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

D. Reichardt taking water measurements at KDA2, photo by. M. Lilly

by

Kristie Holland, Michael Lilly, Horacio Toniolo, Dan Reichardt,

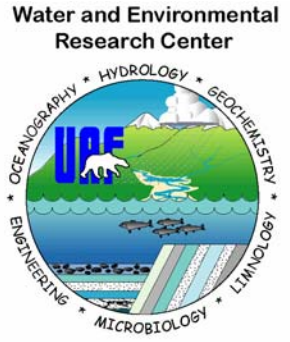
Jeff Derry, Greta Myerchin, Chad Cormack,

and Amanda Blackburn

June 2008

North Slope Lakes Hydrologic Project

Report No. INE/WERC 08.12



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Kristie Holland[1], Michael Lilly[1], Horacio Toniolo[2], Dan Reichardt[1], Jeff Derry[1], Greta Myerchin[2], Chad Cormack[2], and Amanda Blackburn[1]

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- U.S. Department of Energy
- National Energy Technology Laboratory
- BP Exploration (Alaska), Inc.
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Fairbanks, Alaska
June 2008

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TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

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.

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

Conversion Factors

Multiply	By	To obtain
	Length	
inch (in.)	25.4	millimeter (mm)
inch (in.)	2.54	centimeter (cm)
foot (ft)	0.3048	meter (m)
mile (mi)	1.609	kilometer (km)
	Area	
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)
	Volume	
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)
	Velocity and Discharge	
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)
	Hydraulic Conductivity	
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)
	Hydraulic Gradient	
foot per foot (ft/ft)	5280	foot per mile (ft/mi)
foot per mile (ft/mi)	0.1894	meter per kilometer (m/km)
	Pressure	
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 (m^3/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:

$$°F = 1.8(°C) + 32$$

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 (^{o}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^{o}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

ACKNOWLEDGEMENTS

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Lake Chemistry and Physical Data For Selected North Slope, Alaska, Lakes: May 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 had been used in past years for ice-road construction, but was not pumped during the 2005-06 or 2006-07 winters, however, it was heavily pumped throughout the 2007-08 winter. 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 May 2008, 2) summarize accomplished field trip objectives.

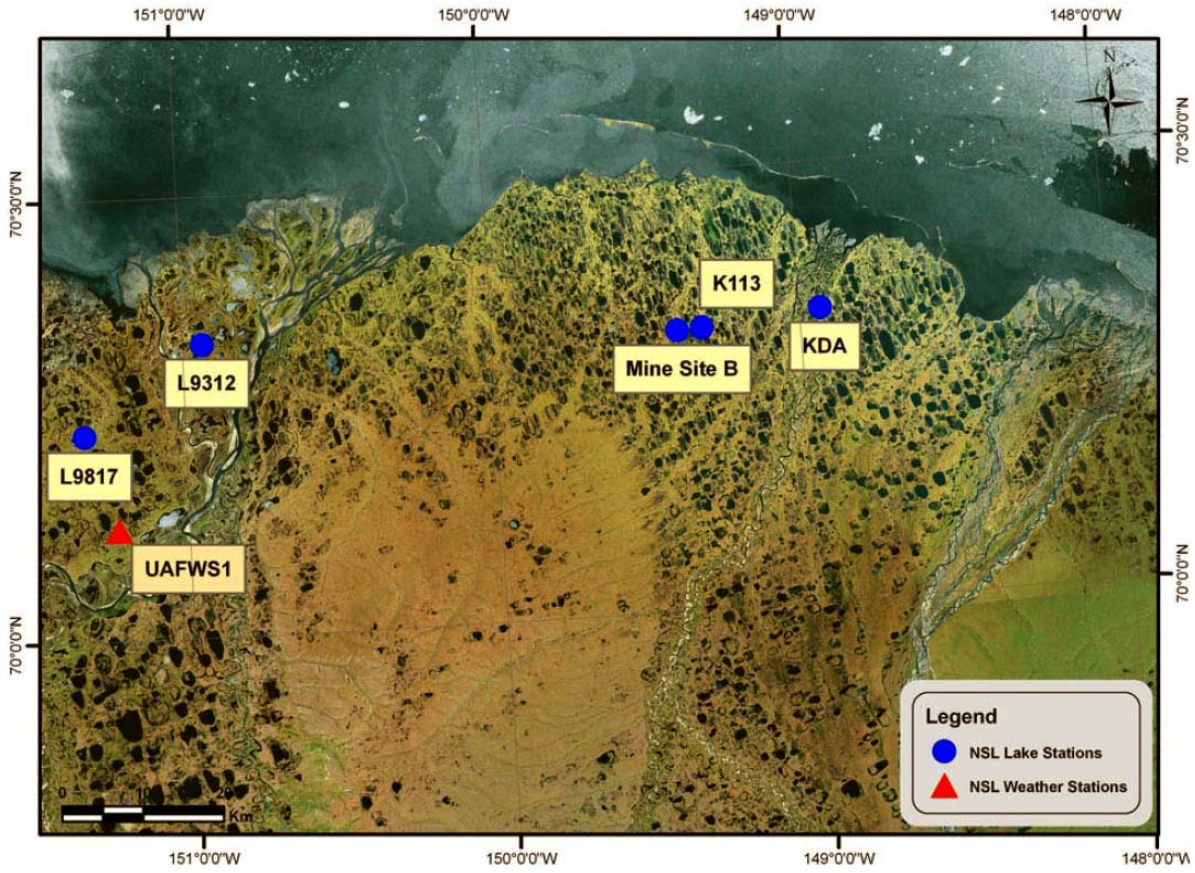

Figure 1. Location of study lakes in the NPR-A, Alpine, Kuparuk, and Prudhoe Bay field operating areas, North Slope, Alaska.

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 May 2008, we focused on the following locations/tasks:

1. Kuparuk Deadarm Lakes, (Cells 1-3)
    - Measure field water-quality parameters in cells 1, 2, and 3.
    - Conduct snow surveys at standard locations.
    - Install water temperature thermistors at KDA2.
2. 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.
    - Install water temperature thermistors at MSB-N
3. K113
    - Measured field water-quality parameters.
4. Webster Reservoir
    - Measure water quality parameters near pump inlet and in reservoir.
5. 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.
6. 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.
    - Adjust remote camera station and install markers to aid in observing water levels.
7. Prudhoe Bay Operating Area, Primary Objective
    - Betty Pingo: conduct snow survey.
    - Franklin Bluffs: conduct snow survey.

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 (Figure 2). 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 Quick Cal 224 mV	within 10%

Figure 2. Dan Reichardt clearing snow from KDA2 ice hole.

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 the Kuparuk Deadarm Reservoirs, K113, Mine Site B, L9817, L9312, and Webster Reservoir during the May 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 an increase in water level this month with the exception of KDA-1 (decrease of 0.28 ft) and KDA-3 (decrease of 0.10 feet). DO concentrations remained relatively similar to the April readings at all of the sampling sites. L9817 exhibited extremely high conductivity levels on this

sampling trip and has shown a trend of higher conductivity since March, when there was a 500 us/cm increase in concentration.

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

Sampling Site	Ice Thickness [ft; (m)]	Median DO Concentration [mg/L]	Median Actual Conductivity [μS/cm]	Water level change since mid April [ft; (m)]
KDA1-CT	6.17; (1.88)	13.79	139.25	-0.28; (-0.0853)
KDA2-CT	6.13; (1.86)	16.61	154.2	+0.91; (+0.277)
KDA3-CT	5.95; (1.81)	15.20	135.3	-0.10; (-0.0304)
MSBS-CT	6.05; (1.84)	12.83	188.65	+0.31; (+0.0944)
MSBN-CT	6.35; (1.94)	6.71	192.7	+0.06; (+0.0182)
L9312-Raft B	5.15; (1.57)	6.07	98.65	+0.02; (+0.0060)
L9817-1	5.95; (1.82)	0.935	1548	+0.02; (+0.0060)

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

Holland, K.M., Blackburn, A.J., and Lilly, M.R., 2008. Lake Chemistry and Physical Data For Selected North Slope, Alaska, Lakes: April 2008. University of Alaska Fairbanks, Water and Environmental Research Center, Report INE/WERC 08.11, Fairbanks, Alaska, 6 pp.

Reichardt, D., 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: May 2008. Water and Environmental Research Center, University of Alaska Fairbanks. 21 pages.

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: 5/10/08 Time: 10:14

FIELD MEASUREMENTS

GPS Coord. Northing: N70°19.995' Easting: W150°56.918' Datum: NAD83

Measurements By: DAR Time: 10:14

Water Depth (ft): 10.83 Ice Thickness (ft): 5.15

Freeboard (ft): 0.35 Snow Depth (ft): 0.70

Elev. (BPMSL +/- .02): 7.14 Survey By: MRL Date: 5/10/08 Time: 13:20

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:	10:31	10:36	10:42	10:52	11:09	11:17	11:20			
Depth BWS (ft):	5	6	7	8	9	10	BOT (10.8)			
Temp (°C):	0.18	0.45	0.93	1.63	1.94	2.06	2.11			
pH:	6.84	6.83	6.82	6.77	6.71	6.68	6.68			
Barometeric (mmHg):	763.6	763.6	763.7	763.7	763.7	763.7	763.7			
Pressure (kPa):	14.451	17.637	20.626	23.541	26.511	29.540	31.476			
Conductivity (µS/cm):	96.60	96.68	97.64	98.65	102.3	110.7	115.6			
RDO (ppm): (mg/L)	9.53	9.31	9.13	6.07	3.42	2.39	2.04			
Turbidity (NTU):	1.2	1.6	3.0	3.1	4.0	7.4	12.6			
ORP	260	259	259	258	253	238	214			

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 CaCO3
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 NH3-N
Ammonia/ Iron dilution										

Remarks:

Field-Form Filled Out By: AJB Date: 5/15/08

QAQC Check By: KMH Date: 5/20/08

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 Screen

Sample Purpose: **Lake Water Quality** Date: 5/10/08 Time: 11:45

FIELD MEASUREMENTS

GPS Coord. Northing: N70°20.003' Easting: W150°57.005' Datum: NAD83

Measurements By: DAR Time: n/a

Water Depth (ft): 11.35 Ice Thickness (ft): 5.20

Freeboard (ft): 0.4 Snow Depth (ft): 0.90

Elev. (BPMSL +/- .02): 7.14 Survey By: MRL Date: 5/10/08 Time: 13:20

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:	11:45	11:48	11:51	11:54	12:07	12:13	12:17	12:19		
Depth BWS (ft):	5	6	7	8	9	10	11	BOT(11.35)		
Temp (°C):	0.15	0.28	0.95	1.26	1.85	2.10	2.20	2.23		
pH:	6.81	6.82	6.80	6.79	6.69	6.65	7.00	7.19		
Barometeric (mmHg):	763.5	763.5	763.5	763.5	763.6	763.6	763.6	763.6		
Pressure (kPa):	14.571	17.393	20.622	23.327	26.562	29.542	32.196	33.104		
Conductivity (µS/cm):	96.11	97.6	98.79	98.98	102.9	108.3	167.8	165.1		
RDO (ppm): (mg/L)	9.59	9.77	10.07	10.07	4.65	2.44	0.76	0.49		
Turbidity (NTU):	2.8	3.3	4.4	4.8	6.9	14.8	79.7	755.0		
ORP	222	222	222	222	224	213	112	40		

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 CaCO3
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 NH3-N
Ammonia/ Iron dilution										

Remarks: INSITU CORD # 1

Field-Form Filled Out By: AJB Date: 5/15/08

QAQC Check By: KMH Date: 5/20/08

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: 5/10/08 Time: nr

FIELD MEASUREMENTS

GPS Coord. Northing: N70°20.017' Easting: W150°57.076' Datum: NAD83

Measurements By: DAR Time: nr

Water Depth (ft): 9.2 Ice Thickness (ft): 5.10

Freeboard (ft): 0.25 Snow Depth (ft): 1.50

Elev. (BPMSL +/- .02): 7.14 Survey By: MRL Date: 5/10/08 Time: 13:20

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:	12:35	12:40	12:47	12:54	12:59					
Depth BWS (ft):	5	6	7	8	BOT (9)					
Temp (°C):	0.14	0.29	0.99	1.38	1.56					
pH:	6.82	6.79	6.71	6.70	6.67					
Barometeric (mmHg):	763.5	763.4	763.4	763.5	763.5					
Pressure (kPa):	14.511	17.787	20.854	23.972	26.502					
Conductivity (µS/cm):	98.25	98.74	101.8	103.1	104.3					
RDO (ppm): (mg/L)	8.31	8.39	4.78	4.29	2.83					
Turbidity (NTU):	1.4	6.5	4.4	6.1	172.7					
ORP	96	103	113	119	121					

