

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



*Ice Expansion crack at Mine Site B, photo by D. Reichardt*

by  
Kristie Holland, Amanda Blackburn and Michael Lilly

April 2008

North Slope Lakes Hydrologic Project  
Report No. INE/WERC 08.10

Water and Environmental  
Research Center



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By:

Kristie Holland<sup>1</sup> Amanda Blackburn<sup>1</sup>, and Michael Lilly<sup>1</sup>

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- National Energy Technology Laboratory
- BP Exploration (Alaska), Inc.
- ConocoPhillips Alaska, Inc.
- Bureau of Land Management
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April 2008

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## **DISCLAIMER**

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

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

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

## Conversion Factors

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

### Physical and Chemical Water-Quality Units:

Temperature:

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

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

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

Specific electrical conductance (conductivity):

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

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

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

Millivolt (mV):

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

Vertical Datum:

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

Horizontal Datum:

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



## Abbreviations, Acronyms, and Symbols

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

### Lake Nomenclature

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

## **PROJECT COOPERATORS**

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

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

## **ACKNOWLEDGEMENTS**

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# **Lake Chemistry and Physical Data For Selected North Slope, Alaska, Lakes: March 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 March 2008, 2) summarize accomplished field trip objectives.















## **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: 3/11/08 Time: 10:50

**FIELD MEASUREMENTS**

GPS Coord. Northing: N70°19.995' Easting: W150°56.918' Datum: NAD83  
 Measurements By: GMM Time: nr  
 Water Depth (ft): 10.85 Ice Thickness (ft): 4.15  
 Freeboard (ft): 0.25 Snow Depth (ft): 0.50  
 Elev. (BPMSL +/- .02): 7.81 Survey By: CC/HT Date: 3/11/08 Time: 13:35  
 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					
<b>Parameters</b>										
	<b>Field Measurements</b>									
Time:	11:06	11:13	11:20	11:30	11:35	11:40	11:45	11:51		
Depth BWS (ft):	4	5	6	7	8	9	10	10.5		
Temp (°C):	0.15	0.18	0.76	1.20	1.46	1.78	2.07	2.22		
pH:	6.80	6.82	6.82	6.81	6.81	6.79	6.68	6.63		
Barometric (mmHg):	766.4	766.4	766.5	766.5	766.6	766.6	766.6	766.6		
Pressure (kPa):	10.282	13.228	16.605	19.522	22.307	25.144	28.205	29.852		
Conductivity (µS/cm):	87.08	86.64	86.37	86.60	86.83	86.79	88.52	95.17		
RDO (ppm): (mg/L)	11.82	12.04	12.36	12.57	12.73	12.72	11.12	9.01		
Turbidity (NTU):	1.0	3.6	5.3	7.4	9.7	7.3	8.2	10.6		
ORP	254	253	250	249	248	248	250	228		

**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 <sub>3</sub> )										Digital titrator 10-4000 mg/L as CaCO <sub>3</sub>
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 <sub>3</sub> -N)****										0.01-0.50 mg/L NH <sub>3</sub> -N
Ammonia/ Iron dilution										

Remarks: log start 11:05; log stop 11:51

Field-Form Filled Out By: GMM Date: 3/16/08  
 QAQC Check By: CMC Date: 3/16/08









**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: L9817 - 20  
 Sample Purpose: Lake Water Quality Date: 3/12/08 Time: 1:48

**FIELD MEASUREMENTS**

GPS Coord. Northing: N70°14.079' Easting: W151°19.969' Datum: NAD83  
 Measurements By: GMM Time: nr  
 Water Depth (ft): 7.77 Ice Thickness (ft): 4.95  
 Freeboard (ft): 0.55 Snow Depth (ft): 0.45  
 Elev. (BPMSL +/- .02): 51.84 Survey By: DAR/CC Date: 3/12/08 Time: 12:00  
 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	IN-SITU Troll 9000	33033	PASS	PASS
<b>Parameters</b>					
<b>Field Measurements</b>					
Time:	13:54	13:57	13:59	14:01	14:03
Depth BWS (ft):	5	6	7	8	BOT (7.77)
Temp (°C):	0.38	0.51	0.52	0.70	0.77
pH:	6.72	6.80	6.82	6.91	7.00
Barometric (mmHg):	30.35	30.34	30.34	30.34	30.34
Pressure (kPa):	16.269	19.225	19.231	20.954	22.690
Conductivity (µS/cm):	920.3	930.7	933.4	958.8	970.5
RDO (ppm): (mg/L)	0.66	0.44	0.45	0.28	0.19
Turbidity (NTU):	13.8	13.8	12.5	20.3	575.8
ORP	318	308	301	288	279

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 <sub>3</sub> )										Digital titrator 10-4000 mg/L as CaCO <sub>3</sub>
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 <sub>3</sub> -N)****										0.01-0.50 mg/L NH <sub>3</sub> -N
Ammonia/ Iron dilution										

Remarks: Start log 13:53; stop log 14:03. Rugged reader battery dying at 13:59.

