Ice Surface		13.00	4.94	8.07				Top of surface at hole
Turn on L9312 WL								
Ice Surface	4.55	12.62		8.07				
L9312 WL		12.62	5.46	7.16				Water Surface Level
99-32-59		12.62	1.96	14.58				
TBM"O"		12.62	1.13	11.49				
TBM"P"		12.62	0.86	11.75				close survey to 0.02'

Abbreviations: backsight, BS; degrees, dd; feet, ft; feet above mean sea level, fasm; foresight, FS; height of instrument, HI; minutes, mm; seconds, ss; BP Mean Sea Level, BPMSL

University of Alaska Fairbanks, Water and Environmental Research Center
Form F-011: Elevation Survey Form

Project ID: North Slope Lakes Site Location/Lake ID: L9817
 Survey Purpose: Water-Level Elevations Date: 4/16/2008 Time: 14:19

Location:		Lake L9817 in NPRA, adjacent to Rondy Ice Road						
Survey objective:		Determine FWS Elevation.				Weather Observations:		
Instrument Type:		Leica NA720	Instrument ID:	SN:5482372				-5°F, 10 mph winds, Clear
Rod Type:		Fiberglass	Rod ID:	Crane 20' Fiberglass				
Bench Mark Information:						Survey Team Names		
Name	Agency Responsible	Elevation (ft)	Latitude (dd-mm.mmm)	Longitude (ddd-mm.mmm)		Dan Reichardt, Jeff Derry		
B	nr	54.98	na	na				
Station	BS (ft)	HI (ft)	FS (ft)	Elevation (fasl)	Distance (ft)	Horizontal Angle	Vertical Angle	Remarks
B	2.349	57.33		54.98				rebar survey control
C		57.33	1.40	55.93				rebar survey control
E		57.33	0.99	56.34				rebar survey control
L9817_WL		57.33	5.48	51.85				WL=51.85
L9817_TOI		57.33	4.71	52.62				Top of Snow near L9817_WL hole
Turn on L9817_TOI, Move to Inst.2								
L9817_TOI	4.45	57.07		52.62				
L9817_WL		57.07	5.24	51.83				
E		57.07	0.74	56.33				
C		57.07	1.15	55.92				
B		57.07	2.10	54.97				Survey closes within 0.01'

Note: L9817_WL did not freeze over properly. Held survey rod base at water surface.

Abbreviations: backsight, BS; degrees, dd; feet, ft; feet above mean sea level, fasl; foresight, FS; height of instrument, HI; minutes, mm; seconds, ss; BP Mean Sea Level, BPMSL

University of Alaska Fairbanks, Water and Environmental Research Center

Form F-011: Elevation Survey Form

Project ID: North Slope Lakes Site Location/Lake ID: KDA 1,2,3
 Survey Purpose: Water-Level Elevations Date: 4/19/2008 Time: 12:52

Location: Kuparuk Deadarm Lakes, east of the Spine Road Kuparuk bridge.								
Survey objective: Determine FWS Elevation of cell 1, cell 2 and cell 3.				Weather Observations: 25F, light snow, 5mph southwest wind				
Instrument Type: Leica NA 720		Instrument ID: 5482332 (GWS owned)						
Rod Type: Craine fiberglass 25'		Rod ID: GWS owned						
Bench Mark Information:						Survey Team Names		
Name	Agency Responsible	Elevation (ft)	Latitude (dd-mm.mmm)	Longitude (ddd-mm.mmm)	Dan Reichardt, Jeff Derry			
BM1	BP	19.32	na	na				
Station	BS (ft)	HI (ft)	FS (ft)	Elevation (fasl)	Distance (ft)	Horizontal Angle	Vertical Angle	Remarks
BM1	1.15	20.47		19.32				
KDA3_TOI		20.47	13.90	6.57				
KDA3_SH		6.57	0.70	5.87				KDA3 WL=5.87'
KDA2_TOI		20.47	14.65	5.82				
KDA2_SH		5.82	1.85	3.97				KDA2 WL=3.97'
Turn on KDA2-Ice. Move to Inst.2								
KDA2_TOI	14.37	20.20		5.82				
KDA3_TOI		20.20	13.63	6.57				
BM1		20.20	0.88	19.32				close survey to 0.00
Move to Inst.3								
KDA2-SH'	0.66	4.63		3.97				
KDA2-TOI'	9.62	14.25		4.63				
KDA1-TOI		14.25	6.10	8.15				
KDA1-SH		8.15	0.10	8.05				KDA1WL=8.05'
Turn on KDA3-ICE. Move to Inst.4								
KDA1-TOI	6.32	14.48		8.15				
KDA2-TOI'		14.48	9.84	4.64				close survey to 0.01

Note: Survey holes did not freeze. On survey holes Top of Ice is used as the instrument, with Freeboard used as BS or FS.