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 CaCO3
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 NH3-N
Ammonia/ Iron dilution										

Remarks: INSITU CORD # 1

Field-Form Filled Out By: AJB Date: 5/15/08

QAQC Check By: KMH Date: 5/20/08

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: L9817-1

Sample Purpose: **Lake Water Quality** Date: 5/11/08 Time: 10:49

FIELD MEASUREMENTS

GPS Coord. Northing: N70°14.070' Easting: W151°20.121' Datum: NAD83

Measurements By: DAR Time: n/a

Water Depth (ft): 7.40 Ice Thickness (ft): 5.95

Freeboard (ft): 0.15 Snow Depth (ft): 0.70

Elev. (BPMSL +/- .02): 51.83 Survey By: MRL Date: 5/11/08 Time: 12:30

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:	10:52	10:57	11:01	11:05						
Depth BWS (ft):	5	6	7	BOT(7.4)						
Temp (°C):	0.07	0.08	0.32	0.42						
pH:	6.90	6.86	6.90	6.95						
Barometeric (mmHg):	760.1	760.1	760.1	760.1						
Pressure (kPa):	14.406	17.707	20.684	21.120						
Conductivity (µS/cm):	1536	1536	1560	1566						
RDO (ppm): (mg/L)	1.18	1.40	0.47	0.62						
Turbidity (NTU):	5.3	3.9	97.4	76.9						
ORP	264	262	247	218						

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 CaCO3
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 NH3-N
Ammonia/ Iron dilution										

Remarks: INSITU CORD # 1

Field-Form Filled Out By: DAR Date: 5/12/08

QAQC Check By: AJB Date: 5/14/08

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: L9817-2

Sample Purpose: **Lake Water Quality** Date: 5/11/08 Time: 11:15

FIELD MEASUREMENTS

GPS Coord. Northing: N70°14.046' Easting: W151°20.079' Datum: NAD83

Measurements By: DAR Time: n/a

Water Depth (ft): 6.10 Ice Thickness (ft): 5.80

Freeboard (ft): 0.63 Snow Depth (ft): 0.50

Elev. (BPMSL +/- .02): 51.83 Survey By: MRL Date: 5/11/08 Time: 12:30

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:	11:26	11:33								
Depth BWS (ft):	5	BOT(6.1)								
Temp (°C):	0.07	0.06								
pH:	6.87	6.87								
Barometeric (mmHg):	760.0	760.0								
Pressure (kPa):	14.646	17.083								
Conductivity (µS/cm):	1550	1550								
RDO (ppm): (mg/L)	1.57	1.33								
Turbidity (NTU):	10.0	53.5								
ORP	222	219								

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 CaCO3
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 NH3-N
Ammonia/ Iron dilution										

Remarks: INSITU CORD # 1

Field-Form Filled Out By: DAR Date: 5/12/08

QAQC Check By: AJB Date: 5/14/08

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: L9817-3

Sample Purpose: **Lake Water Quality** Date: 5/11/08 Time: 11:45

FIELD MEASUREMENTS

GPS Coord. Northing: N70°14.022' Easting: W151°20.037' Datum: NAD83

Measurements By: DAR Time: n/a

Water Depth (ft): 6.90 Ice Thickness (ft): 5.40

Freeboard (ft): 0.35 Snow Depth (ft): 1.00

Elev. (BPMSL +/- .02): 51.83 Survey By: MRL Date: 5/11/08 Time: 12:30

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:	11:52	11:58	12:05							
Depth BWS (ft):	5	6	BOT(6.8)							
Temp (°C):	0.05	0.07	0.22							
pH:	6.93	6.93	7.00							
Barometeric (mmHg):	759.8	759.8	759.8							
Pressure (kPa):	14.773	17.847	19.947							
Conductivity (µS/cm):	1547	1550	1554							
RDO (ppm): (mg/L)	1.47	0.95	0.65							
Turbidity (NTU):	6.3	5.0	91.9							
ORP	198	190	157							

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 CaCO3
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 NH3-N
Ammonia/ Iron dilution										

Remarks: In-Situ Cord #2

Field-Form Filled Out By: DAR Date: 5/11/08

QAQC Check By: AJB Date: 5/14/08

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: L9817-20

Sample Purpose: **Lake Water Quality** Date: 5/11/08 Time: 13:45

FIELD MEASUREMENTS

GPS Coord. Northing: N70°14.079' Easting: W151°19.969' Datum: NAD83

Measurements By: DAR Time: n/a

Water Depth (ft): 8.70 Ice Thickness (ft): 5.60

Freeboard (ft): 0.40 Snow Depth (ft): 1.00

Elev. (BPMSL +/- .02): 51.83 Survey By: MRL Date: 5/11/08 Time: 12:30

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:	13:49	13:56	13:58	14:01	14:02					
Depth BWS (ft):	5	6	7	8	BOT(8.7)					
Temp (°C):	0.13	0.20	0.35	0.57	0.64					
pH:	6.94	6.94	6.98	7.01	7.12					
Barometeric (mmHg):	759.3	760.3	761.3	762.3	763.3					
Pressure (kPa):	15.106	17.886	21.035	23.983	26.084					
Conductivity (µS/cm):	1541	1547	1561	1664	1716					
RDO (ppm): (mg/L)	0.98	0.55	0.36	0.39	0.31					
Turbidity (NTU):	1.3	0.7	0.4	2.9	325.8					
ORP	139	131	125	114	97					

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 CaCO3
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 NH3-N
Ammonia/ Iron dilution										

Remarks: INSITU CORD # 2

Field-Form Filled Out By: DAR Date: 5/12/08

QAQC Check By: AJB Date: 5/14/08

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: L9817-22

Sample Purpose: **Lake Water Quality** Date: 5/11/08 Time: 13:00

FIELD MEASUREMENTS

GPS Coord. Northing: N70 14.074 Easting: W151 20.017 Datum: NAD83

Measurements By: DAR Time: n/a

Water Depth (ft): 8.1 Ice Thickness (ft): 5.80

Freeboard (ft): 0.20 Snow Depth (ft): 0.50

Elev. (BPMSL +/- .02): 51.83 Survey By: MRL Date: 5/11/08 Time: 12:30

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:	13:03	13:18	13:20	13:22						
Depth BWS (ft):	5	6	7	BOT(8.1')						
Temp (°C):	0.01	0.06	0.24	0.48						
pH:	6.93	6.79	6.90	6.95						
Barometeric (mmHg):	759.5	759.4	759.4	759.6						
Pressure (kPa):	14.480	17.915	20.286	23.026						
Conductivity (µS/cm):	1553	1554	1564	1623						
RDO (ppm): (mg/L)	0.41	0.41	0.38	0.39						
Turbidity (NTU):	3.6	1.1	0.7	2542.0						
ORP	178	175	172	165						

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 CaCO3
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 NH3-N
Ammonia/ Iron dilution										

Remarks: INSITU CORD # 2

Field-Form Filled Out By: DAR Date: 5/11/08

QAQC Check By: AJB Date: 5/14/08

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: L9817-23

Sample Purpose: **Lake Water Quality** Date: 5/11/08 Time: 12:17

FIELD MEASUREMENTS

GPS Coord. Northing: 70°14.071' Easting: W151°20.670' Datum: NAD83

Measurements By: DAR Time: n/a

Water Depth (ft): 7.40 Ice Thickness (ft): 5.38

Freeboard (ft): 0.18 Snow Depth (ft): 0.60

Elev. (BPMSL +/- .02): 51.83 Survey By: MRL Date: 5/11/08 Time: 12:30

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:	12:22	12:28	12:35	12:41						
Depth BWS (ft):	5	6	7	BOT(7.4')						
Temp (°C):	0.04	0.07	0.30	0.39						
pH:	6.89	6.88	6.91	6.92						
Barometeric (mmHg):	759.8	759.7	759.7	759.7						
Pressure (kPa):	14.330	17.318	20.825	21.303						
Conductivity (µS/cm):	1541	1540	1580	1607						
RDO (ppm): (mg/L)	0.66	0.61	0.86	1.01						
Turbidity (NTU):	2.1	1.8	3.0	15.0						
ORP	180	182	173	164						

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 CaCO3
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 NH3-N
Ammonia/ Iron dilution										

Remarks: INSITU CORD # 2

Field-Form Filled Out By: DAR Date: 5/11/08

QAQC Check By: AJB Date: 5/15/08

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: 5/15/08 Time: 17:47

FIELD MEASUREMENTS

GPS Coord. Northing: N70° 19.868' Easting: W148° 56.768' Datum: NAD83

Measurements By: DAR Time: nr

Water Depth (ft): 20.15 Ice Thickness (ft): 6.17

Freeboard (ft): 0.47 Snow Depth (ft): 0.10

Elev. (BPMSL +/- .02): 8.33 Survey By: MRL/DAR Date: 5/23/08 Time: nr

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:	17:59	18:01	18:03	18:07	18:10	18:12	18:14	18:15	18:19	18:20		
Depth BWS (ft):	7	8	9	11	13	15	17	19	20	BOT (20.15)		
Temp (°C):	1.32	2.15	2.29	2.62	2.76	2.77	2.78	2.78	2.78	2.78		
pH:	7.48	7.49	7.48	7.48	7.47	7.47	7.47	7.46	7.46	7.38		
Barometeric (mmHg):	754.0	754.1	754.1	754.2	754.3	754.4	754.4	754.6	754.6	754.6		
Pressure (kPa):	19.236	22.267	25.455	31.037	37.426	42.974	49.430	55.072	57.935	59.621		
Conductivity (µS/cm):	131.5	136.8	137.4	138.7	139.2	139.3	139.2	139.2	139.1	139.1		
RDO (ppm): (mg/L)	12.63	13.15	13.34	13.61	13.75	13.83	13.89	13.94	13.92	13.94		
Turbidity (NTU):	0.0	0.1	0.1	0.3	0.7	0.7	0.7	0.9	1.1	173.5		
ORP	279	279	279	279	279	279	279	279	279	270		

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 CaCO3
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 NH3-N
Ammonia/ Iron dilution										

Remarks: Cord #2 UAF Rugged Reader

Field-Form Filled Out By: AJB Date: 5/28/08

QAQC Check By: KMH Date: 6/16/08

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: 5/15/08 Time: 14:45

FIELD MEASUREMENTS

GPS Coord. Northing: N70° 19.948' Easting: W148° 56.368' Datum: NAD83

Measurements By: DAR Time: nr

Water Depth (ft): 15.17 Ice Thickness (ft): 6.13

Freeboard (ft): 0.53 Snow Depth (ft): 0.10

Elev. (BPMSL +/- .02): 3.06 Survey By: MRL/DAR Date: 5/23/08 Time: nr

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:	15:04	15:09	15:14	15:19	15:23	15:25	15:28	15:33				
Depth BWS (ft):	6	7	9	11	13	14	15	BOT (15.17)				
Temp (°C):	0.65	1.63	3.62	4.11	4.17	4.19	4.24	4.25				
pH:	7.72	7.70	7.69	7.71	7.71	7.69	7.66	7.63				
Barometeric (mmHg):	753.1	753.0	753.2	753.3	753.4	753.4	753.6	753.6				
Pressure (kPa):	17.138	19.423	25.203	31.345	37.298	40.317	43.276	44.415				
Conductivity (µS/cm):	118.0	125.2	149.8	153.9	154.2	154.7	155.6	156.3				
RDO (ppm): (mg/L)	12.99	13.96	15.58	16.51	16.61	16.50	16.12	15.59				
Turbidity (NTU):	0.1	0.0	0.2	0.3	1.7	0.4	0.7	1.4				
ORP	283	283	282	280	280	280	280	281				

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 CaCO3
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 NH3-N
Ammonia/ Iron dilution										

Remarks: cord #2, KDA2 is 30% free of snow.

Field-Form Filled Out By: AJB Date: 5/28/08

QAQC Check By: KMH Date: 6/16/08

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: 5/15/08 Time: 15:59

FIELD MEASUREMENTS

GPS Coord. Northing: N70°20.025' Easting: W148°56.204' Datum: NAD83

Measurements By: DAR Time: nr

Water Depth (ft): 21.57 Ice Thickness (ft): 5.95

Freeboard (ft): 0.42 Snow Depth (ft): 0.80

Elev. (BPMSL +/- .02): 5.97 Survey By: MRL/DAR Date: 5/23/08 Time: nr

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:	16:08	16:12	16:18	16:21	16:24	16:28	16:30	16:32	16:33	16:34	16:36	
Depth BWS (ft):	6	7	9	11	13	15	17	19	20	21	BOT (21.57)	
Temp (°C):	0.66	1.51	3.15	3.49	3.52	3.56	3.57	3.56	3.58	3.59	3.60	
pH:	7.61	7.59	7.58	7.58	7.58	7.58	7.57	7.57	7.58	7.58	7.57	
Barometeric (mmHg):	753.5	753.5	753.7	753.7	753.8	753.9	754.0	754.0	754.0	754.0	754.2	
Pressure (kPa):	16.458	19.167	25.472	31.303	36.901	43.246	49.093	54.772	58.344	61.236	63.766	
Conductivity (µS/cm):	116.2	124.9	133.3	135.0	135.1	135.3	135.3	135.3	135.3	135.4	135.5	
RDO (ppm): (mg/L)	13.58	14.02	14.76	14.95	15.05	15.20	15.25	15.37	15.43	15.49	15.57	
Turbidity (NTU):	0.4	0.7	0.7	1.0	0.9	0.7	0.9	0.7	0.9	0.9	120.2	
ORP	282	282	281	281	281	281	281	281	280	280	280	

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 CaCO3
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 NH3-N
Ammonia/ Iron dilution										

Remarks: cord #2 UAF rugged reader. Lake is 10% clear of snow.