Field-Form Filled Out By: GMM Date: 3/15/08  
 QAQC Check By: DAR Date: 3/15/08



**University of Alaska Fairbanks, Water and Environmental Research Center**

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

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

Site Location/Lake ID: L9817 - 22  
 Date: 3/12/08 Time: 13:11

**FIELD MEASUREMENTS**

GPS Coord. Northing: N70°14.074' Easting: W151°20.017' Datum: NAD83  
 Measurements By: GMM Time: nr  
 Water Depth (ft): 8.25 Ice Thickness (ft): 4.65  
 Freeboard (ft): 0.10 Snow Depth (ft): 0.40  
 Elev. (BPMSL +/- .02): 51.84 Survey By: DAR/CC Date: 3/12/08 Time: 12:00  
 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	IN-SITU Troll 9000	33033	PASS	PASS
<b>Parameters</b>					
<b>Field Measurements</b>					
Time:	13:26	13:29	7:40	13:35	13:39
Depth BWS (ft):	5	6	7	8	BOT (8.25)
Temp (°C):	0.06	0.07	0.21	0.55	0.66
pH:	6.85	6.85	6.84	6.88	6.96
Barometric (mmHg):	30.35	30.34	30.34	30.34	30.35
Pressure (kPa):	13.548	16.394	19.278	22.182	23.634
Conductivity (µS/cm):	931.5	929.1	939.5	1006.0	1018.0
RDO (ppm): (mg/L)	0.49	0.38	0.33	0.24	0.25
Turbidity (NTU):	14.6	15.1	15.5	16.3	18.3
ORP	259	256	253	247	224

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 <sub>3</sub> )										Digital titrator 10-4000 mg/L as CaCO <sub>3</sub>
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 <sub>3</sub> -N)****										0.01-0.50 mg/L NH <sub>3</sub> -N
Ammonia/ Iron dilution										

Remarks: Start log 13:26; stop log ?  
Rugged reader seized up completely. Replaced with UAF rugged reader.

Field-Form Filled Out By: GMM Date: 3/15/08  
 QAQC Check By: DAR Date: 3/15/08

**University of Alaska Fairbanks, Water and Environmental Research Center**

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

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

Site Location/Lake ID: L9817 - 23  
 Date: 3/12/08 Time: 12:46

**FIELD MEASUREMENTS**

GPS Coord. Northing: 70°14.071' Easting: W151°20.67' Datum: NAD83  
 Measurements By: GMM Time: nr  
 Water Depth (ft): 7.35 Ice Thickness (ft): 4.60  
 Freeboard (ft): 0.35 Snow Depth (ft): 0.45  
 Elev. (BPMSL +/- .02): 51.84 Survey By: DAR/CC Date: 3/12/08 Time: 12:00  
 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	IN-SITU Troll 9000	33033	PASS	PASS
<b>Parameters</b>					
<b>Field Measurements</b>					
Time:	12:51	12:56	12:59	13:02	
Depth BWS (ft):	5	6	7	BOT (7.35)	
Temp (°C):	0.08	0.08	0.27	0.40	
pH:	6.84	6.84	6.83	6.86	
Barometric (mmHg):	770.7	770.6	770.7	770.8	
Pressure (kPa):	13.153	16.182	19.290	21.241	
Conductivity (µS/cm):	929.3	926.9	937.9	972.0	
RDO (ppm): (mg/L)	0.72	0.61	0.30	0.21	
Turbidity (NTU):	13.8	14.1	13.9	152.0	
ORP	212	213	213	210	

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 <sub>3</sub> )										Digital titrator 10-4000 mg/L as CaCO <sub>3</sub>
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 <sub>3</sub> -N)****										0.01-0.50 mg/L NH <sub>3</sub> -N
Ammonia/ Iron dilution										

Remarks: Start log 12:51; stop log 12:58

Field-Form Filled Out By: GMM Date: 3/15/08  
 QAQC Check By: DAR Date: 3/15/08

**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: L9312 Screen  
 Sample Purpose: Lake Water Quality Date: 3/11/08 Time: 12:05

