

Lake Chemistry and Physical Data For Selected North Slope, Alaska, Lakes: March 2006



Sampling tent on Mine Site B, photo by K. Holland.

by
Kristie Holland, Jeff Derry, Dan Reichardt, Michael Lilly, and
Amanda Blackburn

June 2007

North Slope Lakes Hydrologic Project
Report No. INE/WERC 06.06

Water and Environmental
Research Center



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Kristie Holland¹, Jeff Derry¹, Dan Reichardt¹, Michael Lilly¹, Amanda Blackburn¹

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DISCLAIMER

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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, 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	43560.0	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	1233.482	cubic meter (m ³)
Acre-ft	325851.43	gallon(gal)
gallon(gal)	0.1337	cubic feet (ft 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)	0.0929	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)	0.00116	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 value in cubic meters per second (m³/s) in parentheses.

Physical and Chemical Water-Quality Units:

Temperature:

Water and air temperature is given in degrees Celsius (°C) and in degrees Fahrenheit (°F). Degrees Celsius can be converted to degrees Fahrenheit by use of the following equation:

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

Electrical Conductance (Actual Conductivity and Specific Conductance):

In this report conductivity of water is expressed as Actual Conductivity [AC] in microSiemens per centimeter (μS/cm). This unit is equivalent to micromhos per centimeter. Elsewhere, conductivity is commonly expressed as Specific Conductance at 25°C [SC25] in μS/cm which is temperature corrected. To convert AC to SC25 the following equation can be used:

Error! Bookmark not defined.
$$SC25 = \frac{AC}{1 + r(T - 25)}$$

where:

SC25 = Specific Conductance at 25°C, in μS/cm

AC = Actual Conductivity, in μS/cm

R = temperature correction coefficient for the sample, in °C

T = temperature of the sample, in °C

Milligrams per liter (mg/L) or micrograms per liter ($\mu\text{g/L}$):

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 (ppm).

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 (CPA)
- Bureau of Land Management
- Alaska Department of Natural Resources
- The Nature Conservancy
- Northern Alaska Environmental Center

ACKNOWLEDGEMENTS

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Lake Chemistry and Physical Data For Selected North Slope, Alaska, Lakes: March 2006

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 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. This lake was used in previous years for ice-road construction, but was not used during winters 2005-06 or 2006-07. 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 9 reservoirs. The three southernmost reservoir cells (1-3) were included in the study to observe ground-water and surface-water interactions between each cell and the adjacent Kuparuk River.

Water-quality and hydrologic data was 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 purpose of this publication is to 1) report data collected for the month of March 2006, 2) summarize accomplished field trip objectives.

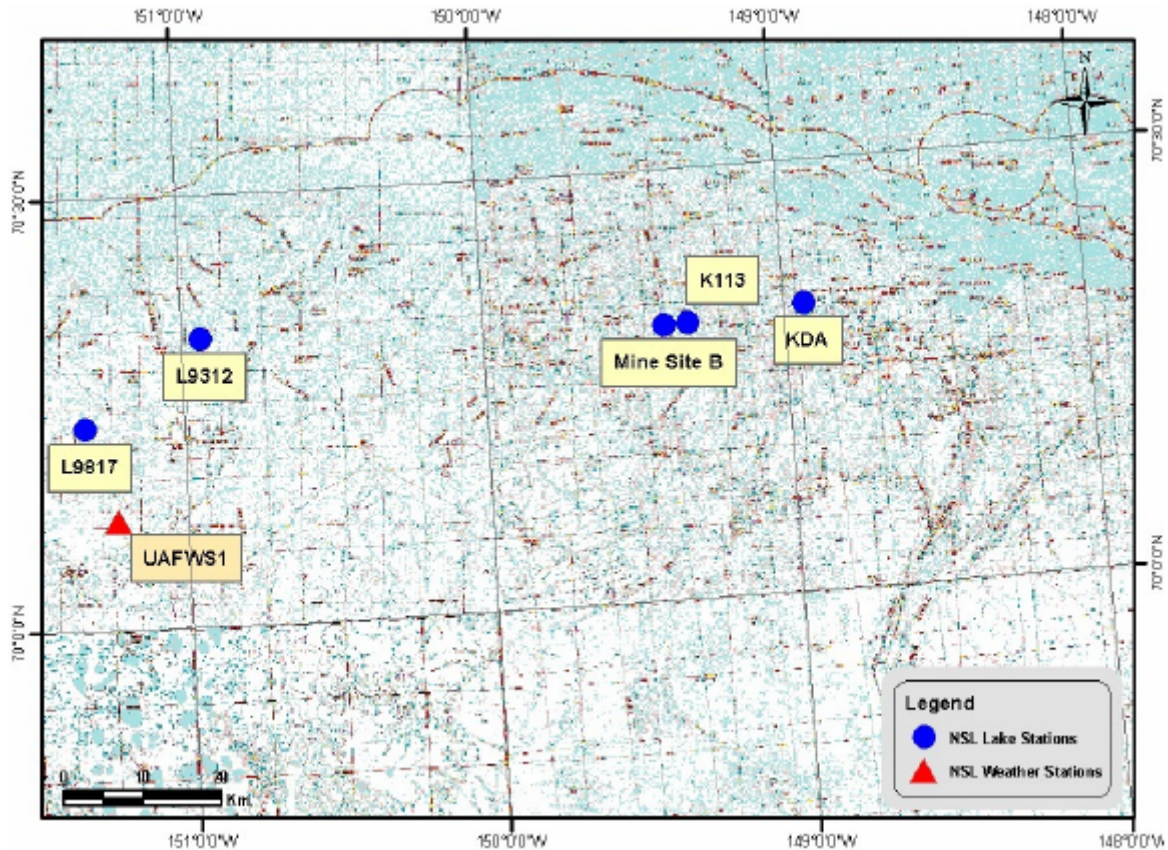


Figure 1. Location of study lakes in the NPR-A, Alpine, Kuparuk, and Prudhoe Bay field operating areas, North Slope, Alaska.

TRIP OBJECTIVES

The goal of each sampling trip is to collect physical and chemical data from each study lake. We drilled a series of holes at designated sampling locations for each lake. 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, 2006). In March 2006, we focused on the following locations and tasks:

1. Kuparuk Dead Arm Reservoirs: Prudhoe Bay operating area.
 - Water chemistry at KDA-2.
 - Survey water levels to local elevation control.
 - Measure ice thickness and field water quality parameters.

2. Mine Site B: Kuparuk operating area.
 - Water chemistry at North Cell, South Cell, and southern stream junction area.
 - Survey water levels to local elevation control.
 - Measure snow depth, ice thickness, and field water quality parameters.
3. L9312: Alpine operating area.
 - Water chemistry at various locations.
 - Survey water levels to local elevation control.
 - Measure snow depth, ice thickness, and field water quality parameters.
4. L9817: NPR-A.
 - L9817 was not visited due to tundra travel restrictions.



Figure 2. Water sampling near the pump house on L9312, photo by K. Holland.

PROCEDURES

Water Chemistry Sampling

All field work followed the specified health, safety, and environmental guidelines outlined by BPX and CPA (White and Lilly, 2006*a, b, c*). Using a gas powered auger, holes were drilled through the ice at specified locations at each study lake. Physical measurements of water depth (top of water to bottom of lake), ice thickness (top of ice to bottom of ice), freeboard (top of water to top of ice), and snow depth (top of ice to top of snow), 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 (µs/cm)	within 10%
100% DO	100 % saturated	within 10%
0% DO	0 % saturated solution	within 0.3 mg/L
ORP	In-Situ QuickCal 224 mV	within 10%

Water samples were also collected at 3 depths (1 ft. below bottom of ice, within the central part of the water column, 1 ft. above lake bottom). Some of these samples were preserved for further analysis at UAF, while other samples were analyzed with a Hach spectrophotometer while still at the facility. UAF laboratory chemistry analysis will be reported separately.