Field-Form Filled Out By: AJB Date: 5/28/08

QAQC Check By: KMH Date: 6/16/08

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: MSBN-CT (page 1 of 2)

Sample Purpose: **Lake Water Quality** Date: 5/16/08 Time: 14:19

FIELD MEASUREMENTS

GPS Coord. Northing: N70°19.181' Easting: W149°24.315' Datum: NAD83

Measurements By: DAR Time: 14:19

Water Depth (ft): 33.05 Ice Thickness (ft): 6.35

Freeboard (ft): 0.45 Snow Depth (ft): 0.10

Elev. (BPMSL +/- .02): 92.68 Survey By: DAR/ MRL Date: 5/16/08 Time: 18:07

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:	14:21	14:23	14:24	14:26	14:31	14:33	14:34	14:35	14:44	14:50	14:53	14:55
Depth BWS (ft):	6	7	9	11	13	15	17	19	21	23	25	27
Temp (°C):	0.23	0.29	1.20	1.63	1.74	1.78	1.79	1.77	1.74	1.75	1.70	1.65
pH:	7.91	7.91	7.84	7.76	7.73	7.71	7.72	7.66	7.33	7.25	7.21	7.18
Barometeric (mmHg):	761.6	761.8	761.8	761.8	761.9	762.0	762.0	762.1	762.1	762.2	762.3	762.4
Pressure (kPa):	16.450	19.096	25.415	31.211	37.046	43.021	48.885	54.773	60.920	66.962	72.811	78.758
Conductivity (µS/cm):	167.5	168.0	172.9	175.7	176.4	176.8	177.2	180.0	192.7	206.7	234.2	275.4
RDO (ppm): (mg/L)	14.37	14.41	14.31	13.94	13.77	13.66	13.61	12.27	6.71	5.04	2.98	2.02
Turbidity (NTU):	3.4	1.4	0.3	0.3	0.2	0.1	0.3	0.2	0.3	1.2	2.5	5.3
ORP	213	215	217	220	226	229	230	232	240	244	247	249

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 CaCO3
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 NH3-N
Ammonia/ Iron dilution										

Remarks: Sheet 1 of 2. Cord #2 water in ice hole looks murky, not silty.

Field-Form Filled Out By: AJB Date: 5/28/08

QAQC Check By: KMH Date: 6/16/08

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: MSBN-CT (page 2 of 2)

Sample Purpose: **Lake Water Quality** Date: 5/16/08 Time: 14:19

FIELD MEASUREMENTS

GPS Coord. Northing: N70°19.181' Easting: W149°24.315' Datum: NAD83

Measurements By: DAR Time: 14:19

Water Depth (ft): 33.05 Ice Thickness (ft): 6.35

Freeboard (ft): 0.45 Snow Depth (ft): 0.10

Elev. (BPMSL +/- .02): 92.68 Survey By: DAR/ MRL Date: 5/16/08 Time: 18:07

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:	14:59	15:01	15:03	15:05	15:07							
Depth BWS (ft):	29	31	32	33	BOT (33.05)							
Temp (°C):	1.61	1.55	1.54	1.50	1.48							
pH:	7.09	7.11	7.06	6.99	7.00							
Barometeric (mmHg):	762.4	762.5	762.6	762.6	762.6							
Pressure (kPa):	84.782	90.618	93.401	96.507	98.138							
Conductivity (µS/cm):	450.7	730.3	1017.0	1439.0	1500.0							
RDO (ppm): (mg/L)	0.48	0.23	0.24	0.21	0.24							
Turbidity (NTU):	1.9	0.8	1.8	7.0	46.4							
ORP	181	140	142	151	149							

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 CaCO3
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 NH3-N
Ammonia/ Iron dilution										

Remarks: Sheet 2 of 2. Cord #2 water in ice hole looks murky, not silty.

Field-Form Filled Out By: AJB Date: 5/28/08

QAQC Check By: KMH Date: 6/16/08

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: MSBS-CT (page 1 of 2)

Sample Purpose: **Lake Water Quality** Date: 5/16/08 Time: 15:20

FIELD MEASUREMENTS

GPS Coord. Northing: N70°19.214' Easting: W149°24.020' Datum: NAD83

Measurements By: DAR Time: 15:20

Water Depth (ft): 26.2 Ice Thickness (ft): 6.05

Freeboard (ft): 0.35 Snow Depth (ft): 0.10

Elev. (BPMSL +/- .02): 93.39 Survey By: DAR/ MRL Date: 5/16/08 Time: 18:07

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:	15:36	15:38	15:44	15:49	15:51	15:52	15:55	16:04	16:05	16:07	16:11	16:23
Depth BWS (ft):	6	7	9	11	13	15	17	19	21	23	24	25
Temp (°C):	0.31	1.35	2.33	2.47	2.48	2.48	2.48	2.50	2.49	2.47	2.44	2.4
pH:	7.86	7.76	7.60	7.59	7.59	7.59	7.59	7.59	7.59	7.57	7.49	7.43
Barometeric (mmHg):	761.8	762.0	762.1	762.1	762.2	762.2	762.3	762.3	762.4	762.5	752.5	762.5
Pressure (kPa):	16.138	19.308	25.459	31.064	37.074	42.971	49.157	55.149	60.842	66.931	69.908	73.034
Conductivity (µS/cm):	173.8	181.4	188.1	189.4	189.5	189.5	189.6	187.7	189.6	190.3	191.8	194
RDO (ppm): (mg/L)	14.90	14.92	13.52	12.98	12.82	12.77	12.80	12.86	12.76	12.57	11.47	10.47
Turbidity (NTU):	2.5	1.2	1.0	1.1	0.9	1.4	1.1	0.9	1.0	1.5	1.7	2.0
ORP	167	169	175	179	180	181	182	186	187	188	191	195

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 CaCO3
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 NH3-N
Ammonia/ Iron dilution										

Remarks: Sheet 1 of 2. Cord #2

Field-Form Filled Out By: AJB Date: 5/28/08

QAQC Check By: KMH Date: 6/16/08

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: MSBS-CT (page 2 of 2)

Sample Purpose: **Lake Water Quality** Date: 5/16/08 Time: 15:20

FIELD MEASUREMENTS

GPS Coord. Northing: N70°19.214' Easting: W149°24.020' Datum: NAD83

Measurements By: DAR Time: 15:20

Water Depth (ft): 26.2 Ice Thickness (ft): 6.05

Freeboard (ft): 0.35 Snow Depth (ft): 0.10

Elev. (BPMSL +/- .02): 93.39 Survey By: DAR/ MRL Date: 5/16/08 Time: 18:07

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:	16:28	16:30										
Depth BWS (ft):	26	BOT (26.2)										
Temp (°C):	2.17	2.11										
pH:	7.18	7.14										
Barometeric (mmHg):	762.6	762.6										
Pressure (kPa):	75.870	78.097										
Conductivity (µS/cm):	219.2	239.5										
RDO (ppm): (mg/L)	4.26	2.60										
Turbidity (NTU):	7.8	52.7										
ORP	199	178										

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 CaCO3
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 NH3-N
Ammonia/ Iron dilution										

Remarks: Sheet 2 of 2 Cord #2

Field-Form Filled Out By: AJB Date: 5/28/08

QAQC Check By: KMH Date: 6/16/08

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: MSBS-SW

Sample Purpose: **Lake Water Quality** Date: 5/16/08 Time: 16:45

FIELD MEASUREMENTS

GPS Coord. Northing: N70°19.186' Easting: W149°24.234' Datum: NAD83

Measurements By: DAR Time: 16:45

Water Depth (ft): 18.51 Ice Thickness (ft): 6.15

Freeboard (ft): 0.65 Snow Depth (ft): 0.20

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:	16:46	16:50	16:56	16:58	17:00	17:04	17:07	17:10				
Depth BWS (ft):	6	7	9	13	15	17	18	BOT				
Temp (°C):	0.77	1.48	2.49	2.51	2.52	2.52	2.53	2.53				
pH:	8.29	8.16	7.71	7.67	7.65	7.62	7.63	7.63				
Barometeric (mmHg):	762.1	762.1	762.1	762.1	762.2	762.3	762.3	762.3				
Pressure (kPa):	16.796	19.627	31.300	37.382	43.057	49.277	52.166	54.750				
Conductivity (µS/cm):	169.7	178.2	188.9	189.3	189.4	189.4	189.4	189.4				
RDO (ppm): (mg/L)	17.52	17.89	15.51	14.75	14.47	14.34	14.07	14.03				
Turbidity (NTU):	2.5	5.1	0.8	1.2	0.9	1.2	1.5	2.1				
ORP	171	174	183	185	185	187	188	189				

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 CaCO3
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 NH3-N
Ammonia/ Iron dilution										

Remarks:

Field-Form Filled Out By: AJB Date: 5/28/08

QAQC Check By: KMH Date: 6/16/08

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: Vern-CT

Sample Purpose: **Lake Water Quality** Date: 5/17/08 Time: 11:34

FIELD MEASUREMENTS

GPS Coord. Northing: N70°14.611' Easting: W149°16.231' Datum: WGS84

Measurements By: DAR Time: 11:34

Water Depth (ft): 51.4 Ice Thickness (ft): 6.14

Freeboard (ft): 0.43 Snow Depth (ft): nr

Elev. (BPMSL +/- .02): 92.22 Survey By: MRL/DAR Date: 5/17/08 Time: 12:42

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:	11:54	11:57	11:59	12:05	12:07	12:09	12:12	12:13	12:14	12:19	12:24	12:28	12:30
Depth BWS (ft):	6	7	10	15	20	25	30	35	40	45	50	51	BOT
Temp (°C):	0.58	1.05	2.53	2.71	2.72	2.73	2.72	2.71	2.71	2.72	2.72	2.72	2.72
pH:	8.04	8.07	8.00	7.96	7.95	7.94	7.94	7.93	7.92	7.93	7.93	7.92	7.92
Barometeric (mmHg):	763.7	763.7	763.9	764.1	764.2	764.4	764.5	764.8	764.9	765.0	765.2	765.3	765.3
Pressure (kPa):	16.646	19.133	28.151	42.904	57.840	72.111	87.739	102.428	117.471	118.834	118.833	--	--
Conductivity (µS/cm):	120.8	126.9	137.3	137.6	137.7	137.7	137.8	137.8	137.8	137.9	137.8	137.8	138.1
RDO (ppm): (mg/L)	11.13	11.45	12.01	12.22	12.24	12.26	12.27	12.27	12.27	12.30	12.37	12.36	12.35
Turbidity (NTU):	0.0	0.0	0.3	0.5	0.5	0.6	0.7	0.4	0.6	0.5	0.6	0.5	49.1
ORP	245	246	247	249	249	250	250	250	250	250	251	251	251

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 CaCO3
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 NH3-N
Ammonia/ Iron dilution										

Remarks:

Field-Form Filled Out By: AJB Date: 5/28/08

QAQC Check By: KMH Date: 6/16/08

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: K113_CT

Sample Purpose: **Lake Water Quality** Date: 5/18/08 Time: 9:30

FIELD MEASUREMENTS

GPS Coord. Northing: N70°19.178" Easting: W149°19.324" Datum: NAD83

Measurements By: DAR Time: 9:30

Water Depth (ft): 5.91 Ice Thickness (ft): 6.14

Freeboard (ft): 0.72 Snow Depth (ft): nr

Elev. (BPMSL +/- .02): n/a Survey By: n/a Date: n/a Time: n/a

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:	10:09	10:11										
Depth BWS (ft):	5	BOT (5.91)										
Temp (°C):	0.23	0.23										
pH:	6.99	6.98										
Barometeric (mmHg):	763.4	763.4										
Pressure (kPa):	14.243	17.174										
Conductivity (µS/cm):	1529	1563										
RDO (ppm): (mg/L)	8.39	8.55										
Turbidity (NTU):	156.8	118.5										
ORP	240	238										