Abbreviations: backsight, BS; degrees, dd; feet, ft; feet above mean sea level, fasml; foresight, FS; height of instrument, HI; minutes, mm; seconds, ss; BP Mean Sea Level, BPMSL; top of ice, TOI; water level, WL

University of Alaska Fairbanks, Water and Environmental Research Center

Form F-011: Elevation Survey Form

Project ID: North Slope Lakes Site Location/Lake ID: Mine Site B
 Survey Purpose: Water-Level Elevations Date: 4/18/2008 Time: 14:00

Location: Mine Site B aka 6 mile Lake								
Survey objective: Determine lake water elevation in North and South Cells					Weather Observations:			
Instrument Type: Leica NA720		Instrument ID: 5482332 (GWS owned)			-5°F, 5 mph wind, high haze			
Rod Type: Craine fiberglass 20'		Rod ID: GWS owned						
Bench Mark Information:					Survey Team Names			
Name	Agency Responsible	Elevation (ft)	Latitude (dd-mm.mmm)	Longitude (ddd-mm.mmm)	Reichardt, Derry			
TBM_1	nr	100.00 Arbitrary	N70°19.308'	W149°23.882'				
Station	BS (ft)	HI (ft)	FS (ft)	Elevation (fasm)	Distance (ft)	Horizontal Angle	Vertical Angle	Remarks
TBM_1	4.224	104.22		100.00				
MSBN-SH1		104.22	11.48	92.74				WL MSBN=92.74'
VSM_S		104.22	0.40	103.82				
VSM_N		104.22	0.78	103.44				
Move instrument to ^2, turn on VSM_N								
VSM_N	0.69	104.13		103.44				
VSM_S		104.13	0.308	103.82				
MSBN-SH1		104.13	11.38	92.75				
TBM_1		104.13	4.13	100.00				closes within ±0.01
Move instrument to ^3 on island, turn on MSBN Water Level								
MSBN_SH2	8.186	100.93		92.74				Survey leg closes within ±0.02
MSBS_SH		100.93	7.23	93.70				WL MSBS=93.70'
MSBS_TOI		100.93	6.21	94.72				Top of ice
Move instrument to ^4, turn on MSBS-Top of ice.								
MSBS_TOI	6.55	101.27		94.72				
MSBS_SH		101.27	7.59	93.68				
MSBN_SH2		101.27	8.53	92.74				closes within ±0.02

Note: Water did not freeze completely in MSBS_SH. Held at rod base at water surface.

Abbreviations: backsight, BS; degrees, dd; feet, ft; feet above mean sea level, fasm; foresight, FS; height of instrument, HI; minutes, mm; seconds, ss; BP Mean Sea Level, BPMSL

APPENDIX D. SNOW SURVEY FORMS

The following forms report the snow survey information obtained during field sampling.

University of Alaska Fairbanks, Water and Environmental Research Center
Form F-012: Snow Depth and Water Content Survey Form

Project ID: North Slope Lakes Site Location/Lake ID: L9312-WxStation
 Survey Purpose: Determine snow water equivalent Date: 4/15/2008 Time: 13:00

Location Description:	North of weather station at L9312. Start at east snow pole, transect goes 25 m west x 25 m North. See L9312 WxSta Snow 070922.JPG for layout.				
Survey objective:	Determine Snow Water Equivalent			Weather Observations:	-10°F, Very windy, blowing snow.
Latitude:	N70°20.019'	Longitude:	W150°57.134'	Datum:	NAD83
Elevation:	Approximately 10 ft	Elevation Datum:	BPMSL	Reference Markers:	Orange snow poles
Drainage Basin:	Lake L9312	Slope Direction:	East	Vegetation Type:	Tussuck tundra
Slope Angle:	2°	Access Notes:		Other:	
Snow Depth Probe Type:	T-handle probe			Snow-Survey Team Names	
Snow Tube Type:	Arinodack snow tube			Jessie Cherrie	

Snow Course Depths, in cm.