**FIELD MEASUREMENTS**

GPS Coord. Northing: N70°20.003' Easting: W150°57.005' Datum: NAD83  
 Measurements By: GMM Time: nr  
 Water Depth (ft): 11 Ice Thickness (ft): 4.35  
 Freeboard (ft): 0.75 Snow Depth (ft): 0.55  
 Elev. (BPMSL +/- .02): 7.81 Survey By: CC/HT Date: 3/11/08 Time: 13:35  
 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					
<b>Parameters</b>										
	<b>Field Measurements</b>									
Time:	12:13	12:23	12:28	12:35	12:40	12:47	12:51			
Depth BWS (ft):	5	6	7	8	9	10	10.7			
Temp (°C):	0.13	0.58	0.97	1.33	1.67	1.98	2.26			
pH:	6.77	6.77	6.76	6.74	6.70	6.66	6.63			
Barometric (mmHg):	766.5	766.5	766.5	766.6	766.6	766.7	766.8			
Pressure (kPa):	13.239	16.325	19.317	27.176	25.327	28.255	30.492			
Conductivity (µS/cm):	89.66	88.01	88.15	87.72	87.74	91.14	93.95			
RDO (ppm): (mg/L)	10.51	10.66	10.58	10.63	9.94	8.72	7.53			
Turbidity (NTU):	4.1	7.5	7.4	7.9	8.2	10.0	10.9			
ORP	299	296	294	293	293	294	285			

**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 <sub>3</sub> )										Digital titrator 10-4000 mg/L as CaCO <sub>3</sub>
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 <sub>3</sub> -N)****										0.01-0.50 mg/L NH <sub>3</sub> -N
Ammonia/ Iron dilution										

Remarks: Log start 12:09; Log stop 12:51

Field-Form Filled Out By: GMM Date: 3/16/08  
 QAQC Check By: CMC Date: 3/16/08



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: L9312 #1  
 Sample Purpose: Lake Water Quality Date: 3/11/08 Time: 15:42

**FIELD MEASUREMENTS**

GPS Coord. Northing: N70 19.872 Easting: W150 56.803 Datum: NAD83  
 Measurements By: GMM Time: nr  
 Water Depth (ft): 12.9 Ice Thickness (ft): 4.80  
 Freeboard (ft): 0.25 Snow Depth (ft): 0.35  
 Elev. (BPMSL +/- .02): 7.81 Survey By: CC/HT Date: 3/11/08 Time: 13:35  
 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					
<b>Parameters</b>										
	<b>Field Measurements</b>									
Time:	15:47	15:53	15:57	16:04	16:10	16:15	16:20			
Depth BWS (ft):	5	6	7	9	11	12	12.8			
Temp (°C):	0.24	0.63	1.05	1.83	2.54	2.91	3.16			
pH:	6.86	6.85	6.85	6.83	6.74	6.85	7.29			
Barometric (mmHg):	767.2	767.2	767.2	767.3	767.4	767.4	767.4			
Pressure (kPa):	13.438	16.337	19.209	25.062	30.979	34.125	36.302			
Conductivity (µS/cm):	83.32	81.10	80.80	81.37	80.66	96.06	149.50			
RDO (ppm): (mg/L)	12.92	12.71	12.78	12.84	10.11	6.41	3.96			
Turbidity (NTU):	1.3	3.4	7.6	4.5	5.1	3.5	2.7			
ORP	320	319	319	318	321	307	79			

**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 <sub>3</sub> )										Digital titrator 10-4000 mg/L as CaCO <sub>3</sub>
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 <sub>3</sub> -N)****										0.01-0.50 mg/L NH <sub>3</sub> -N
Ammonia/ Iron dilution										

Remarks: Log start 15:52; log stop 16:20.

Field-Form Filled Out By: GMM Date: 3/16/08  
 QAQC Check By: CMC Date: 3/16/08

**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: L9312 #2  
 Sample Purpose: Lake Water Quality Date: 3/11/08 Time: 14:54