Snow Surveys

Small-scale snow depth measurements were conducted in “L” shaped patterns on lake surface and/or tundra surface at predetermined locations. Snow-depth measurements were taken every meter for twenty-five meters, then turning 90 degrees, and continuing for another twenty-five meters. Snow samples were also collected for density measurements with an Adirondack snow sampler. Five densities were collected from points on tundra and lake and averaged to establish a representative density.

SELECTED RESULTS

Sampling occurred at Kuparuk Deadarm Lakes, Mine Site B and L9312 during March field activities. Sampling was planned at L9817, however access was not possible due to tundra travel restrictions. As Table 4 demonstrates, water levels in KDA Reservoir 2 and Mine Site “B” are dropping at a rate of over 0.5 ft (0.15 m) per month. L9312 does not show a similarly rapid drop in level probably due to the large surface area relative to the monthly pumping rate.

Table 2 summarizes conditions at priority sampling sites. Each lake we visit has one or more locations where we draw water samples from multiple depths for laboratory analysis. These locations have more historical data than other locations on the lakes, and were chosen as representative of the deeper portion of the respective lakes and reservoirs.

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

Sampling Site	Ice Thickness [ft; (m)]	Median DO Concentration [mg/L]	Median Actual Conductivity [μS/cm]	Water level drop since mid February [ft; (m)]
KDA2-CT	3.9; (1.19)	8.8	134.3	0.93; (0.283)
MSBS-CT	3.5; (1.07)	7.9	202.4	1.41; (0.430)
MSBN-CT	3.3; (1.01)	7.4	219.2	1.46; (0.445)
L9312 Raft B	3.8; (1.16)	10.0	77.0	0.02; (0.007)

Lake and tundra snow surveys were collected at L9312 to compare the accumulation at each location. The average snow depth on the tundra was larger than the depths observed on the lake. We measured the density of 5 different snow samples from each location and determined a higher snow water equivalent over the tundra as well (Table 3).

Table 3. Average snow depth and snow water equivalent at L9312 [in; (cm)]

L9312	Average Depth (cm)	Snow Water Equivalents
Lake	29.1	2.53; (6.4)
Tundra	38.1	3.4; (8.6)

SUMMARY

Continuous monitoring of the 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 drop due to freezing and pumping activities in the winter, it is important to identify the changing water chemistry as well as the potential spring recharge. This information is important 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

- Lilly, M.R., Reichardt, D., and Chambers, M. 2006. A Workplan for Chemistry Sampling and Surveying at Study Lakes in NPRA, Alpine, and Kuparuk River Areas: March 2006. Water and Environmental Research Center, University of Alaska Fairbanks. 9 pages.
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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-SH
 Sample Purpose: Lake Water Quality Date: 3/18/06 Time: 15:26

FIELD MEASUREMENTS

GPS Coord. Northing: N70.33392 Easting: W150.94803 Datum: NAD 27
 Measurements By: DAR Time: 15:29
 Water Depth (ft): 9.8 Ice Thickness (ft): 4
 Freeboard (ft): 0.05 Snow Depth (ft): 0.9
 Elev. (BPMSL): 7.40 +/- .02 Survey By: DAR/MKC Date: 3/17/06 Time: 18:30
 Water Sampling By: DAR Sample Depths BWS (ft): 1 na Date: na Time: na
 2 na
 3 na

WATER QUALITY METER INFORMATION

Calibration Information

Parameter (s)	Owner	Meter Make/Model	Serial No.	Pre-Sampling QAQC Check	Post-Sampling QAQC Check
Temp, Barometric pressure, RDO	UAF	Hach LDO (short)	-	yes	yes
Conductivity	GWS	YSI Meter	-	yes	yes

Parameters	Field Measurements									
	15:33	15:38	15:41	15:48	15:51	15:53	16:00		15:42	
Time:	15:33	15:38	15:41	15:48	15:51	15:53	16:00		15:42	
Depth BWS (ft):	4.0	5.0	6.0	7.0	8.0	9.0	Bottom		4.0	
Temp (°C):	-0.20	0.30	0.50	0.90	1.00	1.10	1.50		0.20	
pH:										
Barometric (mmHg):	764	765	764	765	764	764	765		764	
Pressure (kPa):										
Conductivity (µS/cm):	73.5	72.3	72.1	72.4	72.0	72.0	86.0		73.9	
RDO (ppm): (mg/L)	10.40	9.15	8.72	7.36	7.17	7.03	4.18		9.13	
Turbidity (NTU):										
ORP										

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)										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: Field measurements (physical) taken from data for L9312-SH. 10 ft reading is just above bottom of lake.

Field-Form Filled Out By: DAR/Hilton Date: 3/21/06
 QAQC Check By: St. Amand Date: 3/23/06

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-MP (A-B)
 Sample Purpose: Lake Water Quality Date: 3/18/06 Time: 17:54

FIELD MEASUREMENTS

GPS Coord. Northing: N70.33405 Easting: W150.94272 Datum: NAD 27
 Measurements By: DAR Time: 10:40
 Water Depth (ft): 10.9 Ice Thickness (ft): 4.2
 Freeboard (ft): 0 Snow Depth (ft): 0.7
 Elev. (BPMSL): 7.40 +/- .02 Survey By: DAR/MRL Date: 3/17/06 Time: 18:30
 Water Sampling By: DAR Sample Depths BWS (ft): 1 na Date: na Time: na
 2 na
 3 na

WATER QUALITY METER INFORMATION

Calibration Information

Parameter (s)	Owner	Meter Make/Model	Serial No.	Pre-Sampling QAQC Check	Post-Sampling QAQC Check
Temp, Barometric pressure, RDO	UAF	Hach LDO (short)	-	yes	yes
Conductivity	GWS	YSI Meter	-	yes	yes

Parameters	Field Measurements								
	17:55	17:57	17:59	18:00	18:02	18:08	18:10	18:15	
Time:									
Depth BWS (ft):	4.5	5.5	6.5	7.5	8.5	9.5	10.5	11.0	
Temp (°C):	0.4	0.4	0.7	0.9	1.3	1.6	1.7	1.8	
pH:									
Barometric (mmHg):	765	765	765	765	765	765	765	765	
Pressure (kPa):									
Conductivity (µS/cm):	65.6	65.0	64.7	64.6	64.8	71.0	97.2	120.0	
RDO (ppm): (mg/L)	15.00	15.00	14.40	14.60	14.00	8.79	3.52	1.05	
Turbidity (NTU):									
ORP									
Hach LDO (UAF) mg/L									
Hach temp °C									

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)										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: Midpoint between B and Survey Hole. 11 ft sample is on, or near, bottom

Field-Form Filled Out By: DAR/KMH Date: 3/21/06
 QAQC Check By: St. Amand Date: 3/23/06

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: L9312- B
 Date: 3/17/06 Time: 16:19

FIELD MEASUREMENTS

GPS Coord. Northing: N70.33356 Easting: W150.94537 Datum: NAD 27
 Measurements By: DAR Time: 16:20
 Water Depth (ft): 11.1 Ice Thickness (ft): 3.8
 Freeboard (ft): 0.1 Snow Depth (ft): 0.8
 Elev. (BPMSL): 7.40 +/- .02 Survey By: DAR/MRL Date: 3/17/06 Time: 18:30
 Water Sampling By: DAR Sample Depths BWS (ft): 1 4.5 Date: 3/17/06 Time: 18:30
 2 9
 3 10.5