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 CaCO3
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 NH3-N
Ammonia/ Iron dilution										

Remarks:

Field-Form Filled Out By: AJB Date: 5/28/08

QAQC Check By: KMH Date: 6/16/08

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: Webster-res-CT

Sample Purpose: **Lake Water Quality** Date: 5/17/08 Time: nr

FIELD MEASUREMENTS

GPS Coord. Northing: N70°15.574' Easting: W148°18.315' Datum: WGS84

Measurements By: DAR Time: nr

Water Depth (ft): 12.1 Ice Thickness (ft): 6.03

Freeboard (ft): 0.4 Snow Depth (ft): 0.2

Elev. (BPMSL): na Survey By: na Date: na Time: na

Water Sampling By: na Sample Depths BWS (ft): 1 na Date: na Time: na

2 na

WATER QUALITY METER INFORMATION 3 na

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										
Time:	14:39	14:40	14:46	14:48	14:49	14:50	14:52			
Depth BWS (ft):	6	7	9	10	11	12	BOT			
Temp (°C):	0.76	1.27	3.51	3.98	4.07	4.14	4.12			
pH:	7.83	7.81	7.74	7.73	7.72	7.70	7.67			
Barometeric (mmHg):	763.6	763.6	763.6	763.6	763.7	763.7	763.7			
Pressure (kPa):	16.325	19.158	25.483	28.246	31.126	34.393	35.565			
Conductivity (µS/cm):	280.8	297.6	329.1	335.2	336.7	338.0	338.6			
RDO (ppm):	14.22	14.68	15.05	15.13	15.11	15.02	14.88			
Turbidity (NTU):	0.0	0.0	0.6	1.0	1.3	1.6	27.8			
ORP	257	258	258	259	259	259	259			

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 CaCO3)										Digital titrator 10-4000 mg/L as CaCO3
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 NH3-N)****										0.01-0.50 mg/L NH3-N

Remarks:

Field-Form Filled Out By: AJB Date: 5/28/08

QAQC Check By: KMH Date: 6/16/08

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: 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	5/9/08	16:40	Oakton 4.01	2709256	Aug-09	4.10 @ 18.9	Pass
ph 7.00	5/9/08	16:44	Oakton 7.00	2709203	Aug-09	7.07 @ 18.44	Pass
ph 10.00	5/9/08	16:47	Oakton 10.00	2707084	Jan-09	10.10 @ 18.38	Pass
Conductivity 84 µS/cm	5/9/08	16:53	Oakton 84	2801686	Jan-09	86.0 @ 20.96	Pass
Conductivity 447 µS/cm	5/9/08	16:55	Oakton 447	2803011	Feb-09	403.1 @ 20.1	Pass
ORP	5/9/08	16:56	Zobell's	1801348	Oct-08	248 @ 19.36	Pass
Saturated O_2	5/9/08	16:27	Bubbled Nanopure	--	--	9.14 @ 20.2	Pass
Zero O_2	5/9/08	16:59	Oakton	2706384	Jun-08	0.01 @ 19	Pass

Post-Sampling QA

Parameter	Date	Time	Standard	Lot No.	Exp.	Meter Reading	Pass/Fail
pH 4.01	5/10/08	19:01	Oakton 4.01	2709256	Aug-09	4.10 @ 21.2	Pass
ph 7.00	5/10/08	19:20	Oakton 7.00	2709203	Aug-09	7.12 @ 20.8	Pass
ph 10.00	5/10/08	19:25	Oakton 10.00	2707084	Jan-09	10.07 @ 20.6	Pass
Conductivity 84 µS/cm	5/10/08	19:27	Oakton 84	2801686	Jan-09	84.2 @ 20.6	Pass
Conductivity 447 µS/cm	5/10/08	19:28	Oakton 447	2803011	Feb-09	398.5 @ 20.9	Pass
ORP	5/10/08	19:33	Zobell's	1801348	Oct-08	238 @ 20.9	Pass
Saturated O_2	5/10/08	17:32	Bubbled Nanopure	--	--	9.37 @ 20.44	Pass
Zero O_2	5/10/08	19:38	Oakton	2706384	Jun-08	0.02 @ 20.6	Pass

Remarks:

Field-Form Filled Out By: AJB Date: 6/12/2008

QAQC Check By: KMH Date: 6/16/2008

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	5/10/08	19:01	Oakton 4.01	2709256	Aug-09	4.10 @ 21.2	Pass
ph 7.00	5/10/08	19:20	Oakton 7.00	2709203	Aug-09	7.12 @ 20.8	Pass
ph 10.00	5/10/08	19:25	Oakton 10.00	2707084	Jan-09	10.07 @ 20.6	Pass
Conductivity 84 µS/cm	5/10/08	19:27	Oakton 84	2801686	Jan-09	84.2 @ 20.6	Pass
Conductivity 447 µS/cm	5/10/08	19:28	Oakton 447	2803011	Feb-09	398.5 @ 20.9	Pass
ORP	5/10/08	19:33	Zobell's	1801348	Oct-08	238 @ 20.9	Pass
Saturated O_2	5/10/08	17:32	Bubbled Nanopure	--	--	9.37 @ 20.44	Pass
Zero O_2	5/10/08	19:38	Oakton	2706384	Jun-08	0.02 @ 20.6	Pass

Post-Sampling QA

Parameter	Date	Time	Standard	Lot No.	Exp.	Meter Reading	Pass/Fail
pH 4.01	5/11/08	20:37	Oakton 4.01	2709256	Aug-09	4.01 @ 21.0	Pass
ph 7.00	5/11/08	20:50	Oakton 7.00	2709203	Aug-09	7.06 @ 21.2	Pass
ph 10.00	5/11/08	20:47	Oakton 10.00	2707084	Jan-09	10.02 @ 21.3	Pass
Conductivity 84 µS/cm	5/11/08	20:56	Oakton 84	2801686	Jan-09	83.7 @ 20.9	Pass
Conductivity 447 µS/cm	5/11/08	20:54	Oakton 447	2803011	Feb-09	412 @ 21.1	Pass
ORP	5/11/08	20:57	Zobell's	1801348	Oct-08	251 @ 21.0	Pass
Saturated O_2	5/11/08	20:37	Bubbled Nanopure	--	--	9.20 @ 20.7	Pass
Zero O_2	5/11/08	20:59	Oakton	2706384	Jun-08	0.02 @ 21	Pass

Remarks:

Field-Form Filled Out By: AJB Date: 6/12/2008

QAQC Check By: KMH Date: 6/16/2008

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: Kuparuk Deadarm Lakes

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	5/11/08	20:37	Oakton 4.01	2709256	Aug-09	4.01 @ 21.0	Pass
ph 7.00	5/11/08	20:50	Oakton 7.00	2709203	Aug-09	7.06 @ 21.2	Pass
ph 10.00	5/11/08	20:47	Oakton 10.00	2707084	Jan-09	10.02 @ 21.3	Pass
Conductivity 84 µS/cm	5/11/08	20:56	Oakton 84	2801686	Jan-09	83.7 @ 20.9	Pass
Conductivity 447 µS/cm	5/11/08	20:54	Oakton 447	2803011	Feb-09	412 @ 21.1	Pass
ORP	5/11/08	20:57	Zobell's	1801348	Oct-08	251 @ 21.0	Pass
Saturated O_2	5/11/08	20:37	Bubbled Nanopure	--	--	9.20 @ 20.7	Pass
Zero O_2	5/11/08	20:59	Oakton	2706384	Jun-08	0.02 @ 21	Pass

Post-Sampling QA

Parameter	Date	Time	Standard	Lot No.	Exp.	Meter Reading	Pass/Fail
pH 4.01	5/15/08	10:18	Oakton 4.01	2709256	Aug-09	4.06 @ 15.13	Pass
ph 7.00	5/15/08	10:20	Oakton 7.00	2709203	Aug-09	6.99 @ 15.41	Pass
ph 10.00	5/15/08	10:21	Oakton 10.00	2707084	Jan-09	9.96 @ 15.80	Pass
Conductivity 84 µS/cm	5/15/08	10:23	Oakton 84	2801686	Jan-09	72.2 @ 16	Pass
Conductivity 447 µS/cm	5/15/08	10:25	Oakton 447	2803011	Feb-09	362 @ 16	Pass
ORP	5/15/08	10:26	Zobell's	1801348	Oct-08	254 @ 15.3	Pass
Saturated O_2	5/15/08	10:13	Bubbled Nanopure	--	--	9.95 @ 13.8	Pass
Zero O_2	5/15/08	10:22	Oakton	2706384	Jun-08	0.03 @ 15	Pass

Remarks:

Field-Form Filled Out By: AJB Date: 6/12/2008

QAQC Check By: KMH Date: 6/16/2008

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	5/15/08	10:18	Oakton 4.01	2709256	Aug-09	4.06 @ 15.13	Pass
ph 7.00	5/15/08	10:20	Oakton 7.00	2709203	Aug-09	6.99 @ 15.41	Pass
ph 10.00	5/15/08	10:21	Oakton 10.00	2707084	Jan-09	9.96 @ 15.80	Pass
Conductivity 84 µS/cm	5/15/08	10:23	Oakton 84	2801686	Jan-09	72.2 @ 16	Pass
Conductivity 447 µS/cm	5/15/08	10:25	Oakton 447	2803011	Feb-09	362 @ 16	Pass
ORP	5/15/08	10:26	Zobell's	1801348	Oct-08	254 @ 15.3	Pass
Saturated O_2	5/15/08	10:13	Bubbled Nanopure	--	--	9.95 @ 13.8	Pass
Zero O_2	5/15/08	10:22	Oakton	2706384	Jun-08	0.03 @ 15	Pass

Post-Sampling QA

Parameter	Date	Time	Standard	Lot No.	Exp.	Meter Reading	Pass/Fail
pH 4.01	5/17/08	9:06	Oakton 4.01	2709256	Aug-09	4.07 @ 16.9	Pass
ph 7.00	5/17/08	9:07	Oakton 7.00	2709203	Aug-09	6.99 @ 17.5	Pass
ph 10.00	5/17/08	9:08	Oakton 10.00	2707084	Jan-09	10.01 @ 17.9	Pass
Conductivity 84 µS/cm	5/17/08	9:10	Oakton 84	2801686	Jan-09	73.67 @ 17.8	Pass
Conductivity 447 µS/cm	5/17/08	9:13	Oakton 447	2803011	Feb-09	377 @ 17.5	Pass
ORP	5/17/08	9:15	Zobell's	1801348	Oct-08	257 @ 17.7	Pass
Saturated O_2	5/17/08	9:03	Bubbled Nanopure	--	--	9.84 @ 17.1	Pass
Zero O_2	5/17/08	9:05	Oakton	2706384	Jun-08	0.03 @ 17	Pass

Remarks:

Field-Form Filled Out By: AJB Date: 6/12/2008

QAQC Check By: KMH Date: 6/16/2008

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: Webster Res., Vern Lake

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	5/17/08	9:06	Oakton 4.01	2709256	Aug-09	4.07 @ 16.9	Pass
ph 7.00	5/17/08	9:07	Oakton 7.00	2709203	Aug-09	6.99 @ 17.5	Pass
ph 10.00	5/17/08	9:08	Oakton 10.00	2707084	Jan-09	10.01 @ 17.9	Pass
Conductivity 84 µS/cm	5/17/08	9:10	Oakton 84	2801686	Jan-09	73.67 @ 17.8	Pass
Conductivity 447 µS/cm	5/17/08	9:13	Oakton 447	2803011	Feb-09	377 @ 17.5	Pass
ORP	5/17/08	9:15	Zobell's	1801348	Oct-08	257 @ 17.7	Pass
Saturated O_2	5/17/08	9:03	Bubbled Nanopure	--	--	9.84 @ 17.1	Pass
Zero O_2	5/17/08	9:05	Oakton	2706384	Jun-08	0.03 @ 17	Pass

Post-Sampling QA

Parameter	Date	Time	Standard	Lot No.	Exp.	Meter Reading	Pass/Fail
pH 4.01	5/17/08	21:53	Oakton 4.01	2709256	Aug-09	4.01 @ 20.1	Pass
ph 7.00	5/17/08	22:04	Oakton 7.00	2709203	Aug-09	7.05 @ 19.9	Pass
ph 10.00	5/17/08	22:05	Oakton 10.00	2707084	Jan-09	10.04 @ 19.6	Pass
Conductivity 84 µS/cm	5/17/08	20:09	Oakton 84	2801686	Jan-09	85.57 @ 20.1	Pass
Conductivity 447 µS/cm	5/17/08	20:11	Oakton 447	2803011	Feb-09	445.0 @ 16.9	Pass
ORP	5/17/08	22:06	Zobell's	1801348	Oct-08	240 @ 18.1	Pass
Saturated O_2	5/17/08	21:42	Bubbled Nanopure	--	--	9.53 @ 19.6	Pass
Zero O_2	5/17/08	21:13	Oakton	2706384	Jun-08	0.01 @ 16	Pass