**FIELD MEASUREMENTS**

GPS Coord. Northing: N70 19.837 Easting: W150 57.055 Datum: NAD83  
 Measurements By: GMM Time: nr  
 Water Depth (ft): 10.8 Ice Thickness (ft): 4.35  
 Freeboard (ft): 0.25 Snow Depth (ft): 0.45  
 Elev. (BPMSL +/- .02): 7.81 Survey By: CC/HT Date: 3/11/08 Time: 13:35  
 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				
<b>Parameters</b>									
<b>Field Measurements</b>									
Time:	14:58	15:03	15:07	15:11	15:14	15:19	15:23		
Depth BWS (ft):	5	6	7	8	9	10	10.5		
Temp (°C):	0.23	0.74	1.08	1.47	1.88	2.27	2.41		
pH:	6.87	6.86	6.87	6.87	6.85	6.75	6.71		
Barometric (mmHg):	767.2	767.2	767.1	767.2	767.2	767.2	767.2		
Pressure (kPa):	13.061	16.788	19.162	22.202	25.032	28.132	29.279		
Conductivity (µS/cm):	80.80	79.52	79.66	79.70	79.80	80.86	84.54		
RDO (ppm): (mg/L)	13.91	13.80	13.55	13.57	13.40	10.67	7.99		
Turbidity (NTU):	0.8	2.1	3.4	4.0	4.4	5.6	5.5		
ORP	348	346	344	343	343	337	324		

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 <sub>3</sub> )										Digital titrator 10-4000 mg/L as CaCO <sub>3</sub>
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 <sub>3</sub> -N)****										0.01-0.50 mg/L NH <sub>3</sub> -N
Ammonia/ Iron dilution										

Remarks: Log start 14:58; log stop 13:24.

Field-Form Filled Out By: GMM Date: 3/16/08  
 QAQC Check By: CMC Date: 3/16/08

**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: KDA1  
 Sample Purpose: Lake Water Quality Date: 3/14/08 Time: 12:40

**FIELD MEASUREMENTS**

GPS Coord. Northing: N70° 19.868' Easting: W148° 56.768' Datum: NAD83  
 Measurements By: GMM Time: nr  
 Water Depth (ft): 20.1 Ice Thickness (ft): 5.65  
 Freeboard (ft): 0.45 Snow Depth (ft): 0.10  
 Elev. (BPMSL +/- .02): 5.45 Survey By: DAR/MRL Date: 3/14/08 Time: 13:45  
 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							
<b>Parameters</b>												
	<b>Field Measurements</b>											
Time:	12:47	12:53	12:58	13:02	13:07	13:10	13:14	13:18	13:22	13:26	13:30	13:34
Depth BWS (ft):	6	7	8	9	11	13	15	17	18	19	20	BOT
Temp (°C):	0.42	0.87	1.12	1.26	1.36	1.47	1.54	1.62	1.74	1.83	1.83	1.87
pH:	7.54	7.54	7.55	7.55	7.54	7.54	7.54	7.53	7.47	7.36	7.31	7.28
Barometric (mmHg):	777.1	777.1	777.2	777.2	777.3	777.3	777.4	777.4	777.5	777.5	777.5	777.5
Pressure (mmHg):	16.398	19.288	22.159	25.108	31.103	37.102	42.932	48.913	52.277	55.152	58.019	59.408
Conductivity (µS/cm):	128.1	128.1	128.6	128.3	128.0	127.2	126.8	126.9	126.90	128.20	133.10	134.4
RDO (ppm): (mg/L)	14.74	14.87	14.99	15.24	15.58	15.75	15.94	15.99	15.22	11.12	7.99	5.70
Turbidity (NTU):	0.0	0.0	0.0	0.0	0.1	0.3	0.1	0.1	0.2	1.3	2.4	62.0
ORP	323	320	316	314	313	311	310	309	309	311	312	310

**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 <sub>3</sub> )										Digital titrator 10-4000 mg/L as CaCO <sub>3</sub>
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 <sub>3</sub> -N)****										0.01-0.50 mg/L NH <sub>3</sub> -N
Ammonia/ Iron dilution										

Remarks: Log start 12:45. Log stop 13:35.