WATER QUALITY METER INFORMATION

Calibration Information

Parameter (s)	Owner	Meter Make/Model	Serial No.	Pre-Sampling QAQC Check	Post-Sampling QAQC Check
Temp, Barometric pressure, RDO	UAF	Hach LDO (short)	-	yes	yes
Conductivity	GWS	YSI Meter	-	yes	yes

Parameters	Field Measurements									
	16:27	16:28	16:28	16:29	16:35	16:39	16:44	16:54	16:56	
Time:										
Depth BWS (ft):	4.5	5	6	7	8	9	10.0	10.5	11.0	
Temp (°C):	0.4	0.4	0.7	0.9	1.4	1.5	1.9	2.0	2.0	
pH:										
Barometric (mmHg):	772	772	772	772	772	772	772	772	772	
Pressure (kPa):										
Conductivity (µS/cm):	67.2	66.9	65.8	65.6	65.1	65.1	72.2	94.4	130.7	
RDO (ppm): (mg/L)	15.3	15.1	15.1	15.2	12.6	9.96	6.49	0.20	0.08	
Turbidity (NTU):										
ORP										
Hach LDO (UAF) mg/L										
Hach temp °C										

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): <u>4.5</u>			Depth BWS (ft): <u>9</u>			Depth BWS (ft): <u>10.5</u>			Method
	rep 1	rep 2	rep 3	rep 1	rep 2	rep 3	rep 1	rep 2	rep 3	
Alkalinity (mg/L as CaCO ₃)	39	45	45	42	46	42	84	88	86	Digital titrator 10-4000 mg/L as CaCO ₃
Nitrite (mg/L NO ₂ -N)	0.006	-	-	0.003	-	-	UR= 0.022	-	-	Hach spec 0.002-0.300 mg/L NO ₂ -N
Total iron--UF (mg/L)	0.04	-	-	0.13	-	-	*27.4	-	-	Hach spec 0.02-3.00 mg/L
Filtered Iron--F tot Fe (mg/L)	0.02	-	-	0.09	-	-	*28.1	-	-	Hach spec 0.02-3.00 mg/L
Ammonia (mg/L NH ₃ -N)****	0	-	-	0.04	-	-	*OR	-	-	Hach spec 0.01-0.50 mg/L NH ₃ -N
Ammonia/ Iron dilution							10%	-	-	
pH (hanna)	6.6	-	-	6.7	-	-	6.7	-	-	

Remarks: *Over Range- used a 10% dilution. Probably over range due to iron. Bottom sample is colored. Lab pHs are at warmer temp.

Field-Form Filled Out By: DAR/KMH Date: 3/21/06
 QAQC Check By: St. Amand Date: 3/23/06

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: L9312-MP (B-SH)
 Date: 3/17/06 Time: 9:05

FIELD MEASUREMENTS

GPS Coord. Northing: N70.33378 Easting: W150.94832 Datum: NAD 27
 Measurements By: DAR Time: 9:08
 Water Depth (ft): 10.8 Ice Thickness (ft): 3.8
 Freeboard (ft): 0.1 Snow Depth (ft): 0.7
 Elev. (BPMSL): 7.40 +/- .02 Survey By: DAR/MRL Date: 3/17/06 Time: nr
 Water Sampling By: DAR Sample Depths BWS (ft): 1 na Date: na Time: na
 2 na
 3 na

WATER QUALITY METER INFORMATION

Calibration Information

Parameter (s)	Owner	Meter Make/Model	Serial No.	Pre-Sampling QAQC Check	Post-Sampling QAQC Check
Temp, Barometric pressure, RDO	UAF	Hach LDO (short)	-	yes	yes
Conductivity	GWS	YSI Meter	-	yes	yes

Parameters	Field Measurements								
Time:	9:19	9:20	9:23	9:24	9:27	9:30	9:33	9:42	
Depth BWS (ft):	4.0	5.0	6.0	7.0	8.0	9.0	10.0	10.5	
Temp (°C):	0.30	0.30	0.70	0.80	1.20	1.50	1.80	2.00	
pH:									
Barometric (mmHg):	772	772	772	772	772	772	772	772	
Pressure (kPa):									
Conductivity (µS/cm):	68.9	68.6	67.7	67.5	67.2	67.1	72.3	114.6	
RDO (ppm): (mg/L)	14.40	14.50	13.80	14.00	13.30	11.90	7.11	1.61	
Turbidity (NTU):									
ORP									

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)										0.02-3.00 mg/L
Ammonia (mg/L NH ₃ -N)****										0.01-0.50 mg/L NH3-N
Ammonia/ Iron dilution										

Remarks: 10.5 foot sample on, or just above, bottom.

Field-Form Filled Out By: DAR/Hilton Date: 3/21/06
 QAQC Check By: St. Amand Date: 3/23/06

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: MSB-SC-SW
Date: 3/15/06 Time: 13:56
pg 1 of 2

FIELD MEASUREMENTS

GPS Coord. Northing: N70.31977 Easting: W149.40390 Datum: WGS84
Measurements By: DAR Time: 13:56
Water Depth (ft): 19.3 Ice Thickness (ft): 3.5
Freeboard (ft): 0 Snow Depth (ft): 1
Elev. (BPMSL): 94.61+/- .07 Survey By: DAR/MRL Date: 3/15/06 Time: nr
Water Sampling By: DAR Sample Depths BWS (ft): 1 na Date: na Time: na
2 na
3 na

WATER QUALITY METER INFORMATION

Calibration Information

Parameter (s)	Owner	Meter Make/Model			Serial No.	Pre-Sampling QAQC Check		Post-Sampling QAQC Check		
All	UAF	In-Situ Troll 9000			33205	yes		fail		
Parameters										
Time:	13:58	14:00	14:01	14:03	14:05	14:07	14:09	14:12	14:13	
Depth BWS (ft):	4.0	5.0	6.0	7.0	9.0	11.0	13.0	15.0	16.0	
Temp (°C):	-0.20	-0.20	-0.20	-0.19	-0.14	-0.09	-0.03	0.02	0.04	
pH:	7.76	7.75	7.77	7.76	7.76	7.76	7.76	7.76	7.77	
Barometric (mmHg):	766.9	767.0	767.1	767.2	767.4	767.6	768.0	768.2	768.3	
Pressure (kPa):	10.780	13.900	16.540	19.510	25.470	31.640	37.810	43.450	46.320	
Conductivity (µS/cm):	192.5	192.1	190.6	191.9	190.8	190.8	190.8	191.3	193.7	
RDO (ppm):	12.53	12.54	12.55	12.57	12.52	12.42	12.26	12.20	12.17	
Turbidity (NTU):	-5.4	-3.7	-3.3	-0.4	0.0	7.3	2.8	0.2	-0.1	
ORP										

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
Alkalinity (mg/L as CaCO3)										Digital titrator
Nitrite (mg/L NO2-N)										Hach spec
Ammonia (mg/L NH3-N)										Hach spec
Total iron--UF (mg/L)										Hach spec
Filtered Iron--F tot Fe (mg/L)										Hach spec

Remarks: In-Situ meter had not yet failed at this hole. Elevation closes within 0.07'.