Remarks:

Field-Form Filled Out By: AJB Date: 6/12/2008

QAQC Check By: KMH Date: 6/16/2008

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: K113

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	5/17/08	21:53	Oakton 4.01	2709256	Aug-09	4.01 @ 20.1	Pass
ph 7.00	5/17/08	22:04	Oakton 7.00	2709203	Aug-09	7.05 @ 19.9	Pass
ph 10.00	5/17/08	22:05	Oakton 10.00	2707084	Jan-09	10.04 @ 19.6	Pass
Conductivity 84 µS/cm	5/17/08	20:09	Oakton 84	2801686	Jan-09	85.57 @ 20.1	Pass
Conductivity 447 µS/cm	5/17/08	20:11	Oakton 447	2803011	Feb-09	445.0 @ 16.9	Pass
ORP	5/17/08	22:06	Zobell's	1801348	Oct-08	240 @ 18.1	Pass
Saturated O_2	5/17/08	21:42	Bubbled Nanopure	--	--	9.53 @ 19.6	Pass
Zero O_2	5/17/08	21:13	Oakton	2706384	Jun-08	0.01 @ 16	Pass

Post-Sampling QA

Parameter	Date	Time	Standard	Lot No.	Exp.	Meter Reading	Pass/Fail
pH 4.01	5/18/08	20:21	Oakton 4.01	2709256	Aug-09	4.00 @ 19.7	Pass
ph 7.00	5/18/08	20:26	Oakton 7.00	2709203	Aug-09	7.06 @ 19.8	Pass
ph 10.00	5/18/08	20:29	Oakton 10.00	2707084	Jan-09	10.02 @ 19.8	Pass
Conductivity 84 µS/cm	5/18/08	20:42	Oakton 84	2801686	Jan-09	84.38 @ 19.4	Pass
Conductivity 447 µS/cm	5/18/08	20:47	Oakton 447	2803011	Feb-09	442 @ 19.6	Pass
ORP	5/18/08	20:36	Zobell's	1801348	Oct-08	238 @ 19.3	Pass
Saturated O_2	5/18/08	20:13	Bubbled Nanopure	--	--	9.51 @ 19.4	Pass
Zero O_2	5/18/08	20:55	Oakton	2706384	Jun-08	0.02 @ 19	Pass

Remarks:

Field-Form Filled Out By: AJB Date: 6/12/2008

QAQC Check By: KMH Date: 6/16/2008

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: 5/10/2008 Time: 13:20

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)				
Rod Type:	Fiberglass		Rod ID:	Crane Fiber Glass		10°F, windy, overcast		
Bench Mark Information:						Survey Team Names		
Name	Agency Responsible	Elevation (ft)	Latitude (dd-mm.mmm)	Longitude (ddd-mm.mmm)		Reichardt, Lilly		
L9312"P"	CP	11.72	nr	nr				
Station	**BS (ft)**	**HI (ft)**	**FS (ft)**	**Elevation (fasl)**	**Distance (ft)**	**Horizontal Angle**	**Vertical Angle**	**Remarks**
TBM "P"	1.61	13.33		11.72				Top of inlet pipe support
TBM "O"		13.33	1.88	11.45				Top of inlet pipe support. BM Elev=11.46'
99-32-59		13.33	1.22	14.55				Top of Pumphouse SE VSM. BM Elev = 14.57
L9312 WL		13.33	6.19	7.14				
Ice Surface		13.33	5.97	7.36				Top of ice surface near hole
Turn on L9312 Ice Surface								
Ice Surface	5.85	13.21		7.36				
L9312 WL		13.21	6.07	**7.14**				**Water Surface Level**
99-32-59		13.21	1.34	14.55				Note, rod is read upside down
TBM"O"		13.21	1.76	11.45				
TBM"P"		13.21	1.49	11.72				close survey to 0.00'

Note: L9312_WL did not freeze over. Held survey rod base at water surface.

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: L9312

Survey Purpose: **Water-Level Elevations** Date: 5/20/2008 Time: 13:30

Location:	Lake L9312 survey							
Survey objective:	Determine FWS Elevation.					Weather Observations:		
Instrument Type:	Leica NA720		Instrument ID:	5482372 (GWS owned)				
Rod Type:	Fiberglass		Rod ID:	Crane Fiber Glass		45F, sunny		
Bench Mark Information:						Survey Team Names		
Name	Agency Responsible	Elevation (ft)	Latitude (dd-mm.mmm)	Longitude (ddd-mm.mmm)		Reichardt, Lilly		
L9312"P"	CP	11.72	nr	nr				
Station	**BS (ft)**	**HI (ft)**	**FS (ft)**	**Elevation (fasl)**	**Distance (ft)**	**Horizontal Angle**	**Vertical Angle**	**Remarks**
TBM "P"	0.40	12.12		11.72				Top of inlet pipe support
TBM "O"		12.12	0.66	11.46				Top of inlet pipe support. BM Elev=11.46'
99-32-59		12.12	2.44	14.56				Top of Pumphouse SE VSM. BM Elev = 14.57
L9312 WL		12.12	5.01	7.11				
Ice Surface		12.12	4.90	7.22				Top of ice surface near hole
Turn on L9312 Ice Surface								
Ice Surface	5.12	12.34		7.22				
L9312 WL		12.34	5.20	**7.14**				**Water Surface Level**
99-32-59		12.34	2.22	14.56				Note, rod is read upside down
TBM"O"		12.34	0.88	11.46				
TBM"P"		12.34	0.62	11.72				close survey to 0.00'
Note: L9312_WL did not freeze over. Held survey rod base at water surface.								

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: L9312

Survey Purpose: **Water-Level Elevations** Date: 5/19/2008 Time: 9:30

Location:	Lake L9312 survey by pump house benchmarks							
Survey objective:	Determine FWS Elevation.					Weather Observations:		
Instrument Type:	Leica NA720		Instrument ID:	5482372 (GWS owned)				
Rod Type:	Fiberglass		Rod ID:	Crane Fiber Glass		30°F, windy 6mph, overcast		
Bench Mark Information:						Survey Team Names		
Name	Agency Responsible	Elevation (ft)	Latitude (dd-mm.mmm)	Longitude (ddd-mm.mmm)		Reichardt, Lilly		
L9312"P"	CP	11.72	nr	nr				
Station	**BS (ft)**	**HI (ft)**	**FS (ft)**	**Elevation (fasl)**	**Distance (ft)**	**Horizontal Angle**	**Vertical Angle**	**Remarks**
TBM "P"	1.08	12.80		11.72				Top of inlet pipe support
TBM "O"		12.80	1.34	11.45				Top of inlet pipe support. BM Elev=11.46'
99-32-59		12.80	1.75	14.55				Top of Pumphouse SE VSM. BM Elev = 14.57
L9312 WL		12.80	5.67	7.13				
Ice Surface		12.80	5.44	7.36				Top of ice surface near hole
Turn on L9312 Ice Surface								
Ice Surface	5.06	12.42		7.36				
L9312 WL		12.42	5.30	**7.11**				**Water Surface Level**
99-32-59		12.42	2.13	14.55				Note, rod is read upside down
TBM"O"		12.42	0.96	11.45				
TBM"P"		12.42	0.70	11.72				close survey to 0.00'

Note: L9312_WL did not freeze over. Held survey rod base at water surface.

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: L9312

Survey Purpose: **Water-Level Elevations** Date: 5/24/2008 Time: nr

Location:	Lake L9312 survey							
Survey objective:	Determine FWS Elevation.					Weather Observations:		
Instrument Type:	Leica NA720		Instrument ID:	5482372 (GWS owned)				
Rod Type:	Fiberglass		Rod ID:	Crane Fiber Glass		45F, sunny		
Bench Mark Information:						Survey Team Names		
Name	Agency Responsible	Elevation (ft)	Latitude (dd-mm.mmm)	Longitude (ddd-mm.mmm)		Reichardt, CMC		
L9312"P"	CP	11.72	nr	nr				
Station	**BS (ft)**	**HI (ft)**	**FS (ft)**	**Elevation (fasl)**	**Distance (ft)**	**Horizontal Angle**	**Vertical Angle**	**Remarks**
TBM "P"	1.35	13.07		11.72				Top of inlet pipe support
TBM "O"		13.07	1.62	11.45				Top of inlet pipe support. BM Elev=11.46'
99-32-59		13.07	5.35	18.42				Top of Pumphouse SE VSM. BM Elev = 14.57
L9312 WL		13.07	5.87	7.20				
Ice Surface		13.07	5.63	7.44				Top of ice surface near hole
Turn on L9312 Ice Surface								
Ice Surface	5.39	12.83		7.44				
L9312 WL		12.83	5.62	**7.21**				**Water Surface Level**
99-32-59		12.83	5.11	17.94				Note, rod is read upside down
TBM"O"		12.83	1.37	11.46				
TBM"P"		12.83	1.11	11.72				close survey to 0.00'
Note: L9312_WL did not freeze over. Held survey rod base at water surface.								

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: L9310 (page 1 of 2)

Survey Purpose: **Water-Level Elevations** Date: 5/19/2008 Time: nr

Location:	L9312, L9311, and L9310 survey elevations							
Survey objective:	Determine FWS Elevation.					Weather Observations:		
Instrument Type:	Leica NA720	Instrument ID:	5482372 (GWS owned)					
Rod Type:	Fiberglass	Rod ID:	Crane Fiber Glass			25F, overcast		
Bench Mark Information:						Survey Team Names		
Name	Agency Responsible	Elevation (ft)	Latitude (dd-mm.mmm)	Longitude (ddd-mm.mmm)		DAR,MRL		
BPMSL	na	100	na	na				

Station	**BS (ft)**	**HI (ft)**	**FS (ft)**	**Elevation (fasl)**	**Distance (ft)**	**Horizontal Angle**	**Vertical Angle**	**Remarks**
L9310-TOI	5.70	105.70		100.00				L9310 ice
PT111		105.70	3.55	102.15				PT111
turn instrument								
PT111	3.43	105.57		102.15				
L9310-TOI		105.57	5.570	100.00				
move instrument								
PT111	3.63	105.77		102.15				
L9311-TOI		105.77	4.94	100.83				
turn instrument								
L9311-TOI	5.19	106.02		**100.83**				
PT111		106.02	3.89	102.13				
move to south end of L9311								
PT112	4.45	105.29		100.83				south end of L9311 top of puddle ice
P1		105.29	4.81	100.47				
P2		105.29	5.32	99.97				
turn instrument								
P2	5.13	105.10		99.97				
PT112		105.10	4.27	100.83				

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: L9310 (pg 2 of 2)

Survey Purpose: **Water-Level Elevations** Date: 5/19/2008 Time: nr

Location:	L9312, L9311, and L9310 survey elevations							
Survey objective:	Determine FWS Elevation.					Weather Observations:		
Instrument Type:	Leica NA720	Instrument ID:	5482372 (GWS owned)			25F, overcast		
Rod Type:	Fiberglass	Rod ID:	Crane Fiber Glass					
Bench Mark Information:						Survey Team Names		
Name	Agency Responsible	Elevation (ft)	Latitude (dd-mm.mmm)	Longitude (ddd-mm.mmm)		DAR,MRL		
BPMSL	na	100	na	na				
Station	**BS (ft)**	**HI (ft)**	**FS (ft)**	**Elevation (fasl)**	**Distance (ft)**	**Horizontal Angle**	**Vertical Angle**	**Remarks**
P1		105.10	4.64	100.46				
move instrument								
P2	5.48	105.45		99.97				
PT113		105.45	5.580	99.87				
P4		105.45	5.77	99.68				
turn on P4								
P4	5.59	105.27		99.68				
P113		105.27	5.35	99.93				
P2		105.273	5.251	100.02				
turn on P4								
P4	5.11	105.04		99.93				
L9312-TOI		105.04	5.75	99.29				GPS 115 Baker staff gauge top of steel
TOS-STAFF		105.04	1.99	103.05				
turn on top of steel								
TOS-STAFF	1.83	104.88		103.05				GPS114
L9312-TOI		104.88	5.59	99.29				
P4		104.88	4.95	99.93				

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: L9817

Survey Purpose: **Water-Level Elevations** Date: 5/11/2008 Time: 12:30

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				
Rod Type:	Fiberglass		Rod ID:	Crane 20' Fiberglass		10°F, 18 mph winds, overcast		
Bench Mark Information:						Survey Team Names		
Name	Agency Responsible	Elevation (ft)	Latitude (dd-mm.mmm)	Longitude (ddd-mm.mmm)		Michael Lilly, Roy Baldwin (LCMF)		
B	nr	54.98	nr	nr				