	1	2	3	4	5
1	19.0	29.0	30.0	51.0	41.0
2	17.0	28.0	14.0	60.0	33.0
3	18.0	19.0	14.0	41.0	21.0
4	27.0	16.0	16.0	42.0	18.0
5	35.0	15.0	17.0	24.0	40.0
6	16.0	19.0	13.0	16.0	53.0
7	19.0	30.0	11.0	23.0	41.0
8	27.0	32.0	13.0	40.0	75.0
9	30.0	38.0	30.0	46.0	79.0
10	38.0	41.0	45.0	42.0	66.0

(cm)
 Average snow depth = 31.4
 Maximum snow depth = 79.0
 Minimum snow depth = 11.0
 Standard variation = 16.2

Snow Sample Depths and Weights

Bag #	Depth (cm)	Weight (gr)	Volume (cm ³)	Density (gr/cm ³)
1	21	173.8	749.7	0.23
2	21	320.2	749.7	0.43
3	10	125.2	357.0	0.35
4	6	84.7	214.2	0.40
5	16	312.9	571.2	0.55

Average Density = 0.39
 Average Snow Water Equivalent (SWE) = 12.2 cm H2O
 Average Snow Water Equivalent = 4.82 inches H2O
 Average Snow Water Equivalent = 0.40 feet H2O

SWE = avg. snow depth*(density snow/density water)

University of Alaska Fairbanks, Water and Environmental Research Center
Form F-012: Snow Depth and Water Content Survey Form

Project ID: North Slope Lakes Site Location/Lake ID: L9312_Raft_B
 Survey Purpose: Determine snow water equivalent Date: 4/15/2008 Time: 14:00

Location Description:	Started 5 meters north of "Raft B" on L9312. Travelled 25 meters northerly towards Raft A. Turned left 90° and travelled 25 meters west to end point.				
Survey objective:	Determine Snow Water Equivalent			Weather Observations:	-10°F, Very windy, blowing snow.
Latitude:	N 70° 19.995'	Longitude:	W 150° 56.918'	Datum:	NAD 83
Elevation:	7 ft	Elevation Datum:	BPMSL	Reference Markers:	Raft B is marked with lathe
Drainage Basin:	Lake L9312	Slope Direction:	Flat	Vegetation Type:	Ice
Slope Angle:	Flat	Access Notes:	Snowmobile	Other:	
Snow Depth Probe Type:	T-handle probe			Snow-Survey Team Names	
Snow Tube Type:	Arinodack snow tube			Jessie Cherrie	

Snow Course Depths, in cm.

	1	2	3	4	5
1	24.0	13.0	12.0	4.0	7.0
2	16.0	11.0	10.0	4.0	7.0
3	15.0	12.0	7.0	6.0	7.0
4	13.0	13.0	15.0	6.0	8.0
5	10.0	10.0	12.0	7.0	6.0
6	9.0	10.0	9.0	19.0	7.0
7	11.0	34.0	3.0	23.0	5.0
8	18.0	30.0	4.0	14.0	3.0
9	13.0	19.0	5.0	11.0	5.0
10	10.0	11.0	4.0	12.0	10.0

(cm)
 Average snow depth = 11.1
 Maximum snow depth = 34.0
 Minimum snow depth = 3.0
 Standard variation = 6.5

Snow Sample Depths and Weights

Bag #	Depth (cm)	Weight (gr)	Volume (cm ³)	Density (gr/cm ³)
1	22	291.9	785.4	0.37
2	14	200.4	499.8	0.40
3	18	171.4	642.6	0.27
4	2	54.6	71.4	0.76
5	16	257.4	571.2	0.45

Average Density = 0.45
 Average Snow Water Equivalent (SWE) = 5.0 cm H2O
 Average Snow Water Equivalent = 1.97 inches H2O
 Average Snow Water Equivalent = 0.16 feet H2O

SWE = avg. snow depth*(density snow/density water)