Field-Form Filled Out By: DAR Date: 3/15/06
QAQC Check By: Hilton Date: 3/23/06

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: MSB-SC-SW
 Sample Purpose: Lake Water Quality Date: 3/15/06 Time: 13:56
 pg 2 of 2

FIELD MEASUREMENTS

GPS Coord. Northing: N70.31977 Easting: W149.40390 Datum: WGS84
 Measurements By: DAR Time: 13:56
 Water Depth (ft): 19.3 Ice Thickness (ft): 3.5
 Freeboard (ft): 0 Snow Depth (ft): 1
 Elev. (BPMSL): 94.61+/- .07 Survey By: DAR/MRL Date: 3/15/06 Time: nr
 Water Sampling By: DAR Sample Depths BWS (ft): 1 na Date: na Time: na
 2 na
 3 na

WATER QUALITY METER INFORMATION

Calibration Information

Parameter (s)	Owner	Meter Make/Model	Serial No.	Pre-Sampling QAQC Check	Post-Sampling QAQC Check
All	UAF	In-Situ Troll 9000	33205	yes	fail
Parameters					
Time:	14:15	14:17	14:19	14:22	
Depth BWS (ft):	17.0	18.0	19.0	bottom	
Temp (°C):	0.09	0.25	0.28	0.28	
pH:	7.78	7.74	7.71	7.70	
Barometric (mmHg):	768.5	768.8	769.0	769.1	
Pressure (kPa):	49.370	52.210	55.130	57.010	
Conductivity (µS/cm):	193.9	197.1	192.5	192.9	
RDO (ppm):	12.15	11.85	11.28	11.29	
Turbidity (NTU):	0.1	-1.8	-1.8	84.8	
ORP					

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
Alkalinity (mg/L as CaCO ₃)										Digital titrator
Nitrite (mg/L NO ₂ ⁻ -N)										Hach spec
Ammonia (mg/L NH ₃ -N)										Hach spec
Total iron--UF (mg/L)										Hach spec
Filtered Iron--F tot Fe (mg/L)										Hach spec

Remarks: In-Situ meter had not yet failed at this hole. Elevation closes within 0.07'.

Field-Form Filled Out By: DAR Date: 3/15/06
 QAQC Check By: Hilton Date: 3/23/06

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: MSB-SC-SJ
 Sample Purpose: Lake Water Quality Date: 3/15/06 Time: 14:30

FIELD MEASUREMENTS

GPS Coord. Northing: N70.31969 Easting: W149.40526 Datum: WGS84
 Measurements By: DAR Time: 14:30
 Water Depth (ft): 4 Ice Thickness (ft): 3.3
 Freeboard (ft): 0/unknown Snow Depth (ft): 1.5
 Elev. (BPMSL): 94.61 +/- .07 Survey By: DAR/MRL Date: 3/15/06 Time: nr
 Water Sampling By: DAR Sample Depths BWS (ft): 1 na Date: na Time: na
 2 na
 3 na

WATER QUALITY METER INFORMATION

Calibration Information

Parameter (s)	Owner	Meter Make/Model	Serial No.	Pre-Sampling QAQC Check	Post-Sampling QAQC Check
All	UAF	In-Situ Troll 9000	33205	yes	yes
Parameters					
Time:	nr				
Depth BWS (ft):	3.5				
Temp (°C):	-0.27				
pH:	34.94				
Barometric (mmHg):	768.1				
Pressure (kPa):	9.520				
Conductivity (µS/cm):	710.20				
RDO (ppm):	0.12				
Turbidity (NTU):	19.5				
ORP					

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
Alkalinity (mg/L as CaCO ₃)										Digital titrator
Nitrite (mg/L NO ₂ ⁻ -N)										Hach spec
Ammonia (mg/L NH ₃ -N)										Hach spec
Total iron--UF (mg/L)										Hach spec
Filtered Iron--F tot Fe (mg/L)										Hach spec

Remarks: Note faulty pH reading. In-Situ (GWS) failed at this hole. Elevation closes within 0.07

Field-Form Filled Out By: DAR Date: 3/15/06
 QAQC Check By: Hilton Date: 3/23/06

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: MSB-SC-CT
 Sample Purpose: Lake Water Quality Date: 3/15/06 Time: 11:01
 pg 1 of 2

FIELD MEASUREMENTS

GPS Coord. Northing: N70.32024 Easting: W149.40034 Datum: WGS84
 Measurements By: DAR Time: 11:01
 Water Depth (ft): 27.6' Ice Thickness (ft): 3.5
 Freeboard (ft): 0.25 Snow Depth (ft): 0.75
 Elev. (BPMSL): 94.61 +/- .07 Survey By: DAR Date: 3/15/06 Time: nr
 Water Sampling By: DAR Sample Depths BWS (ft): 1 4 Date: na Time: na
2 17
3 27

WATER QUALITY METER INFORMATION

Calibration Information

Parameter (s)	Owner	Meter Make/Model	Serial No.	Pre-Sampling QAQC Check	Post-Sampling QAQC Check					
All	UAF	In-Situ Troll 9000	33205	yes	yes					
Parameters										
Time:	11:17	11:20	11:22	11:24	11:25	11:28	11:30	11:33	11:35	11:37
Depth BWS (ft):	9.0	4.0	5.0	6.0	7.0	9.0	11.0	13.0	15.0	17.0
Temp (°C):	-0.04	-0.20	-0.20	-0.17	-0.15	-0.10	-0.02	0.07	0.14	0.21
pH:	7.79	7.80	7.80	7.80	7.83	7.82	7.82	7.81	7.79	7.79
Barometric (mmHg):	768.9	767.0	767.5	766.7	766.3	765.7	765.5	765.2	765.2	765.3
Pressure (kPa):	26.090	11.110	14.050	16.660	19.970	25.910	32.270	37.790	44.070	50.130
Conductivity (µS/cm):	189.6	191.5	191.2	191.7	188.8	191.6	190.6	187.7	189.9	189.8
RDO (ppm):	12.24	12.32	12.33	12.33	12.32	12.27	12.24	12.22	12.18	12.12
Turbidity (NTU):	0.0	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.1	0.1
ORP										

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): <u>4</u>			Depth BWS (ft): <u>17</u>			Depth BWS (ft): <u>27</u>			Method
	rep 1	rep 2	rep 3	rep 1	rep 2	rep 3	rep 1	rep 2	rep 3	
Alkalinity (mg/L as CaCO ₃)	114	123	125	125	122	123	174	181	182	Hach spec 0.3-15 mg/L
Nitrite (mg/L NO ₂ ⁻ -N)	0.004	-	-	0.003	-	-	UR= 0.027	-	-	Digital titrator 10-4000 mg/L as CaCO ₃
Ammonia (mg/L NH ₃ -N)	0.00	-	-	0.00	-	-	OR	-	-	Hach spec 0.02-3.00 mg/L
Total iron--UF (mg/L)	0.03	-	-	0.04	-	-	* 20.6	-	-	Hach spec 0.02-3.00 mg/L
Filtered Iron--F tot Fe (mg/L)	0.03	-	-	0.02	-	-	*22.2	-	-	Hach spec 0.01-0.50 mg/L NH ₃ - N
pH (Hanna Probe)	7.71	-	-	7.67	-	-	7.27	-	-	

Remarks: Filtered was done after unfiltered, so this might explain higher iron in filtered than total.