Field-Form Filled Out By: GMM Date: 3/16/08  
 QAQC Check By: CMC Date: 3/16/08







**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  
 Sample Purpose: Lake Water Quality Date: 3/15/08 Time: 11:04

**FIELD MEASUREMENTS**

GPS Coord. Northing: N70°19.280' Easting: W149°24.009' Datum: NAD83  
 Measurements By: GMM Time: nr  
 Water Depth (ft): 33.3 Ice Thickness (ft): 5.50  
 Freeboard (ft): 0.5 Snow Depth (ft): 0.20  
 Elev. (BPMSL +/- .02): 93.42 Survey By: CC/MRL Date: 3/15/08 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							
<b>Parameters</b>												
<b>Field Measurements</b>												
Time:	11:14	11:17	11:21	11:25	11:32	11:37	11:39	11:42	11:45	11:48	11:51	11:54
Depth BWS (ft):	5	6	7	9	11	13	15	17	19	21	23	25
Temp (°C):	1.20	0.68	0.51	0.63	0.90	1.05	1.24	1.37	1.49	1.56	1.63	1.72
pH:	7.60	7.62	7.63	7.63	7.65	7.65	7.65	7.63	7.62	7.61	7.60	7.55
Barometric (mmHg):	771.3	771.2	771.2	771.2	771.4	776.3	771.4	771.5	771.5	771.6	771.6	771.6
Pressure (kPa):	13.228	16.346	19.236	25.546	31.313	37.002	43.013	49.091	55.115	60.195	66.891	72.727
Conductivity (µS/cm):	179.4	173.8	171.1	167.9	167.4	167.4	167.1	167.0	167.0	167.0	167.1	167.4
RDO (ppm): (mg/L)	12.71	13.35	13.91	14.22	14.52	14.46	14.56	14.30	14.17	14.13	14.14	13.96
Turbidity (NTU):	0.4	0.2	0.3	0.4	0.1	0.2	0.1	0.3	0.3	0.2	0.0	0.1
ORP	247	245	244	243	240	238	238	238	237	237	237	237

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 <sub>3</sub> )										Digital titrator 10-4000 mg/L as CaCO <sub>3</sub>
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 <sub>3</sub> -N)****										0.01-0.50 mg/L NH <sub>3</sub> -N
Ammonia/ Iron dilution										

Remarks: Sheet 1 of 2. No Log

Field-Form Filled Out By: GMM Date: 3/16/08  
 QAQC Check By: CMC Date: 3/16/08

**University of Alaska Fairbanks, Water and Environmental Research Center**

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

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

Site Location/Lake ID: MSBN-CT  
 Date: 3/15/08 Time: 11:04

**FIELD MEASUREMENTS**

GPS Coord. Northing: N70°19.280' Easting: W149°24.009' Datum: NAD83  
 Measurements By: GMM Time: nr  
 Water Depth (ft): 33.3 Ice Thickness (ft): 5.50  
 Freeboard (ft): 0.5 Snow Depth (ft): 0.20  
 Elev. (BPMSL +/- .02): 93.42 Survey By: CC/MRL Date: 3/15/08 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		
<b>Parameters</b>									
Time:	11:58	12:01	12:03	12:06	12:09	12:13			
Depth BWS (ft):	27	29	31	32	33	BOT(33.3)			
Temp (°C):	1.86	2.02	2.03	1.94	1.88	1.85			
pH:	7.32	7.25	7.17	7.37	7.50	7.40			
Barometric (mmHg):	771.7	771.7	771.8	771.8	771.8	771.8			
Pressure (kPa):	78.717	84.702	90.783	93.824	96.531	98.764			
Conductivity (µS/cm):	172.8	198.0	249.6	313.3	386.5	417.7			
RDO (ppm): (mg/L)	10.71	7.07	4.62	3.19	2.34	1.57			
Turbidity (NTU):	1.1	2.6	4.3	7.4	17.7	21.7			
ORP	243	247	222	174	123	108			

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 <sub>3</sub> )										Digital titrator 10-4000 mg/L as CaCO <sub>3</sub>
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 <sub>3</sub> -N)****										0.01-0.50 mg/L NH <sub>3</sub> -N
Ammonia/ Iron dilution										

Remarks: Sheet 2 of 2. No Log

Field-Form Filled Out By: GMM Date: 3/16/08  
 QAQC Check By: CMC Date: 3/16/08

**University of Alaska Fairbanks, Water and Environmental Research Center**

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

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

Site Location/Lake ID: MSBS-CT  
 Date: 3/14/08 Time: 12:31

**FIELD MEASUREMENTS**

GPS Coord. Northing: N70°19.214' Easting: W149°24.020' Datum: NAD83  
 Measurements By: GMM Time: nr  
 Water Depth (ft): 26.2 Ice Thickness (ft): 5.05  
 Freeboard (ft): 0.4 Snow Depth (ft): 0.50  
 Elev. (BPMSL +/- .02): 94.58 Survey By: CC/MRL Date: 3/15/08 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							
<b>Parameters</b>												
<b>Field Measurements</b>												
Time:	12:40	12:42	12:45	12:47	12:49	12:52	12:55	12:57	12:59	13:02	13:05	13:08
Depth BWS (ft):	5	6	7	9	11	13	15	17	19	21	23	24
Temp (°C):	0.18	0.17	0.94	1.33	1.44	1.45	1.49	1.55	1.60	1.66	1.82	1.95
pH:	7.49	7.49	7.50	7.51	7.51	7.52	7.52	7.50	7.49	7.47	7.45	7.37
Barometric (mmHg):	770.6	770.6	770.7	770.7	770.7	770.8	770.8	770.8	770.9	770.9	770.9	770.9
Pressure (kPa):	13.281	16.425	19.377	25.068	31.006	37.047	43.080	48.925	55.233	60.962	67.026	70.106
Conductivity (µS/cm):	174.8	175.2	174.3	174.8	175.1	177.2	176.3	176.6	176.7	176.4	176.0	176.9
RDO (ppm): (mg/L)	11.39	11.40	11.46	11.63	11.78	12.01	12.22	11.98	11.87	11.71	11.11	10.12
Turbidity (NTU):	0.1	0.2	0.6	0.7	0.9	0.9	0.6	0.5	0.5	0.8	0.6	1.3
ORP	170	171	170	170	170	170	171	172	172	173	174	176