University of Alaska Fairbanks, Water and Environmental Research Center
Form F-012: Snow Depth and Water Content Survey Form

Project ID: North Slope Lakes
 Survey Purpose: Determine snow water equivalent

Site Location/Lake ID: L9817-WxStation, Tundra
 Date: 4/16/2008 Time: 14:30

Location Description:	South side of lake done on tundra. Did "L" shape, started at North and went West 25 x 25m for 1m increments				
Survey objective:	Determine Snow Water Equivalent			Weather Observations:	-25F. Unrestricted
Latitude:	N 70° 16.832	Longitude:	W 148° 53.856	Datum:	NAD83
Elevation:	Approximately 10 ft	Elevation Datum:	BPMSL	Reference Markers:	Lathe
Drainage Basin:	Lake L9817	Slope Direction:	Flat	Vegetation Type:	Tussuck tundra
Slope Angle:	Flat	Access Notes:	Truck	Other:	
Snow Depth Probe Type:	T-handle probe			Snow-Survey Team Names	
Snow Tube Type:	Adirondak, 6.74 cm diameter cutter, area = 35.7 cm ²			Jessie Cherry	

Snow Course Depths, in cm.

	1	2	3	4	5
1	33.0	21.0	48.0	38.0	41.0
2	26.0	10.0	41.0	40.0	25.0
3	47.0	24.0	49.0	48.0	32.0
4	36.0	34.0	44.0	36.0	33.0
5	37.0	49.0	47.0	36.0	25.0
6	39.0	35.0	47.0	41.0	28.0
7	41.0	27.0	53.0	39.0	32.0
8	47.0	45.0	46.0	43.0	50.0
9	37.0	52.0	53.0	38.0	40.0
10	30.0	41.0	49.0	42.0	53.0

(cm)
 Average snow depth = 39.0
 Maximum snow depth = 53.0
 Minimum snow depth = 10.0
 Standard variation = 9.4

Snow Sample Depths and Weights

Bag #	Depth (cm)	Weight (gr)	Volume (cm ³)	Density (gr/cm ³)
1	24	224.2	856.8	0.26
2	28	226.4	999.6	0.23
3	21	178.9	749.7	0.24
4	25	321.8	892.5	0.36
5	24	238.6	856.8	0.28

Average Density = 0.27
 Average Snow Water Equivalent (SWE) = 10.6 cm H2O
 Average Snow Water Equivalent = 4.19 inches H2O
 Average Snow Water Equivalent = 0.35 feet H2O

SWE = avg. snow depth*(density snow/density water)

University of Alaska Fairbanks, Water and Environmental Research Center
Form F-012: Snow Depth and Water Content Survey Form

Project ID: North Slope Lakes Site Location/Lake ID: L9817_Lake
 Survey Purpose: Determine snow water equivalent Date: 4/16/2008 Time: nr

Location Description:	Conducted on lake. L-shaped, 25 m by 25 m. Measurements took every 1 meter.				
Survey objective:	Determine Snow Water Equivalent			Weather Observations:	-25F. Unrestricted
Latitude:	N 70° 19.995'	Longitude:	W 150° 56.918'	Datum:	NAD 83
Elevation:	7 ft	Elevation Datum:	BPMSL	Reference Markers:	Near Lathe marked #3
Drainage Basin:	Lake L9817	Slope Direction:	Flat	Vegetation Type:	Ice
Slope Angle:	Flat	Access Notes:	Truck	Other:	
Snow Depth Probe Type:	T-handle probe			Snow-Survey Team Names	
Snow Tube Type:	Adirondak, 6.74 cm diameter cutter, area = 35.7 cm ²			Jessie Cherry	

Snow Course Depths, in cm.