Bottom sample is colored. *Over Range- diluted to 10%

Field-Form Filled Out By: DAR Date: 3/15/06
 QAQC Check By: Hilton Date: 3/23/06

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: MSB-SC-CT
 Date: 3/15/06 Time: 11:01
 pg 2 of 2

FIELD MEASUREMENTS

GPS Coord. Northing: N70.32024 Easting: W149.40034 Datum: WGS84
 Measurements By: DAR Time: 11:01
 Water Depth (ft): 27.6' Ice Thickness (ft): 3.5
 Freeboard (ft): 0.25 Snow Depth (ft): 0.75
 Elev. (BPMSL): 94.61 +/- .07 Survey By: DAR Date: 3/15/06 Time: nr
 Water Sampling By: DAR Sample Depths BWS (ft): 1 4 Date: na Time: na
2 17
3 27

WATER QUALITY METER INFORMATION

Calibration Information

Parameter (s)	Owner	Meter Make/Model	Serial No.	Pre-Sampling QAQC Check	Post-Sampling QAQC Check					
All	UAF	In-Situ Troll 9000	33205	yes	yes					
Parameters										
Time:	11:43	11:48	11:57	12:02	12:07	12:18	12:23	12:26	12:27	12:29
Depth BWS (ft):	19.0	20.0	21.0	22.0	23.0	24.0	25.0	26.0	27.0	27.7
Temp (°C):	0.36	0.43	0.50	0.57	0.63	0.68	0.73	0.79	0.82	0.84
pH:	7.73	7.65	7.51	7.45	7.39	7.63	7.36	7.47	7.63	8.01
Barometric (mmHg):	765.7	766.1	767.0	767.5	767.8	768.6	769.0	769.3	769.4	769.6
Pressure (kPa):	55.990	58.900	61.740	64.530	67.410	70.490	73.350	76.410	79.320	81.590
Conductivity (µS/cm):	189.20	188.20	188.90	193.00	194.80	199.50	204.10	223.40	250.20	315.80
RDO (ppm):	11.41	9.38	5.61	4.42	2.82	0.73	0.12	0.01	0.00	-0.01
Turbidity (NTU):	0.10	0.10	0.20	0.50	0.80	1.60	1.90	0.70	0.70	27.40
ORP										

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

Parameter	1	2	3	4	5
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
Alkalinity (mg/L as CaCO ₃)										Digital titrator
Nitrite (mg/L NO ₂ ⁻ -N)										Hach spec
Ammonia (mg/L NH ₃ -N)										Hach spec
Total iron--UF (mg/L)										Hach spec
Filtered Iron--F tot Fe (mg/L)										Hach spec
OH (Hanna Probe)										

Remarks: Lab Chemistry on page 1.

Field-Form Filled Out By: DAR Date: 3/15/06
 QAQC Check By: Hilton Date: 3/23/06

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: MSB-NC-CT
 Date: 3/14/06 Time: 13:39

FIELD MEASUREMENTS

GPS Coord. Northing: N70.32134 Easting: W149.40015 Datum: NAD 27
 Measurements By: DAR Time: 13:40
 Water Depth (ft): 34.3 Ice Thickness (ft): 3.3
 Freeboard (ft): -0.1 Snow Depth (ft): 1
 Elev. (BPMSL): 94.56 +/- .02 Survey By: DAR/MRL Date: 3/14/06 Time: nr
 Water Sampling By: DAR Sample Depths BWS (ft): 1 4 Date: 3/14/2006 Time: nr
2 24
3 34

WATER QUALITY METER INFORMATION

Calibration Information

Parameter (s)	Owner	Meter Make/Model	Serial No.	Pre-Sampling QAQC Check	Post-Sampling QAQC Check				
All	GWS	Troll 9000	33033	yes	yes				
All	UAF	Troll 9000	33205	yes	yes				
Parameters									
Time:	13:47	13:52	13:55	13:57	13:58	14:02	14:17	14:20	14:24
Depth BWS (ft):	4.0	5.0	6.0	7.0	9.0	11.0	13.0	13.0	15.0
Temp (°C):	-0.04	-0.05	-0.05	-0.06	-0.06	-0.02	0.03	0.07	0.13
pH:									
Barometric (mmHg):	774.3	774.3	774.3	774.3	774.3	774.3	774.3	774.5	774.5
Pressure (kPa):	10.280	13.330	16.350	19.240	25.520	31.060	37.150	36.890	43.150
Conductivity (µS/cm):	189.30	188.10	187.80	187.40	187.10	186.20	185.90	186.80	190.70
RDO (ppm):	12.11	12.21	12.25	12.27	12.29	12.28	12.26	12.02	12.06
Turbidity (NTU):	-0.20	-0.20	-0.30	-0.20	-0.20	-0.20	-0.30	nr	-0.20
ORP									

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): 4			Depth BWS (ft): 24			Depth BWS (ft): 34			Method	Detection range
	rep 1	rep 2	rep 3	rep 1	rep 2	rep 3	rep 1	rep 2	rep 3		
Alkalinity (mg/L as CaCO ₃)	**	103	102	103	104	104	172	173	171	Digital titrator	10-4000 mg/L as CaCO ₃
Nitrite (mg/L NO ₂ -N)	0.001			0.004			UR= 0.037			Hach spec	0.002-0.300 mg/L NO ₂ -N
Ammonia (mg/L NH ₃ -N)	UR=0.01			UR= 0.02			***OR			Hach spec	0.01-0.50 mg/L NH ₃ -N
Total iron--UF (mg/L)	0.03			0.02			*27.4			Hach spec	0.02-3.00 mg/L
Filtered Iron--F tot Fe (mg/L)	0.01			0.01			*19.1			Hach spec	0.02-3.00 mg/L
pH (with Hanna probe)	7.56			7.58			7.15				

Remarks: Bottom sample is colored. *Sample was over range, dilluted to 10%

I think acid cartridge was not yet flowing properly. *I didn't bother with dilution because this is surely an iron interference which we have no means to correct for. (see Hach directions- we aren't adding to iron blank.) Elevation closes within 0.07'

Field-Form Filled Out By: DAR Date: 3/14/06
 QAQC Check By: Hilton Date: 3/23/06

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: MSB-NC-CT
 Date: 3/14/06 Time: 13:39

pg 1 of 3

FIELD MEASUREMENTS

GPS Coord. Northing: N70.32134 Easting: W149.40015 Datum: NAD 27
 Measurements By: DAR Time: 13:40
 Water Depth (ft): 34.3 Ice Thickness (ft): 3.3
 Freeboard (ft): -0.1 Snow Depth (ft): 1
 Elev. (BPMSL): 94.56 +/- .02 Survey By: DAR/MRL Date: 3/14/06 Time: nr
 Water Sampling By: DAR Sample Depths BWS (ft): 1 4 Date: 3/14/2006 Time: nr
2 24
3 34

WATER QUALITY METER INFORMATION

Calibration Information

Parameter (s)	Owner	Meter Make/Model	Serial No.	Pre-Sampling QAQC Check	Post-Sampling QAQC Check				
All	GWS	Troll 9000	33033	yes	yes				
All	UAF	Troll 9000	33205	yes	yes				
Parameters									
Time:	13:47	13:52	13:55	13:57	13:58	14:02	14:17	14:20	14:24
Depth BWS (ft):	4.0	5.0	6.0	7.0	9.0	11.0	13.0	13.0	15.0
Temp (°C):	-0.04	-0.05	-0.05	-0.06	-0.06	-0.02	0.03	0.07	0.13
pH:									
Barometric (mmHg):	774.3	774.3	774.3	774.3	774.3	774.3	774.3	774.5	774.5
Pressure (kPa):	10.280	13.330	16.350	19.240	25.520	31.060	37.150	36.890	43.150
Conductivity (µS/cm):	189.30	188.10	187.80	187.40	187.10	186.20	185.90	186.80	190.70
RDO (ppm):	12.11	12.21	12.25	12.27	12.29	12.28	12.26	12.02	12.06
Turbidity (NTU):	-0.20	-0.20	-0.30	-0.20	-0.20	-0.20	-0.30	nr	-0.20
ORP									