**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 <sub>3</sub> )										Digital titrator 10-4000 mg/L as CaCO <sub>3</sub>
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 <sub>3</sub> -N)****										0.01-0.50 mg/L NH <sub>3</sub> -N
Ammonia/ Iron dilution										

Remarks: Sheet 1 of 2. Log start 12:36; log stop 13:18.

Field-Form Filled Out By: GMM Date: 3/16/08  
 QAQC Check By: CMC Date: 3/16/08



**University of Alaska Fairbanks, Water and Environmental Research Center**

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

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

Site Location/Lake ID: MSBS-SW-Creek  
 Date: 3/15/08 Time: 13:28

**FIELD MEASUREMENTS**

GPS Coord. Northing: N70°19.186' Easting: W149°24.234' Datum: WGS84  
 Measurements By: GMM Time: nr  
 Water Depth (ft): 19 Ice Thickness (ft): 5.25  
 Freeboard (ft): 0.45 Snow Depth (ft): 0.30  
 Elev. (BPMSL +/- .02): 94.58 Survey By: CC/MRL Date: 3/15/08 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							
<b>Parameters</b>												
<b>Field Measurements</b>												
Time:	13:35	13:39	13:42	13:44	13:46	13:49	13:51	13:54	13:57	14:00		
Depth BWS (ft):	5	6	7	9	11	13	15	17	18	19		
Temp (°C):	0.17	0.20	0.90	1.25	1.33	1.35	1.39	1.42	1.49	1.54		
pH:	7.55	7.55	7.54	7.46	7.56	7.57	7.56	7.52	7.48	7.46		
Barometric (mmHg):	770.1	770.2	770.4	770.2	770.2	770.2	770.3	770.4	770.5	770.5		
Pressure (kPa):	13.073	16.315	19.370	25.318	31.139	37.177	43.255	48.992	52.155	55.131		
Conductivity (µS/cm):	185.3	181.6	179.0	178.0	179.6	179.7	179.5	179.4	178.7	178.8		
RDO (ppm): (mg/L)	13.03	13.02	12.88	12.83	13.01	13.25	13.06	12.64	11.96	11.44		
Turbidity (NTU):	0.6	1.3	0.8	2.0	1.6	1.0	0.6	1.2	1.1	0.8		
ORP	272	270	268	267	265	264	263	263	263	263		

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 <sub>3</sub> )										Digital titrator 10-4000 mg/L as CaCO <sub>3</sub>
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 <sub>3</sub> -N)****										0.01-0.50 mg/L NH <sub>3</sub> -N
Ammonia/ Iron dilution										

Remarks: Log start 13:33; log stop 14:00.

Field-Form Filled Out By: GMM Date: 3/16/08  
 QAQC Check By: CMC Date: 3/16/08

## **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: 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	3/10/08	20:57	Oakton 4.01	2612530	Dec-08	4.12 @ 19.11	Pass
ph 7.00	3/10/08	20:58	Oakton 7.00	2709203	Aug-09	7.03 @ 19.15	Pass
ph 10.00	3/10/08	21:01	Oakton 10.00	2707084	Jan-09	10.00 @ 19.63	Pass
Conductivity 84 µS/cm	3/10/08	20:22	Oakton 84	2706156	Jun-08	76.89 @ 19.25	Pass
Conductivity 447 µS/cm	3/10/08	20:24	Oakton 447	2707012	Jul-08	393.7 @ 19.37	Pass
ORP	3/10/08	20:30	Zobell's	2709340	Jun-08	242 @ 18.52	Pass
Saturated O <sub>2</sub>	3/10/08	20:06	Bubbled Nanopure	--	--	98.1 @ 19.56	Pass
Zero O <sub>2</sub>	3/10/08	21:08	Oakton	2706384	Jun-08	0.02 @ 15.47	Pass