	1	2	3	4	5
1	6.0	15.0	13.0	1.0	14.0
2	8.0	15.0	18.0	0.0	4.0
3	8.0	14.0	16.0	15.0	4.0
4	4.0	13.0	7.0	10.0	3.0
5	4.0	13.0	5.0	10.0	3.0
6	4.0	12.0	10.0	9.0	5.0
7	9.0	14.0	12.0	2.0	5.0
8	12.0	13.0	14.0	1.0	3.0
9	13.0	20.0	2.0	5.0	5.0
10	16.0	28.0	9.0	8.0	4.0

(cm)
 Average snow depth = 9.2
 Maximum snow depth = 28.0
 Minimum snow depth = 0.0
 Standard variation = 5.8

Snow Sample Depths and Weights

Bag #	Depth (cm)	Weight (gr)	Volume (cm ³)	Density (gr/cm ³)
1	18	317.2	642.6	0.49
2	13	186.1	464.1	0.40
3	14	194.6	499.8	0.39
4	11	216.0	392.7	0.55
5	6	126.0	214.2	0.59

Average Density = 0.48
 Average Snow Water Equivalent (SWE) = 4.4 cm H₂O
 Average Snow Water Equivalent = 1.75 inches H₂O
 Average Snow Water Equivalent = 0.15 feet H₂O

SWE = avg. snow depth*(density snow/density water)

University of Alaska Fairbanks, Water and Environmental Research Center
Form F-012: Snow Depth and Water Content Survey Form

Project ID: North Slope Lakes Site Location/Lake ID: K113-CT
 Survey Purpose: Determine snow water equivalent Date: 4/18/2008 Time: 16:00

Location Description:	At survey hole on lake at K113. Snow course bears North, then West.				
Survey objective:	Determine Snow Water Equivalent			Weather Observations:	-10°F, 5 mph E wind, mostly clear.
Latitude:	N70°19.250'	Longitude:	W149°19.183'	Datum:	NAD83
Elevation:	Approximately 50 ft BPMSL	Elevation Datum:	BPMSL	Reference Markers:	None
Drainage Basin:	Milne Creek	Slope Direction:	Flat	Vegetation Type:	None
Slope Angle:	flat	Access Notes:	Highway Vehicle	Other:	
Snow Depth Probe Type:	T-handle probe			Snow-Survey Team Names	
Snow Tube Type:	Arinodack snow tube			Jeff Derry	

Snow Course Depths, in cm.

	1	2	3	4	5
1	0.5	2.0	14.0	0.0	2.0
2	0.5	2.0	7.0	0.0	3.0
3	0.5	0.5	2.0	1.0	10.0
4	0.5	0.5	0.0	3.0	14.0
5	4.0	0.5	0.0	2.0	13.0
6	5.0	4.0	0.0	2.0	12.0
7	8.0	14.0	0.0	3.0	12.0
8	10.0	17.0	0.0	3.0	15.0
9	7.0	15.0	0.0	3.0	18.0
10	5.0	14.0	0.0	2.0	22.0

(cm)
 Average snow depth = 5.5
 Maximum snow depth = 22.0
 Minimum snow depth = 0.0
 Standard variation = 6.1

Snow Sample Depths and Weights

Bag #	Depth (cm)	Weight (gr)	Volume (cm ³)	Density (gr/cm ³)
1	9	130.8	321.3	0.41
2	11	138.8	392.7	0.35
3	24	294.0	856.8	0.34
4	14	164.2	499.8	0.33
5	8	102.8	285.6	0.36

Average Density = 0.36
 Average Snow Water Equivalent (SWE) = 2.0 cm H₂O
 Average Snow Water Equivalent = 0.77 inches H₂O
 Average Snow Water Equivalent = 0.06 feet H₂O

SWE = avg. snow depth*(density snow/density water)

University of Alaska Fairbanks, Water and Environmental Research Center
Form F-012: Snow Depth and Water Content Survey Form

Project ID: North Slope Lakes Site Location/Lake ID: MSB-CT
 Survey Purpose: Determine snow water equivalent Date: 4/18/2008 Time: 14:30

Location Description:	At MSBN-CT, on lake. Snow course bears West 25 meters, then South 25 meters.				
Survey objective:	Determine Snow Water Equivalent			Weather Observations:	-5°F, 5 mph E wind, mostly clear. Dark.
Latitude:	N70°19.280'	Longitude:	W149°24.009'	Datum:	NAD83
Elevation:	Approximately 50 ft BPMSL	Elevation Datum:	BPMSL	Reference Markers:	Lathe is at MSBN-CT
Drainage Basin:	Milne Creek	Slope Direction:	Flat	Vegetation Type:	Ice
Slope Angle:	flat	Access Notes:	Highway Vehicle	Other:	glaze lake ice. No or little snow on surface.
Snow Depth Probe Type:	T-handle probe			Snow-Survey Team Names	
Snow Tube Type:	Arinodack snow tube			Jeff Derry	

Snow Course Depths, in cm.