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): 4			Depth BWS (ft): 24			Depth BWS (ft): 34			Method	Detection range
	rep 1	rep 2	rep 3	rep 1	rep 2	rep 3	rep 1	rep 2	rep 3		
Alkalinity (mg/L as CaCO ₃)	**	103	102	103	104	104	172	173	171	Digital titrator	10-4000 mg/L as CaCO ₃
Nitrite (mg/L NO ₂ -N)	0.001			0.004			UR=0.037			Hach spec	0.002-0.300 mg/L NO ₂ -N
Ammonia (mg/L NH ₃ -N)	UR=0.01			UR=0.02			***OR			Hach spec	0.01-0.50 mg/L NH ₃ -N
Total iron--UF (mg/L)	0.03			0.02			*27.4			Hach spec	0.02-3.00 mg/L
Filtered Iron--F tot Fe (mg/L)	0.01			0.01			*19.1			Hach spec	0.02-3.00 mg/L
pH (with Hanna probe)	7.56			7.58			7.15				

Remarks: Bottom sample is colored. *Sample was over range, dilluted to 10%

I think acid cartridge was not yet flowing properly. *I didn't bother with dilution because this is surely an iron interference which we have no means to correct for. (see Hach directions- we aren't adding to iron blank.) Elevation closes within 0.07'

Field-Form Filled Out By: DAR Date: 3/14/06
 QAQC Check By: Hilton Date: 3/23/06

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: MSB-NC-CT
 Date: 3/14/06 Time: 13:39
 pg 3 of 3

FIELD MEASUREMENTS

GPS Coord. Northing: N70.32134 Easting: W149.40015 Datum: NAD 27
 Measurements By: DAR Time: 13:40
 Water Depth (ft): 34.3 Ice Thickness (ft): 3.3
 Freeboard (ft): -0.1 Snow Depth (ft): 1
 Elev. (BPMSL): 94.56 +/- .02 Survey By: DAR/MRL Date: 3/14/06 Time: nr
 Water Sampling By: DAR Sample Depths BWS (ft): 1 4 Date: 3/14/2006 Time: nr
2 24
3 34

WATER QUALITY METER INFORMATION

Calibration Information

Parameter (s)	Owner	Meter Make/Model	Serial No.	Pre-Sampling QAQC Check	Post-Sampling QAQC Check
All	GWS	Troll 9000	33033	yes	yes
All	UAF	Troll 9000	33205	yes	yes
Parameters					
Time:	16:37	16:44	16:46	16:48	
Depth BWS (ft):	31.0	32.0	33.0	34.0	
Temp (°C):	0.61	0.62	0.62	0.62	
pH:					
Barometric (mmHg):	772.8	772.9	773.0	773.0	
Pressure (kPa):	90.610	93.870	96.540	99.705	
Conductivity (µS/cm):	210.9	243.4	280.3	357.6	
RDO (ppm):	0.31	0.11	0.01	-0.02	
Turbidity (NTU):	1.60	nr	0.80	1.00	
ORP					

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
Alkalinity (mg/L as CaCO ₃)										Digital titrator
Nitrite (mg/L NO ₂ ⁻ -N)										Hach spec
Ammonia (mg/L NH ₃ -N)										Hach spec
Total iron--UF (mg/L)										Hach spec
Filtered Iron--F tot Fe (mg/L)										Hach spec

Remarks: _____

Field-Form Filled Out By: DAR Date: 3/14/06
 QAQC Check By: Hilton Date: 3/23/06

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: KDA2- CT
 Date: 3/16/06 Time: 11:29

pg 1 of 2

FIELD MEASUREMENTS

GPS Coord. Northing: N70.33296 Easting: W148.94077 Datum: WGS84
 Measurements By: DAR Time: nr
 Water Depth (ft): 17.5 Ice Thickness (ft): 3.9
 Freeboard (ft): -0.2 Snow Depth (ft): 0.8
 Elev. (BPMSL): 5.53 +/- .02 Survey By: DAR/MRL Date: 3/16/06 Time: 14:00
 Water Sampling By: DAR/MKC Sample Depths BWS (ft): 1 4 Date: na Time: na
 2 7
 3 17

WATER QUALITY METER INFORMATION

Calibration Information

Parameter (s)	Owner	Meter Make/Model	Serial No.	Pre-Sampling QAQC Check	Post-Sampling QAQC Check
Temp, Barometric pressure, RDO	UAF	Hach LDO (short)	-	yes	yes
Conductivity	GWS	YSI Meter	-	yes	yes

Parameters	Field Measurements									
	11:29	11:34	11:36	11:37	11:40	11:41	11:42	11:46	11:51	
Time:	11:29	11:34	11:36	11:37	11:40	11:41	11:42	11:46	11:51	
Depth BWS (ft):	4.0	5.0	6.0	7.0	9.0	11.0	13.0	14.0	15.0	
Temp (°C):	0.3	0.1	0.1	0.1	0.2	0.3	0.6	0.6	0.9	
pH:										
Barometric (mmHg):	773	773	773	773	773	773	773	773	773	
Pressure (kPa):										
Conductivity (µS/cm):	119.6	118.6	118.1	118.2	118.3	118.4	118.7	120.2	127.7	
RDO (ppm): (mg/L)	17.10	17.00	17.00	17.10	17.10	17.20	16.80	12.30	6.57	
Turbidity (NTU):										
ORP										

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): <u>4</u>			Depth BWS (ft): <u>7</u>			Depth BWS (ft): <u>17</u>			Method
	rep 1	rep 2	rep 3	rep 1	rep 2	rep 3	rep 1	rep 2	rep 3	
Alkalinity (mg/L as CaCO ₃)	94	96	95	95	96	95	137	138	136	Digital titrator 10-4000 mg/L as CaCO ₃
Nitrite (mg/L NO ₂ -N)	0.004	-	-	0.005	-	-	0.008	-	-	Hach spec 0.002-0.300 mg/L NO ₂ -N
Total iron--UF (mg/L)	0.04	-	-	0.01	-	-	1.65	-	-	Hach spec 0.02-3.00 mg/L
Filtered Iron--F tot Fe (mg/L)	0.00	-	-	0.01	-	-	1.04	-	-	Hach spec 0.02-3.00 mg/L
Ammonia (mg/L NH ₃ -N)****	0.00	-	-	0.02	-	-	0.46	-	-	0.01-0.50 mg/L NH ₃ -N
Ammonia/ Iron dilution										
pH (hanna)	7.63 @ 10.9C			7.66 @ 11.1C			7.42 @ 10.6C			

Remarks: Depth= 17.5'. LDO cord used for profile depths, remained crooked due to lack of weight. Bottom sample slightly colored, probably an iron interference on this and all bottom samples for ammonia.

Field-Form Filled Out By: DAR/Hilton Date: 3/21/06
 QAQC Check By: St. Amand Date: 3/23/06

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: KDA2- CT
 Date: 3/16/06 Time: 11:29

pg 2 of 2

FIELD MEASUREMENTS

GPS Coord. Northing: N70.33296 Easting: W148.94077 Datum: WGS84
 Measurements By: DAR Time: nr
 Water Depth (ft): 17.5 Ice Thickness (ft): 3.9
 Freeboard (ft): -0.2 Snow Depth (ft): 0.8
 Elev. (BPMSL): 5.53 +/- .02 Survey By: DAR/MRL Date: 3/16/06 14:00 18:30
 Water Sampling By: DAR/MKC Sample Depths BWS (ft): 1 4 Date: na Time: na
 2 7
 3 17

WATER QUALITY METER INFORMATION

Calibration Information

Parameter (s)	Owner	Meter Make/Model	Serial No.	Pre-Sampling QAQC Check	Post-Sampling QAQC Check
Temp, Barometric pressure, RDO	UAF	Hach LDO (short)	-	yes	yes
Conductivity	GWS	YSI Meter	-	yes	yes
Parameters					
	Field Measurements				
Time:	11:53	11:55	11:58		
Depth BWS (ft):	16.0	17.0	18.0		
Temp (°C):	1.0	1.0	1.2		
pH:					
Barometric (mmHg):	773	773	773		
Pressure (kPa):					
Conductivity (µS/cm):	129.7	142.6	174.1		
RDO (ppm): (mg/L)	4.47	1.69	0.44		
Turbidity (NTU):					
ORP					