**Post-Sampling QA**

Parameter	Date	Time	Standard	Lot No.	Exp.	Meter Reading	Pass/Fail
pH 4.01	3/11/08	20:01	Oakton 4.01	2612530	Dec-08	4.06 @ 20.68	Pass
ph 7.00	3/11/08	20:03	Oakton 7.00	2709203	Aug-09	7.06 @ 20.55	Pass
ph 10.00	3/11/08	20:05	Oakton 10.00	2707084	Jan-09	10.00 @ 20.32	Pass
Conductivity 84 µS/cm	3/11/08	19:55	Oakton 84	2706156	Jun-08	78.90 @ 20.05	Pass
Conductivity 447 µS/cm	3/11/08	19:57	Oakton 447	2707012	Jul-08	404.6 @ 20.45	Pass
ORP	3/11/08	20:05	Zobell's	2709340	Jun-08	230 @ 20.56	Pass
Saturated O <sub>2</sub>	3/11/08	19:53	Bubbled Nanopure	--	--	100.4 @ 18.12	Pass
Zero O <sub>2</sub>	3/11/08	20:11	Oakton	2706384	Jun-08	0.03 @ 15.32	Pass

Remarks: Changed ph/ORP reference solution and junction in pH/ORP probe. pH/ORP recalibrated before cal-check. ph/ORP probe SN:PP10242 (GWS)

Field-Form Filled Out By: GMM Date: 3/16/2008  
 QAQC Check By: CMC Date: 3/16/2008



**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	3/11/08	20:01	Oakton 4.01	2612530	Dec-08	4.06 @ 20.68	Pass
ph 7.00	3/11/08	20:03	Oakton 7.00	2709203	Aug-09	7.06 @ 20.55	Pass
ph 10.00	3/11/08	20:05	Oakton 10.00	2707084	Jan-09	10.00 @ 20.32	Pass
Conductivity 84 µS/cm	3/11/08	19:55	Oakton 84	2706156	Jun-08	78.90 @ 20.05	Pass
Conductivity 447 µS/cm	3/11/08	19:57	Oakton 447	2707012	Jul-08	404.6 @ 20.45	Pass
ORP	3/11/08	20:05	Zobell's	2709340	Jun-08	230 @ 20.56	Pass
Saturated O <sub>2</sub>	3/11/08	19:53	Bubbled Nanopure	--	--	100.4 @ 18.12	Pass
Zero O <sub>2</sub>	3/11/08	20:11	Oakton	2706384	Jun-08	0.03 @ 15.32	Pass

**Post-Sampling QA**

Parameter	Date	Time	Standard	Lot No.	Exp.	Meter Reading	Pass/Fail
pH 4.01	3/12/08	18:23	Oakton 4.01	2612530	Dec-08	4.06 @ 19.69	Pass
ph 7.00	3/12/08	18:25	Oakton 7.00	2709203	Aug-09	7.01 @ 19.28	Pass
ph 10.00	3/12/08	18:27	Oakton 10.00	2707084	Jan-09	9.99 @ 19.69	Pass
Conductivity 84 µS/cm	3/12/08	18:19	Oakton 84	2706156	Jun-08	81.68 @ 19.34	Pass
Conductivity 447 µS/cm	3/12/08	18:21	Oakton 447	2707012	Jul-08	401.4 @ 19.76	Pass
ORP	3/12/08	18:29	Zobell's	2709340	Jun-08	235 @ 20.35	Pass
Saturated O <sub>2</sub>	3/12/08	18:16	Bubbled Nanopure	--	--	100.2 @ 17.55	Pass
Zero O <sub>2</sub>	3/12/08	18:35	Oakton	2706384	Jun-08	0.03 @ 16.83	Pass

Remarks: \_\_\_\_\_  
 ph/ORP probe SN:PP10242 (GWS)

Field-Form Filled Out By: GMM Date: 3/16/2008  
 QAQC Check By: CMC Date: 3/16/2008