Station	**BS (ft)**	**HI (ft)**	**FS (ft)**	**Elevation (fasl)**	**Distance (ft)**	**Horizontal Angle**	**Vertical Angle**	**Remarks**
B	4.190	59.17		54.98				rebar survey control
C		59.17	3.24	55.93				rebar survey control
E		59.17	2.83	56.34				rebar survey control
L9817_WL		59.17	7.34	**51.83**				**WL=51.83**
L9817_TOI		59.17	6.62	52.55				Top of lake ice near L9817_WL hole (#3)
Turn on L9817_TOI, Move to Inst.2								
L9817_TOI	6.72	59.27		52.55				
L9817_WL		59.27	7.44	51.83				closes to 0.01
E		59.27	2.92	56.35				closes to 0.01
C		59.27	3.33	55.94				closes to 0.01
B		59.27	4.28	54.99				Survey closes within 0.01'

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

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: L9817

Survey Purpose: **Water-Level Elevations** Date: 5/11/2008 Time: 15:45

Location:	Lake L9817 in NPRA, adjacent to Rondy Ice Road							
Survey objective:	Determine Temporary Staff Gage Elevation.					Weather Observations:		
Instrument Type:	Leica NA720		Instrument ID:	SN:5482372				
Rod Type:	Fiberglass		Rod ID:	Crane 20' Fiberglass		10°F, 18 mph winds, overcast		
Bench Mark Information:						Survey Team Names		
Name	Agency Responsible	Elevation (ft)	Latitude (dd-mm.mmm)	Longitude (ddd-mm.mmm)		Michael Lilly, Roy Baldwin (LCMF)		
B	nr	54.98	nr	nr				
Station	**BS (ft)**	**HI (ft)**	**FS (ft)**	**Elevation (fasl)**	**Distance (ft)**	**Horizontal Angle**	**Vertical Angle**	**Remarks**
B	3.43	58.41		54.98				rebar survey control
Staff Gage Rebar		58.41	5.01	53.40				Top of rebar used to mount staff gage
Turn on L9817_Staff_Rebar, Move to Inst.2								
Staff Gage Rebar	4.95	58.35		53.40				
B		58.35	3.37	54.98				Survey closes within 0.00'

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

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: L9817

Survey Purpose: **Water-Level Elevations** Date: 5/24/2008 Time: nr

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				
Rod Type:	Fiberglass		Rod ID:	Crane 20' Fiberglass		nr		
Bench Mark Information:						Survey Team Names		
Name	Agency Responsible	Elevation (ft)	Latitude (dd-mm.mmm)	Longitude (ddd-mm.mmm)		DAR		
B	nr	54.98	nr	nr				

Station	**BS (ft)**	**HI (ft)**	**FS (ft)**	**Elevation (fasl)**	**Distance (ft)**	**Horizontal Angle**	**Vertical Angle**	**Remarks**
B	3.810	58.79		54.98				rebar survey control
C		58.79	2.87	55.92				rebar survey control
E		58.79	2.46	56.33				rebar survey control
WL		58.79	6.77	**52.02**				**WL=52.02**
TOI		58.79	6.65	52.14				
move instrument								
TOI	6.74	58.88		52.14				
WL		58.88	6.84	52.04				closes to 0.01
E		58.88	2.54	56.34				
C		58.88	2.95	55.93				closes to 0.01
B		58.88	3.89	54.99				
Shore-Ice		58.88	6.04	52.84				Survey closes within 0.01'

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

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: KDA 1,2,3 (pg 1 of 2)

Survey Purpose: **Water-Level Elevations** Date: 5/15/2008 Time: 18:00

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:		20F light wind, overcast
Instrument Type:	Leica NA 720		Instrument ID:	5482332 (GWS owned)				
Rod Type:	Craine fiberglass 25'		Rod ID:					
Bench Mark Information:						Survey Team Names		
Name	Agency Responsible	Elevation (ft)	Latitude (dd-mm.mmm)	Longitude (ddd-mm.mmm)		Dan Reichardt, MRL		
BM1	BP	19.32	na	na				
Station	**BS (ft)**	**HI (ft)**	**FS (ft)**	**Elevation (fasl)**	**Distance (ft)**	**Horizontal Angle**	**Vertical Angle**	**Remarks**
BM1	0.96	20.28		19.32				
KDA3_TOI		20.28	13.96	6.32				
KDA3_WL		20.19	14.35	**5.93**				**Water Level KDA3**
KDA2_WL		20.28	16.97	**3.31**				**Water Level KDA2**
KDA2_TOI		20.19	17.29	2.99				
Move to Instr.								
KDA2_TOI	17.18	20.16		2.99				
KDA_WL		20.16	16.85	3.31				
KDA2_WL		20.16	14.25	5.91				
KDA2-TOI'		20.16	13.85	6.31				
BM1		20.16	0.85	19.31				
KDA2-WL	11.17	14.48		3.31				
KDA2-TOI		14.48	8.89	5.59				
KDA3_WL		14.48	6.38	8.10				
KDA3_TOI		14.48	6.02	8.46				
Move instrument								

Note:

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: KDA 1,2,3 (pg 2 of 2)

Survey Purpose: **Water-Level Elevations** Date: 5/15/2008 Time: 18:00

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:		20F light wind, overcast
Instrument Type:	Leica NA 720		Instrument ID:	5482332 (GWS owned)				
Rod Type:	Craine fiberglass 25'		Rod ID:					
Bench Mark Information:						Survey Team Names		
Name	Agency Responsible	Elevation (ft)	Latitude (dd-mm.mmm)	Longitude (ddd-mm.mmm)		Dan Reichardt, MRL		
BM1	BP	19.32	na	na				
Station	**BS (ft)**	**HI (ft)**	**FS (ft)**	**Elevation (fasl)**	**Distance (ft)**	**Horizontal Angle**	**Vertical Angle**	**Remarks**
KDA3_TOI	5.75	14.21		8.46				
KDA3_WL		14.21	8.10	6.11				
KDA2_TOI		14.21	5.59	8.62				
KDA2_WL		14.21	3.31	10.91				close survey to 0.00

Note:

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: KDA 3,2

Survey Purpose: **Water-Level Elevations** Date: 5/23/2008 Time: nr

Location:	Kuparuk Deadarm Lakes							
Survey objective:	Determine FWS Elevation of cell 2 and cell 3.					Weather Observations:		sunny
Instrument Type:	Leica NA 720		Instrument ID:	5482332 (GWS owned)				
Rod Type:	Craine fiberglass 25'		Rod ID:					
Bench Mark Information:						Survey Team Names		
Name	Agency Responsible	Elevation (ft)	Latitude (dd-mm.mmm)	Longitude (ddd-mm.mmm)		Dan Reichardt, MRL		
BM1	BP	19.32	na	na				
Station	**BS (ft)**	**HI (ft)**	**FS (ft)**	**Elevation (fasl)**	**Distance (ft)**	**Horizontal Angle**	**Vertical Angle**	**Remarks**
BM1	0.19	19.51		19.32				
KDA3_WL		19.51	13.54	**5.97**				**KDA3 WL=5.97'**
KDA3_TOI		19.51	13.21	6.30				
KDA2_WL		19.51	16.45	**3.06**				**KDA2 WL=3.06'**
KDA2_TOI		19.51	17.41	2.10				in snow
Move to Instr.								
KDA2_TOI	17.65	19.75		2.10				
KDA2_WL		19.75	16.69	3.06				
KDA3_TOI		19.75	13.43	6.32				
KDA3-WL		19.75	13.78	5.97				
BM1		19.75	0.42	19.33				close survey to +/- 0.01

Note:

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: KDA 1,2

Survey Purpose: **Water-Level Elevations** Date: 5/23/2008 Time: nr

Location:	Kuparuk Deadarm Lakes							
Survey objective:	Determine FWS Elevation of cell 1and cell 2					Weather Observations:		sunny
Instrument Type:	Leica NA 720		Instrument ID:	5482332 (GWS owned)				
Rod Type:	Craine fiberglass 25'		Rod ID:					
Bench Mark Information:						Survey Team Names		
Name	Agency Responsible	Elevation (ft)	Latitude (dd-mm.mmm)	Longitude (ddd-mm.mmm)		Dan Reichardt, MRL		
BM1	BP	19.32	na	na				
Station	**BS (ft)**	**HI (ft)**	**FS (ft)**	**Elevation (fasl)**	**Distance (ft)**	**Horizontal Angle**	**Vertical Angle**	**Remarks**
KDA2_WL	12.70	15.76		**3.06**				**KDA2 WL= 3.06'**
KDA2_TOI		15.76	10.53	5.23				
KDA1_WL		15.76	7.43	**8.33**				**KDA1 WL= 8.33'**
move instrument ^								
KDA1_WL	7.19	15.52		8.33				
KDA2_TOI		15.52	10.24	5.28				
KDA2_WL		15.52	12.42	3.10				Close survey to+/- 0.04

Note:

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: 5/16/2008 Time: 18:07

Location:	Mine Site B							
Survey objective:	Determine lake water elevation in North and South Cells					Weather Observations:		
Instrument Type:	Leica NA720		Instrument ID:	5482332 (GWS owned)				
Rod Type:	Craine fiberglass 20'		Rod ID:	GWS owned		sunny, 40F light breeze		
Bench Mark Information:						Survey Team Names		
Name	Agency Responsible	Elevation (ft)	Latitude (dd-mm.mmm)	Longitude (ddd-mm.mmm)		D. Reichardt, M. Lilly		
TBM_1	nr	100.00 Arbitrary	N70°19.308'	W149°23.882'				
Station	**BS (ft)**	**HI (ft)**	**FS (ft)**	**Elevation (fasl)**	**Distance (ft)**	**Horizontal Angle**	**Vertical Angle**	**Remarks**
TBM_1	5.955	105.96		100.00				
MSBN-WL		105.96	13.280	**92.68**				**Water Level MSBN**
VSM_S		105.96	2.130	103.83				
VSM_N		105.96	2.502	103.45				
Move instrument								
VSM_N	2.183	105.64		103.45				
VSM_S		105.64	1.808	103.83				
MSBN-WL		105.64	12.942	92.69				
TBM_1		105.64	5.639	100.00				
Move instrument								
MSBN_2	8.340	101.02		92.68				
MSBS_WL		101.02	7.625	**93.39**				**Water Level MSBS**
MSBS_Hi		101.02	6.330	94.69				
Move instrument								
MSBS_SHi	6.489	101.17		94.69				
MSBS_WL		101.17	7.782	93.39				
MSBN 2		101.17	8.505	92.67				closes within ±0.00

Note:

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: Mine Site B

Survey Purpose: **Water-Level Elevations** Date: 5/23/2008 Time: 11:00

Location:	Mine Site B							
Survey objective:	Determine lake water elevation in North and South Cells					Weather Observations:		
Instrument Type:	Leica NA720		Instrument ID:	5482332 (GWS owned)				
Rod Type:	Craine fiberglass 20'		Rod ID:	GWS owned		Sunny, light breeze		
Bench Mark Information:						Survey Team Names		
Name	Agency Responsible	Elevation (ft)	Latitude (dd-mm.mmm)	Longitude (ddd-mm.mmm)		D. Reichardt, M. Lilly		
TBM_1	nr	100.00 Arbitrary	N70°19.308'	W149°23.882'				

Station	**BS (ft)**	**HI (ft)**	**FS (ft)**	**Elevation (fasl)**	**Distance (ft)**	**Horizontal Angle**	**Vertical Angle**	**Remarks**
TBM_1	2.23	102.46		100.23				
MSBN-WL		102.46	9.30	**93.16**				**Water Level MSBN**
MSBN_TOI		102.46	8.44	94.02				
MSBS_WL		102.46	8.59	**93.87**				**Water Level MSBS**
MSBS_TOI		102.46	7.720	94.74				
move instrument ^								
MSBS_TOI	7.44	102.18		94.74				
MSBS-WL		102.18	8.30	93.88				
MSBN_TOI		102.18	8.15	94.03				
MSBN_WL		102.18	9.010	93.17				
TBM_1		102.18	1.94	100.24				

Note:

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: Vern

Survey Purpose: **Water-Level Elevations** Date: 5/17/2008 Time: 12:42

Location:	Vern Lake							
Survey objective:	Determine FWS Elevation.					Weather Observations:		
Instrument Type:	Leica NA720		Instrument ID:	5482372 (GWS owned)				
Rod Type:	Fiberglass		Rod ID:	Crane Fiber Glass		35F, sunny, 3mph winds		
Bench Mark Information:						Survey Team Names		
Name	Agency Responsible	Elevation (ft)	Latitude (dd-mm.mmm)	Longitude (ddd-mm.mmm)		DAR,MRL		
Vern-Staff	na	100	N70 14.611'	W1480 16.231'				
Station	**BS (ft)**	**HI (ft)**	**FS (ft)**	**Elevation (fasl)**	**Distance**	**Horizontal Angle**	**Vertical Angle**	**Remarks**
Vern-Staff	0.39	100.39		100.00				
WL-SH		100.39	8.17	92.22				
TOI-SH		100.39	8.00	92.39				
turn on SH-TOI, move instrument								
SH-TOI	7.80	100.19		92.39				
SH-WL		100.19	7.970	**92.22**				**Water Level =92.22'**
Vern-Staff		100.19	0.14	100.05				
Vern-Staff	1.65	101.65		100.00				
SH-WL		101.65	9.48	92.17				
SH-TOI		101.65	9.31	92.34				
turn on SH-TOI								
SH-TOI	9.02	101.36		92.34				
SH-WL		101.36	9.19	92.17				
Vern-Staff		101.36	1.36	100.00				

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

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: 5/10/2008 Time: 13:45

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, windy, overcast
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:	Adirondak, 6.74 cm diameter cutter, area = 35.7 cm^2			Lilly	

Snow Course Depths, in cm.