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	
Alkalinity (mg/L as CaCO ₃)										Digital titrator 10-4000 mg/L as CaCO ₃
Nitrite (mg/L NO ₂ -N)										Hach spec 0.002-0.300 mg/L NO ₂ -N
Total iron--UF (mg/L)										Hach spec 0.02-3.00 mg/L
Filtered Iron--F tot Fe (mg/L)										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: Lab Chemistry on first page

Field-Form Filled Out By: DAR/KMH Date: 3/21/06
 QAQC Check By: St. Amand Date: 3/23/06

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
 Sample Purpose: Lake Water Quality

Site Location/Lake ID: L9312

WATER QUALITY METER INFORMATION

Meter Make: YSI/ Hach Make: LDO
 Owner: GWS/ UAF S/N: _____

CALIBRATION AND QUALITY ASSURANCE INFORMATION

Pre-Sampling QA

Parameter	Date	Time	Standard	Lot No.	Exp.	Meter Reading	Pass/Fail
Conductivity	3/17/06	nr	Oakton 447 uS	2511074	Oct-06	394.7 @ 18.9C	Pass
100% RDO	3/17/06	nr	tetra bubbler	na	na	13.2 @ 3.0C= 96.6%	Pass

Post-Sampling QA

Parameter	Date	Time	Standard	Lot No.	Exp.	Meter Reading	Pass/Fail
100% RDO	3/18/06	nr	tetra bubbler	na	na	13.2 @ 2C= 95.3%	Pass
Conductivity	3/18/06	nr	Oakton 447 uS	2511074	Oct-06	362.7 @ 14.9C	Pass

Remarks: _____

Field-Form Filled Out By: Nicole Date: 3/10/2006
 QAQC Check By: Hilton Date: 3/20/2006

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: KDA

WATER QUALITY METER INFORMATION

Meter Make: YSI/ Hach Make: LDO
 Owner: GWS/ UAF S/N: _____

CALIBRATION AND QUALITY ASSURANCE INFORMATION

Pre-Sampling QA

Parameter	Date	Time	Standard	Lot No.	Exp.	Meter Reading	Pass/Fail
Conductivity	3/15/06	nr	Oakton 447 uS	2511074	Oct-06	341.1 @ 12C	Pass

Post-Sampling QA

Parameter	Date	Time	Standard	Lot No.	Exp.	Meter Reading	Pass/Fail
100% RDO	3/14/06	nr	tetra bubbler	na	na	14.2 @ 1.9C= 101%	Pass
Conductivity	3/15/06	nr	Oakton 447 uS	2511074	Oct-06	341.1 @ 12C	Pass

Remarks: _____

Field-Form Filled Out By: Nicole Date: 3/10/2006
 QAQC Check By: Hilton Date: 3/20/2006

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: Mine Site B

WATER QUALITY METER INFORMATION

Meter Make: In-Situ 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	3/11/06	nr	Oakton	2404386	Apr-06	4.03	Pass
pH 7.00	3/11/06	nr	Oakton	2402119	Jan-06	7.01	Pass
pH 10.01	3/11/06	nr	Oakton	2404058	Sep-06	9.95	Pass
Conductivity	3/9/06	20:05	Oakton 447 uS	2511074	Oct-06	425.5 @21.28C	Pass
0% RDO	3/11/06	nr	Hanna	690	Dec-06	-0.01	Pass
100% RDO	3/14/06	nr	tetra bubbler	na	na	13.73 @ 1.68C= 96.5%	Pass

Post-Sampling QA

Parameter	Date	Time	Standard	Lot No.	Exp.	Meter Reading	Pass/Fail
100% RDO	3/14/06	nr	tetra bubbler	na	na	13.73 @ 1.68C= 96.5%	Pass
pH 4.01	3/14/06	nr	Oakton	2404386	Apr-06	4.06	Pass
pH 7.00	3/14/06	nr	Oakton	2402119	Jan-06	6.96	Pass
pH 10.01	3/14/06	nr	Oakton	2404058	Sep-06	10.67	Fail
Conductivity	3/14/06	20:05	Oakton 447 uS	2511074	Oct-06	273.3 @ 2.72C	Pass

Remarks: _____

Field-Form Filled Out By: Nicole
 QAQC Check By: Hilton

Date: 3/10/2006
 Date: 3/20/2006

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: 3/17/2006 Time: 18:25

Location: Lake L9312, located southeast of Alpine pad, survey by pump house benchmarks								
Survey objective: Lake water elevation survey					Weather Observations:			
Instrument Type: Optical Survey Level		Instrument ID: na		Cold, windy, blowing snow				
Rod Type: Fiberglass		Rod ID: na						
Bench Mark Information:					Survey Team Names			
Name	Agency Responsible	Elevation (ft)	Latitude (dd-mm.mmm)	Longitude (ddd-mm.mmm)	Michael Lilly Daniel Reichardt			
L9312 "P"	CP	11.61 BPMSL	na	na				
Station	BS (ft)	HI (ft)	FS (ft)	Elevation (fasl)	Distance (ft)	Horizontal Angle	Vertical Angle	Remarks
P	1.42	13.14		11.72				Top of inlet pipe support
O		13.14	1.69	11.45				Top of inlet pipe support
PH-VSM		13.14	-1.42	14.56				Top of VSM plate, SE corner of pump house
WL		13.14	5.74	7.40				water in ice hole, slush
								moved Instr., used WL as turn point
WL	5.15	12.55		7.40				
PH-VSM		12.55	-2.02	14.57				+0.01
O		12.55	1.08	11.47				+0.02
P		12.55	0.81	11.74				close survey to +0.02

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: L9817
 Survey Purpose: Water-Level Elevations Date: 3/17/2007 Time: 14:00

Location:		Lake L9817, located west of Nuiqsut, survey control at southeast corner of lake						
Survey objective:		Lake water elevation survey			Weather Observations:			
Instrument Type:	Leica NA720	Instrument ID:	5482372 (GWS)		Mild, overcast, no wind			
Rod Type:	Craine fiberglass 20'	Rod ID:	GWS					
Bench Mark Information:					Survey Team Names			
Name	Agency Responsible	Elevation (ft)	Latitude (dd-mm.mmm)	Longitude (ddd-mm.mmm)	Michael Lilly Chad Cormack			
L9817 "B"	BLM	54.98 BPMSL	na	na				
Station	BS (ft)	HI (ft)	FS (ft)	Elevation (fasl)	Distance (ft)	Horizontal Angle	Vertical Angle	Remarks
B	6.57	61.55		54.98				SE TBM, rebar stake
A		61.55	6.43	55.12				NE TBM, rebar stake
D		61.55	6.87	54.68				NW TBM, rebar stake
C		61.55	5.62	55.93				south-central TBM, rebar stake
E		61.55	5.08	56.47				SW TBM, rebar stake
F		61.55	8.07	53.48				WL TBM, rebar stake
F-hub		61.55	8.18	53.37				WL TBM, 2"x2" hub, shoreline
WL		61.55	8.49	53.06				Top of ice in refrozen hole
								moved Instr., used WL ice as turn point
WL	8.32	61.38		53.06				L9817 WL
F-hub		61.38	8.02	53.36				-0.01
F		61.38	7.90	53.48				+0.00
E		61.38	4.92	56.46				-0.01
C		61.38	5.45	55.93				-0.00
D		61.38	6.70	54.68				+0.00
A		61.38	6.26	55.12				+0.00
B		61.38	6.41	54.97				close survey to +0.01