	1	2	3	4	5
1	11.0	9.0	16.0	14.0	5.0
2	9.0	10.0	17.0	11.0	5.0
3	9.0	11.0	15.0	9.0	6.0
4	9.0	10.0	12.0	11.0	8.0
5	7.0	10.0	11.0	9.0	12.0
6	9.0	11.0	13.0	14.0	14.0
7	12.0	10.0	15.0	18.0	16.0
8	7.0	12.0	19.0	15.0	15.0
9	12.0	14.0	25.0	10.0	16.0
10	11.0	15.0	27.0	7.0	17.0

(cm)
 Average snow depth = 12.2
 Maximum snow depth = 27.0
 Minimum snow depth = 5.0
 Standard variation = 4.4

Snow Sample Depths and Weights

Bag #	Depth (cm)	Weight (gr)	Volume (cm ³)	Density (gr/cm ³)
1	16	199.5	571.2	0.35
2	24	240.1	856.8	0.28
3	12	131.8	428.4	0.31
4	12	145.4	428.4	0.34
5	14	179.2	499.8	0.36

Average Density = 0.33
 Average Snow Water Equivalent (SWE) = 4.0 cm H2O
 Average Snow Water Equivalent = 1.57 inches H2O
 Average Snow Water Equivalent = 0.13 feet H2O

SWE = avg. snow depth*(density snow/density water)

University of Alaska Fairbanks, Water and Environmental Research Center
Form F-012: Snow Depth and Water Content Survey Form

Project ID: North Slope Lakes Site Location/Lake ID: MSB-SNOTUN
 Survey Purpose: Determine snow water equivalent Date: 4/18/2008 Time: 14:00

Location Description:	At MSBN-SNOTUN, on tundra. Snow course bears West 25 meters, then South 25 meters.				
Survey objective:	Determine Snow Water Equivalent			Weather Observations:	-10°F, 5 mph E wind, mostly clear.
Latitude:	N70°19.256'	Longitude:	W149°24.242'	Datum:	NAD83
Elevation:	Approximately 50 ft BPMSL	Elevation Datum:	BPMSL	Reference Markers:	Lathe is at MSBN-SNOTUN in tundra west of Lake
Drainage Basin:	Milne Creek	Slope Direction:	Flat	Vegetation Type:	Tussock Tundra
Slope Angle:	flat	Access Notes:	Highway Vehicle	Other:	Very thin crust, snow in depressions.
Snow Depth Probe Type:	T-handle probe			Snow-Survey Team Names	
Snow Tube Type:	Arinodack snow tube			Jeff Derry	

Snow Course Depths, in cm.

	1	2	3	4	5
1	32.0	36.0	34.0	34.0	33.0
2	30.0	41.0	32.0	21.0	41.0
3	29.0	29.0	33.0	19.0	28.0
4	28.0	25.0	34.0	44.0	16.0
5	24.0	30.0	32.0	38.0	13.0
6	30.0	33.0	35.0	26.0	13.0
7	41.0	30.0	29.0	30.0	11.0
8	51.0	40.0	24.0	24.0	16.0
9	52.0	48.0	20.0	25.0	12.0
10	23.0	37.0	25.0	29.0	24.0

(cm)
 Average snow depth = 29.7
 Maximum snow depth = 52.0
 Minimum snow depth = 11.0
 Standard variation = 9.5

Snow Sample Depths and Weights

Bag #	Depth (cm)	Weight (gr)	Volume (cm ³)	Density (gr/cm ³)
1	29	433.1	1035.3	0.42
2	52	605.4	1856.4	0.33
3	20	251.0	714.0	0.35
4	16	211.7	571.2	0.37
5	32	304.7	1142.4	0.27

Average Density = 0.35
 Average Snow Water Equivalent (SWE) = 10.3 cm H₂O
 Average Snow Water Equivalent = 4.05 inches H₂O
 Average Snow Water Equivalent = 0.34 feet H₂O

SWE = avg. snow depth*(density snow/density water)