	1	2	3	4	5
1	21.5	36.5	23.0	51.0	49.0
2	21.5	34.5	40.0	68.5	50.5
3	18.0	30.0	42.0	49.5	51.0
4	28.5	23.0	38.0	46.5	43.5
5	71.5	19.5	16.0	43.5	35.5
6	33.0	18.0	17.0	21.0	25.0
7	22.0	19.5	16.0	20.0	21.0
8	29.0	15.5	10.5	16.5	45.5
9	35.0	17.5	13.5	34.0	47.0
10	32.5	20.0	48.0	48.5	57.0

	(cm)
Average snow depth =	**32.7**
Maximum snow depth =	71.5
Minimum snow depth =	10.5
Standard variation =	14.9

Snow Sample Depths and Weights

Bag #	Depth (cm)	Weight (gr)	Volume (cm^3)	Density (gr/cm^3)
1	20.5	173.8	731.9	0.24
2	31.5	260.3	1124.6	0.23
3	20.0	225.9	714.0	0.32
4	50.5	530.4	1802.9	0.29
5	67.0	809.1	2391.9	0.34

Average Density =	**0.28**	
Average Snow Water Equivalent (SWE) =	**9.3**	cm H2O
Average Snow Water Equivalent =	**3.65**	inches H2O
Average Snow Water Equivalent =	**0.30**	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: 5/10/2008	Time: 11:40

Location Description:	Started 5 meters north of "Raft B" on L9312. Traveled 25 meters northerly towards Raft A. Turned left 90° and traveled 25 meters west to end point.				
Survey objective:	Determine Snow Water Equivalent			Weather Observations:	10°F, windy, overcast
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:	Haggland	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			Lilly	

Snow Course Depths, in cm.

	1	2	3	4	5
1	18.0	6.0	8.5	9.5	19.5
2	17.0	5.0	10.0	12.5	22.0
3	11.0	4.5	10.5	16.5	14.5
4	11.5	5.0	13.0	12.0	11.0
5	7.5	3.0	15.0	5.5	14.5
6	9.0	3.0	11.0	6.5	22.0
7	11.0	3.5	8.0	13.5	21.0
8	5.0	6.0	11.5	8.0	28.5
9	3.0	9.5	9.0	15.5	31.0
10	6.5	9.5	9.5	20.0	22.5

	(cm)
Average snow depth =	**11.7**
Maximum snow depth =	31.0
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	19.5	219.8	696.2	0.32
2	8.0	106.2	285.6	0.37
3	13.0	184.2	464.1	0.40
4	18.0	201.7	642.6	0.31
5	31.0	393.0	1106.7	0.36

Average Density =	**0.35**	
Average Snow Water Equivalent (SWE) =	**4.1**	cm H2O
Average Snow Water Equivalent =	**1.62**	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: **L9312-SNO 1**
Survey Purpose: **Determine snow water equivalent** Date: 5/21/2008 Time: 12:30

Location Description:	SNO1 is pretty representative of general area. Survey conducted 25m x 25x in an "L" shape.				
Survey objective:	Determine Snow Water Equivalent			Weather Observations:	45°F, sunny
Latitude:	nr	Longitude:	nr	Datum:	na
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:	Haggland	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			DAR	

Snow Course Depths, in cm.

	1	2	3	4	5
1	29.0	30.0	49.0	48.0	24.0
2	49.0	21.0	9.0	50.0	32.0
3	18.0	31.0	10.0	50.0	24.0
4	21.0	29.0	39.0	46.0	14.0
5	33.0	43.0	38.0	41.0	23.0
6	24.0	22.0	23.0	37.0	15.0
7	25.0	0.0	15.0	14.0	4.0
8	17.0	0.0	75.0	0.0	25.0
9	30.0	15.0	55.0	8.0	15.0
10	18.0	46.0	34.0	12.0	36.0

	(cm)
Average snow depth =	**27.3**
Maximum snow depth =	75.0
Minimum snow depth =	0.0
Standard variation =	16.0

Snow Sample Depths and Weights

Bag #	Depth (cm)	Weight (gr)	Volume (cm^3)	Density (gr/cm^3)
1	16.0	236.6	571.2	0.41
2	26.5	408.9	946.1	0.43
3	32.0	314.5	1142.4	0.28
4	28.0	341.7	999.6	0.34
5	18.0	142.0	642.6	0.22

Average Density =	**0.34**	
Average Snow Water Equivalent (SWE) =	**9.2**	cm H2O
Average Snow Water Equivalent =	**3.62**	inches H2O
Average Snow Water Equivalent =	**0.30**	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**
Survey Purpose: **Determine snow water equivalent** Date: 5/21/2008 Time: 13:00

Location Description:	started at East corner, going west 25m x south 25m				
Survey objective:	Determine Snow Water Equivalent			Weather Observations:	45°F, sunny
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:	Adirondak, 6.74 cm diameter cutter, area = 35.7 cm^2			DAR	

Snow Course Depths, in cm.

	1	2	3	4	5
1	66.0	35.0	22.0	32.0	20.0
2	60.0	25.0	26.0	40.0	19.0
3	48.0	10.0	0.0	29.0	12.0
4	46.0	0.0	0.0	15.0	0.0
5	34.0	35.0	0.0	0.0	0.0
6	0.0	43.0	0.0	0.0	0.0
7	8.0	32.0	0.0	0.0	35.0
8	27.0	52.0	0.0	0.0	58.0
9	31.0	37.0	2.0	2.0	7.0
10	37.0	25.0	33.0	2.0	9.0

	(cm)
Average snow depth =	**20.3**
Maximum snow depth =	66.0
Minimum snow depth =	0.0
Standard variation =	19.4

Snow Sample Depths and Weights

Bag #	Depth (cm)	Weight (gr)	Volume (cm^3)	Density (gr/cm^3)
1	68.0	939.4	2427.6	0.39
2	65.0	248.1	2320.5	0.11
3	23.0	337.7	821.1	0.41
4	28.0	186.6	999.6	0.19
5	22.0	86.5	785.4	0.11

Average Density = **0.24**
Average Snow Water Equivalent (SWE) = **4.9** cm H2O
Average Snow Water Equivalent = **1.92** 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** Site Location/Lake ID: **L9312-SNO 1**
Survey Purpose: **Determine snow water equivalent** Date: 5/21/2008 Time: 12:30

Location Description:	SNO1 is pretty representative of general area. Survey conducted 25m x 25x in an "L" shape.				
Survey objective:	Determine Snow Water Equivalent			Weather Observations:	45°F, sunny
Latitude:	nr	Longitude:	nr	Datum:	na
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:	Haggland	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			DAR	

Snow Course Depths, in cm.

	1	2	3	4	5
1	29	30	49	48	24
2	49	21	9	50	32
3	18	31	10	50	24
4	21	29	39	46	14
5	33	43	38	41	23
6	24	22	23	37	15
7	25	0	15	14	4
8	17	0	75	0	25
9	30	15	55	8	15
10	18	46	34	12	36

	(cm)
Average snow depth =	**27.3**
Maximum snow depth =	75.0
Minimum snow depth =	0.0
Standard variation =	16.0

Snow Sample Depths and Weights

Bag #	Depth (cm)	Weight (gr)	Volume (cm^3)	Density (gr/cm^3)
1	16.0	236.6	571.2	0.41
2	26.5	408.9	946.1	0.43
3	32.0	314.5	1142.4	0.28
4	28.0	341.7	999.6	0.34
5	18.0	142.0	642.6	0.22

Average Density = **0.34**
Average Snow Water Equivalent (SWE) = **9.2** cm H2O
Average Snow Water Equivalent = **3.62** inches H2O
Average Snow Water Equivalent = **0.30** 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**
Survey Purpose: **Determine snow water equivalent** Date: 5/21/2008 Time: 13:00

Location Description:	started at East corner, going west 25m x south 25m				
Survey objective:	Determine Snow Water Equivalent			Weather Observations:	45°F, sunny
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:	Adirondak, 6.74 cm diameter cutter, area = 35.7 cm^2			DAR	

Snow Course Depths, in cm.

	1	2	3	4	5
1	66	35	22	32	20
2	60	25	26	40	19
3	48	10	0	29	12
4	46	0	0	15	0
5	34	35	0	0	0
6	0	43	0	0	0
7	8	32	0	0	35
8	27	52	0	0	58
9	31	37	2	2	7
10	37	25	33	2	9

	(cm)
Average snow depth =	**20.3**
Maximum snow depth =	66.0
Minimum snow depth =	0.0
Standard variation =	19.4

Snow Sample Depths and Weights

Bag #	Depth (cm)	Weight (gr)	Volume (cm^3)	Density (gr/cm^3)
1	65.0	939.4	2320.5	0.40
2	23.0	248.1	821.1	0.30
3	28.0	337.7	999.6	0.34
4	22.0	186.6	785.4	0.24
5	10.0	86.5	357.0	0.24

Average Density =	**0.30**	
Average Snow Water Equivalent (SWE) =	**6.2**	cm H2O
Average Snow Water Equivalent =	**2.43**	inches H2O
Average Snow Water Equivalent =	**0.20**	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: 5/11/2008	Time: 13:00

Location Description:	Conducted on lake. L-shaped, 25 m by 25 m. Measurements every 1 meter.				
Survey objective:	Determine Snow Water Equivalent			Weather Observations:	12F, overcast, windy
Latitude:	N 70o 14.046'	Longitude:	W 151o 20.079'	Datum:	NAD 83
Elevation:	55 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:	Haggland	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			Lilly, Baldwin (LCMF)	

Snow Course Depths, in cm.

	1	2	3	4	5
1	9.0	22.0	6.0	20.0	38.0
2	10.5	22.0	11.5	20.0	37.0
3	8.5	18.0	12.0	20.0	34.5
4	13.0	9.5	15.5	21.5	29.5
5	13.5	8.5	19.0	25.0	21.0
6	16.0	9.0	18.0	26.0	21.5
7	19.0	8.0	15.0	30.0	21.0
8	17.0	9.0	16.0	33.0	20.0
9	21.0	5.0	16.5	35.5	19.0
10	24.5	5.0	17.5	37.5	20.5

	(cm)
Average snow depth =	**18.9**
Maximum snow depth =	38.0
Minimum snow depth =	5.0
Standard variation =	8.7

Snow Sample Depths and Weights

Bag #	Depth (cm)	Weight (gr)	Volume (cm^3)	Density (gr/cm^3)
1	9	87.0	321.3	0.27
2	22	275.6	785.4	0.35
3	20	268.4	714.0	0.38
4	28	374.3	999.6	0.37
5	24	296.5	856.8	0.35

Average Density =	**0.34**	
Average Snow Water Equivalent (SWE) =	**6.5**	cm H2O
Average Snow Water Equivalent =	**2.56**	inches H2O
Average Snow Water Equivalent =	**0.21**	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-WxStation, Tundra**
Survey Purpose: **Determine snow water equivalent** Date: 5/11/2008 Time: 13:30

Location Description:	East side of lake on tundra. Did "L" shape. Started at ~30 south of Met Pole, went due south, then west, 25 x 25m for 1m increments				
Survey objective:	Determine Snow Water Equivalent			Weather Observations:	12F, overcast, windy
Latitude:	N 70° 16.832	Longitude:	W 148° 53.856	Datum:	NAD83
Elevation:	Approximately 55 ft	Elevation Datum:	BPMSL	Reference Markers:	Lathe
Drainage Basin:	Lake L9817	Slope Direction:	Flat	Vegetation Type:	Tussuck tundra
Slope Angle:	Flat	Access Notes:	Haggland	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			Lilly, Baldwin (LCMF)	

Snow Course Depths, in cm.