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

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

Project ID: North Slope Lakes Site Location/Lake ID: Kuparuk Deadarm Mine Sites
 Survey Purpose: Water-Level Elevations Date: 3/16/2006 Time: 14:30

Location: Kuparuk Deadarm Mine Sites, reservoir 1, 2, 3. Adjacent to Kuparuk River								
Survey objective: Determine elevations in reservoirs 1, 2, 3					Weather Observations:			
Instrument Type: Optical Survey Level		Instrument ID: na		Cold, winds around 20mph, blowing snow, 0 deg F.				
Rod Type: Fiberglass		Rod ID: na						
Bench Mark Information:					Survey Team Names			
Name	Agency Responsible	Elevation (ft)	Latitude (dd-mm.mmm)	Longitude (ddd-mm.mmm)	Dan Reichardt, Molly Chambers Michael Lilly			
BM #1 WO040768	BP	19.32	N70 20.065 NAD27	W148 56.183 NAD27				
Station	BS (ft)	HI (ft)	FS (ft)	Elevation (ft)	Distance (ft)	Horizontal Angle	Vertical Angle	Remarks
BM#1	0.24	19.56		19.32				Bell Assoc. Benchmark
KDA3-S1		19.56	12.82	6.74				S1 was measured at water surface, slush, SW corner
KDA2-S1		19.56	14.03	5.53				S1 was measured at water surface, slush, NW corner. WS Elevation for Reservoir #2
								moved Instr. Used KDA2-S1 as turn pt.
KDA2-S1	14.98	20.51		5.53				
KDA3-S1		20.51	13.78	6.73				WS Elevation for Reservoir #3
BM #1		20.51	1.17	19.34				Close survey to 0.02
KDA2-S2	11.29	16.82		5.53				S2 was measured at water surface
KDA1-S1		16.82	8.05	8.77				S1 was measured on water surface. WS Elevation for Reservoir #1
								moved Instr. Used KDA1-S1 as turn pt.
KDA1-S1	8.29	17.06		8.77				
KDA2-S2		17.06	11.52	5.54				Close survey to 0.01
Note: Field notes use temporary datum for BM #1 = 100.00 ft.								
KDA2-S1 is in NW Corner of Reservoir 2, KDA3-S1 is in SW Corner of Reservoir 3, BM #1 is set in dirt west of dike with pink flagging. KDA2-S2 is in SE Corner of Reservoir 2. KDA1-S1 is in NE corner of Reservoir 1.								

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: Mine Site B
 Survey Purpose: Water-Level Elevations Date: 3/15/2006 Time: 14:00

Location:	Mine Site B, NE corner of North Cell, temporary datum							
Survey objective:	Lake water elevation survey				Weather Observations:			
Instrument Type:	Leica NA720	Instrument ID:	Survey Exchange Rental		n/a			
Rod Type:	Fiberglass	Rod ID:	Survey Exchange					
Bench Mark Information:					Survey Team Names			
Name	Agency Responsible	Elevation (ft)	Latitude (dd-mm.mmm)	Longitude (ddd-mm.mmm)	Reichardt, Chambers, Lilly			
TBM__	nr	100 Temp.	na	na				
Station	BS (ft)	HI (ft)	FS (ft)	Elevation (fasm)	Distance (ft)	Horizontal Angle	Vertical Angle	Remarks
TBM_1	4.30	104.30		100.00				
MSBN_SH1		104.30	9.74	94.56				
Turn point, Moved instrument.								
MSBN_SH1	10.05	104.61		94.56				WL
TBM_1		104.61	4.61	100.00				Survey closes within 0.00'
Move instrument to island between MSBN and MSBS								
MSBN_SH2	8.40	102.96		94.56				
MSBS_SH		102.96	8.35	94.61				WL
Turn point, Moved instrument.								
MSBS_SH	8.11	102.72		94.61				
MSBN_SH2		102.72	8.23	94.49				Survey closes within 0.07'

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 - Tundra
 Survey Purpose: Snow Depth and Water Content Date: 3/17/2006 Time: 17:11

Location:	L9312 snow survey located west of pump house and south of water pipeline		
Survey objective:	Snow depths and snow-water content for lake recharge estimates	Weather Observations:	Cold, windy
Snow Depth Probe Type:	T-handle snow depth probe,	Snow-Survey Team Names	
Snow Tube Type:	Adiraondak, 6.8 cm diameter cutter, area = 36.33 cm ²	Michael Lilly Molly Chambers	

Snow Course Depths, in cm.					
	1	2	3	4	5
1	37.0	27.5	44.0	30.0	47.0
2	43.0	31.0	26.0	43.0	44.0
3	41.0	37.5	29.0	68.5	42.0
4	52.0	34.5	47.5	65.5	37.0
5	48.0	34.0	42.0	29.0	24.5
6	39.0	40.0	37.0	15.0	23.0
7	50.5	43.0	38.0	12.5	27.0
8	41.0	43.0	37.0	20.0	38.0
9	45.0	37.5	29.0	31.0	59.0
10	25.0	47.0	17.0	39.0	68.0

Average snow depth = 38.1
 Maximum snow depth = 68.5
 Minimum snow depth = 12.5
 Standard variation = 12.2

Snow Sample Depths and Weights

Bag #	Depth (cm)	Weight (gr)	(gr/cm ²)	(unitless)
1	40	385	10.6	0.26
2	61	508	14.0	0.23
3	24	143	3.9	0.16
4	42	399	11.0	0.26
5	35	272	7.5	0.21

Average = 0.23
 Average Snow Water Equivalent = 8.6 cm H2O
 Average Snow Water Equivalent = 3.40 inches H2O
 Average Snow Water Equivalent = 0.28 feet H2O

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: Mine Site B - Tundra
 Survey Purpose: Snow Depth and Water Content Date: 3/16/2006 Time: 16:00

Location:	Mine Site B, located north of stream junction samplng point, on tundra between Milne Creek and south cell		
Survey objective:	Snow depths and snow-water content for lake recharge estimates	Weather Observations:	Cold, windy
Snow Depth Probe Type:	T-handle snow depth probe,	Snow-Survey Team Names	
Snow Tube Type:	Adiraondak, 6.8 cm diameter cutter, area = 36.33 cm ²	Michael Lilly	

Snow Course Depths, in cm.

	1	2	3	4	5
1	16.5	29.0	19.5	27.0	57.5
2	14.5	24.0	20.0	31.0	58.0
3	17.0	17.0	15.0	27.0	55.0
4	12.5	20.5	10.5	40.0	48.0
5	16.5	15.0	14.0	48.0	34.0
6	22.0	21.0	16.0	45.0	36.0
7	20.0	23.0	14.5	48.5	37.0
8	14.5	17.5	17.0	59.0	44.5
9	25.0	12.0	14.0	64.0	53.0
10	21.0	13.0	26.0	57.0	47.0

Average snow depth = 29.1
 Maximum snow depth = 64
 Minimum snow depth = 10.5
 Standard variation = 15.8

Snow Sample Depths and Weights

Bag #	Depth (cm)	Weight (gr)	(gr/cm ²)	(unitless)
1	14	104	2.9	0.20
2	21	135	3.7	0.18
3	12	74	2.0	0.17
4	47	432	11.9	0.25
5	45	490	13.5	0.30

Average = 0.22
 Average Snow Water Equivalent = 6.4 cm H₂O
 Average Snow Water Equivalent = 2.53 inches H₂O
 Average Snow Water Equivalent = 0.21 feet H₂O