	1	2	3	4	5
1	26.5	16.0	17.0	21.0	29.5
2	14.0	19.0	15.0	23.5	23.0
3	22.0	15.5	21.0	15.0	27.5
4	18.0	15.0	19.5	18.0	18.5
5	17.0	27.0	20.5	21.5	25.0
6	16.0	19.0	20.0	15.5	29.5
7	13.0	19.0	17.0	19.0	35.5
8	15.0	27.0	17.5	21.5	36.0
9	13.0	26.0	23.0	17.0	41.0
10	16.0	16.0	22.0	22.0	39.5

	(cm)
Average snow depth =	**21.2**
Maximum snow depth =	41.0
Minimum snow depth =	13.0
Standard variation =	6.6

Snow Sample Depths and Weights

Bag #	Depth (cm)	Weight (gr)	Volume (cm^3)	Density (gr/cm^3)
1	17	65.7	606.9	0.11
2	17.5	77.5	624.8	0.12
3	18.5	115.6	660.5	0.18
4	17.5	100.9	624.8	0.16
5	32.5	329.7	1160.3	0.28

Average Density =	**0.17**	
Average Snow Water Equivalent (SWE) =	**3.6**	cm H2O
Average Snow Water Equivalent =	**1.43**	inches H2O
Average Snow Water Equivalent =	**0.12**	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: 5/21/2008	Time: 11:15

Location Description:	Conducted on lake. L-shaped, 25 m by 25 m. Measurements every 1 meter. Established snow survey is on barest portion of tundra.				
Survey objective:	Determine Snow Water Equivalent			Weather Observations:	40F, bright and sunny
Latitude:	N 70o 14.046'	Longitude:	W 151o 20.079'	Datum:	NAD 83
Elevation:	55 ft	Elevation Datum:	BPMSL	Reference Markers:	nr
Drainage Basin:	Lake L9817	Slope Direction:	Flat	Vegetation Type:	Ice
Slope Angle:	Flat	Access Notes:	Haggland	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			DAR	

Snow Course Depths, in cm.

	1	2	3	4	5
1	28	0	3	16	26
2	12	0	19	22	29
3	0	0	0	0	21
4	0	0	5	28	28
5	0	0	0	16	24
6	0	18	21	0	29
7	0	17	16	17	23
8	0	13	8	22	31
9	12	0	0	30	24
10	0	0	0	24	28

	(cm)
Average snow depth =	**12.2**
Maximum snow depth =	31.0
Minimum snow depth =	0.0
Standard variation =	11.6

Snow Sample Depths and Weights

Bag #	Depth (cm)	Weight (gr)	Volume (cm^3)	Density (gr/cm^3)
1	21	316.2	749.7	0.42
2	25	259.2	892.5	0.29
3	22.5	163.3	803.3	0.20
4	26	255.3	928.2	0.28
5	27	264.8	963.9	0.27

Average Density =	**0.29**	
Average Snow Water Equivalent (SWE) =	**3.6**	cm H2O
Average Snow Water Equivalent =	**1.41**	inches H2O
Average Snow Water Equivalent =	**0.12**	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: **Betty Pingo**
Survey Purpose: **Determine snow water equivalent** Date: 5/17/2008 Time: 18:12

Location Description:	Approximately 30 feet from Wyoming Gage. Marked with lathe and rebar				
Survey objective:	Determine Snow Water Equivalent			Weather Observations:	fog, slight breeze, 35-40F
Latitude:	N 70° 16.831	Longitude:	W 148° 53.8833	Datum:	NAD83
Elevation:	Approximately 10 ft	Elevation Datum:	BPMSL	Reference Markers:	lathe
Drainage Basin:	Kuparuk River	Slope Direction:	flat	Vegetation Type:	Tundra
Slope Angle:	flat	Access Notes:	Highway vehicle	Other:	
Snow Depth Probe Type:		T-handle probe		Snow-Survey Team Names	
Snow Tube Type:	n/a			MRL, DAR	

Snow Course Depths, in cm.

	1	2	3	4	5
1	39.0	36.5	16.0	17.0	39.0
2	41.5	43.0	29.0	29.0	39.0
3	28.0	37.0	44.0	27.5	38.0
4	27.0	31.0	32.5	20.5	40.0
5	36.0	36.0	12.0	24.0	29.5
6	34.0	36.0	0.0	38.5	27.0
7	56.0	41.0	12.0	27.0	18.0
8	40.0	42.0	11.0	35.0	14.0
9	29.0	27.0	9.0	32.0	17.0
10	37.0	17.5	15.0	35.0	14.0

(cm)
Average snow depth = **29.1**
Maximum snow depth = 56.0
Minimum snow depth = 0.0
Standard variation = 11.4

Snow Sample Depths and Weights

Bag #	Depth (cm)	Weight (gr)	Volume (cm^3)	Density (gr/cm^3)
1	45	559.8	1606.5	0.35
2	30	312.7	1071.0	0.29
3	27	262.9	963.9	0.27
4	30	341.3	1071.0	0.32
5	19	182.0	678.3	0.27

Average Density = **0.30**
Average Snow Water Equivalent (SWE) = **8.7** cm H2O
Average Snow Water Equivalent = **3.44** inches H2O
Average Snow Water Equivalent = **0.29** 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:	**Betty Pingo**
Survey Purpose:	**Determine snow water equivalent**	Date: 5/20/2008	Time: 21:54

Location Description:	Approximately 30 feet from Wyoming Gage. Marked with lathe and rebar				
Survey objective:	Determine Snow Water Equivalent			Weather Observations:	nr
Latitude:	N 70° 16.831	Longitude:	W 148° 53.8833	Datum:	NAD83
Elevation:	Approximately 10 ft	Elevation Datum:	BPMSL	Reference Markers:	lathe
Drainage Basin:	Kuparuk River	Slope Direction:	flat	Vegetation Type:	Tundra
Slope Angle:	flat	Access Notes:	Highway vehicle	Other:	
Snow Depth Probe Type:		T-handle probe		Snow-Survey Team Names	
Snow Tube Type:	n/a			MRL, DAR	

Snow Course Depths, in cm.

	1	2	3	4	5
1	40.0	36.0	42.5	23.0	32.5
2	45.0	30.0	28.0	31.0	34.5
3	33.5	39.0	31.5	24.0	33.0
4	30.0	23.0	13.0	26.0	19.5
5	27.0	29.0	0.0	42.0	18.5
6	24.0	34.5	0.0	24.0	19.0
7	16.0	33.0	11.0	36.5	15.5
8	19.0	44.0	8.0	35.0	23.5
9	0.0	36.0	8.0	32.0	44.0
10	33.0	30.5	4.5	39.0	37.0

	(cm)
Average snow depth =	**26.8**
Maximum snow depth =	45.0
Minimum snow depth =	0.0
Standard variation =	12.0

Snow Sample Depths and Weights

Bag #	Depth (cm)	Weight (gr)	Volume (cm^3)	Density (gr/cm^3)
zoe1	32	411.0	1142.4	0.36
zoe2	31	311.0	1106.7	0.28
zoe3	36	574.9	1285.2	0.45
zoe4	41	470.3	1463.7	0.32
zoe5	22	232.7	785.4	0.30

Average Density =	**0.34**	
Average Snow Water Equivalent (SWE) =	**9.1**	cm H2O
Average Snow Water Equivalent =	**3.60**	inches H2O
Average Snow Water Equivalent =	**0.30**	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: **Franklin Bluffs**
Survey Purpose: **Determine snow water equivalent** Date: 5/17/2008 Time: nr

Location Description:	L-shaped, 25 m by 25 m. Measurments took every 1 meter.				
Survey objective:	Determine Snow Water Equivalent			Weather Observations:	clear, breezy
Latitude:		Longitude:		Datum:	
Elevation:	7 ft	Elevation Datum:	BPMSL	Reference Markers:	Near Lathe marked #3
Drainage Basin:	nr	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			MRL	

Snow Course Depths, in cm.

	1	2	3	4	5
1	40.5	29.0	24.0	24.0	40.0
2	30.5	37.0	33.0	23.0	36.5
3	27.0	37.0	34.0	21.0	30.0
4	28.0	36.0	42.0	32.5	35.5
5	24.0	27.0	36.0	26.5	31.0
6	26.0	31.0	38.0	37.0	31.0
7	19.5	24.0	37.0	38.5	31.0
8	35.0	30.4	38.0	36.0	25.0
9	25.0	31.0	30.5	38.5	25.6
10	28.0	29.5	30.0	39.0	37.5

(cm)
Average snow depth = **31.5**
Maximum snow depth = 42.0
Minimum snow depth = 19.5
Standard variation = 5.7

Snow Sample Depths and Weights

Bag #	Depth (cm)	Weight (gr)	Volume (cm^3)	Density (gr/cm^3)
J1	26	268.7	928.2	0.29
J2	30	318.6	1071.0	0.30
J3	38	341.9	1356.6	0.25
J4	50	587.3	1785.0	0.33
J5	30	307.4	1071.0	0.29

Average Density = **0.29**
Average Snow Water Equivalent (SWE) = **9.2** cm H2O
Average Snow Water Equivalent = **3.61** inches H2O
Average Snow Water Equivalent = **0.30** 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: **KDA2-CT**
Survey Purpose: **Determine snow water equivalent** Date: 5/15/2008 Time: 21:00

Location Description:	At KDA2-CT snow course bears North 25 meters, then West 25 meters.				
Survey objective:	Determine Snow Water Equivalent			Weather Observations:	overcast, slight breeze
Latitude:	N70°19.966'	Longitude:	W14°856.429'	Datum:	NAD83
Elevation:	Approximately 10 ft	Elevation Datum:	BPMSL	Reference Markers:	KDA-CT Lathe
Drainage Basin:	Kuparuk River	Slope Direction:	flat	Vegetation Type:	Ice
Slope Angle:	flat	Access Notes:	Highway vehicle	Other:	
Snow Depth Probe Type:		T-handle probe		Snow-Survey Team Names	
Snow Tube Type:	n/a			MRL, DAR	

Snow Course Depths, in cm.

	1	2	3	4	5
1	7.5	0.0	10.0	1.0	2.5
2	3.5	2.0	11.0	2.5	3.0
3	2.0	4.0	9.5	0.0	3.0
4	1.0	6.5	6.5	0.0	2.0
5	3.0	8.0	5.5	0.5	1.5
6	1.0	9.5	5.5	0.5	1.0
7	0.0	8.0	11.0	0.0	0.5
8	0.0	7.5	6.0	1.0	0.0
9	0.0	8.0	4.5	2.0	4.0
10	0.0	8.0	1.0	1.0	4.0

	(cm)
Average snow depth =	**3.6**
Maximum snow depth =	11.0
Minimum snow depth =	0.0
Standard variation =	3.4

Snow Sample Depths and Weights

Bag #	Depth (cm)	Weight (gr)	Volume (cm^3)	Density (gr/cm^3)
* no snow samples were taken				

Average Density =
Average Snow Water Equivalent (SWE) = _____ cm H2O
Average Snow Water Equivalent = _____ inches H2O
Average Snow Water Equivalent = _____ 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: 5/11/2008 Time: 19:00

Location Description:	At MSBN, on tundra. Snow course bears West 25 meters, then South 25 meters.				
Survey objective:	Determine Snow Water Equivalent			Weather Observations:	nr
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:	10-30% snow
Slope Angle:	flat	Access Notes:	Highway Vehicle	Other:	nr
Snow Depth Probe Type:		T-handle probe		Snow-Survey Team Names	
Snow Tube Type:	Arinodack snow tube			MRL, DAR	

Snow Course Depths, in cm.

	1	2	3	4	5
1	25.0	26.0	14.0	14.0	35.5
2	28.0	16.0	19.0	14.0	28.0
3	20.0	16.0	22.0	23.0	0.0
4	8.0	25.0	23.0	28.0	0.0
5	21.0	26.0	16.0	28.5	0.0
6	25.0	31.0	21.0	29.0	0.0
7	44.0	34.0	20.0	26.5	0.0
8	55.0	35.0	24.5	21.0	18.5
9	35.5	21.0	24.0	28.0	30.0
10	29.0	23.0	18.0	31.5	26.0

	(cm)
Average snow depth =	**22.5**
Maximum snow depth =	55.0
Minimum snow depth =	0.0
Standard variation =	10.9

Snow Sample Depths and Weights

Bag #	Depth (cm)	Weight (gr)	Volume (cm^3)	Density (gr/cm^3)
1	25	5.0	892.5	0.01
2	41	2.0	1463.7	0.00
3	22	2.0	785.4	0.00
4	29	4.0	1035.3	0.00
5	22	0.0	785.4	0.00

Average Density = **0.00**
Average Snow Water Equivalent (SWE) = **0.1** cm H2O
Average Snow Water Equivalent = **0.02** inches H2O
Average Snow Water Equivalent = **0.00** feet H2O

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