**University of Alaska Fairbanks, Water and Environmental Research Center**

**Form F-004e: Water Quality Meter Calibration Form**

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

Site Location/Lake ID: Kuparuk Deadarm Lakes

**WATER QUALITY METER INFORMATION**

Meter Make: InSitu  
 Owner: GW Scientific

Make: Troll 9000  
 S/N: 33033

**CALIBRATION AND QUALITY ASSURANCE INFORMATION**

**Pre-Sampling QA**

Parameter	Date	Time	Standard	Lot No.	Exp.	Meter Reading	Pass/Fail
pH 4.01	3/12/08	18:23	Oakton 4.01	2612530	Dec-08	4.06 @ 19.69	Pass
ph 7.00	3/12/08	18:25	Oakton 7.00	2709203	Aug-09	7.01 @ 19.28	Pass
ph 10.00	3/12/08	18:27	Oakton 10.00	2707084	Jan-09	9.99 @ 19.69	Pass
Conductivity 84 µS/cm	3/12/08	18:19	Oakton 84	2706156	Jun-08	81.68 @ 19.34	Pass
Conductivity 447 µS/cm	3/12/08	18:21	Oakton 447	2707012	Jul-08	401.4 @ 19.76	Pass
ORP	3/12/08	18:29	Zobell's	2709340	Jun-08	235 @ 20.35	Pass
Saturated O <sub>2</sub>	3/12/08	18:16	Bubbled Nanopure	--	--	100.2 @ 17.55	Pass
Zero O <sub>2</sub>	3/12/08	18:35	Oakton	2706384	Jun-08	0.03 @ 16.83	Pass

**Post-Sampling QA**

Parameter	Date	Time	Standard	Lot No.	Exp.	Meter Reading	Pass/Fail
pH 4.01	3/14/08	21:05	Oakton 4.01	2612530	Dec-08	4.04 @ 17.96	Pass
ph 7.00	3/14/08	21:10	Oakton 7.00	2709203	Aug-09	7.01 @ 18.69	Pass
ph 10.00	3/14/08	21:12	Oakton 10.00	2707084	Jan-09	10.00 @ 17.16	Pass
Conductivity 447 µS/cm	3/14/08	21:04	Oakton 84	2706156	Jun-08	76.77 @ 19.08	Pass
Conductivity 84 µS/cm	3/14/08	21:06	Oakton 447	2707012	Jul-08	381.0 @ 17.38	Pass
ORP	3/14/08	21:14	Zobell's	2709340	Jun-08	236 @ 17.79	Pass
Saturated O <sub>2</sub>	3/14/08	21:02	Bubbled Nanopure	--	--	102.5 @ 19.73	Pass
Zero O <sub>2</sub>	3/14/08	21:17	Oakton	2706384	Jun-08	0.02 @ 15.70	Pass

Remarks: ph/ORP probe SN:PP10242 (GWS)

Field-Form Filled Out By: GMM  
 QAQC Check By: CMC

Date: 3/16/2008  
 Date: 3/16/2008

**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	3/14/08	21:05	Oakton 4.01	2612530	Dec-08	4.04 @ 17.96	Pass
ph 7.00	3/14/08	21:10	Oakton 7.00	2709203	Aug-09	7.01 @ 18.69	Pass
ph 10.00	3/14/08	21:12	Oakton 10.00	2707084	Jan-09	10.00 @ 17.16	Pass
Conductivity 447 µS/cm	3/14/08	21:04	Oakton 84	2706156	Jun-08	76.77 @ 19.08	Pass
Conductivity 84 µS/cm	3/14/08	21:06	Oakton 447	2707012	Jul-08	381.0 @ 17.38	Pass
ORP	3/14/08	21:14	Zobell's	2709340	Jun-08	236 @ 17.79	Pass
Saturated O <sub>2</sub>	3/14/08	21:02	Bubbled Nanopure	--	--	102.5 @ 19.73	Pass
Zero O <sub>2</sub>	3/14/08	21:17	Oakton	2706384	Jun-08	0.02 @ 15.70	Pass

**Post-Sampling QA**

Parameter	Date	Time	Standard	Lot No.	Exp.	Meter Reading	Pass/Fail
pH 4.01	3/15/08	17:35	Oakton 4.01	2612530	Dec-08	4.05 @ 18.20	Pass
ph 7.00	3/15/08	17:36	Oakton 7.00	2709203	Aug-09	7.06 @ 19.39	Pass
ph 10.00	3/15/08	17:39	Oakton 10.00	2707084	Jan-09	9.98 @ 19.07	Pass
Conductivity 84 µS/cm	3/15/08	17:32	Oakton 84	2706156	Jun-08	79.86 @ 20.26	Pass
Conductivity 447 µS/cm	3/15/08	17:34	Oakton 447	2707012	Jul-08	411.7 @ 21.35	Pass
ORP	3/15/08	17:41	Zobell's	2709340	Jun-08	232 @ 19.74	Pass
Saturated O <sub>2</sub>	3/15/08	17:32	Bubbled Nanopure	--	--	99.5 @ 21.10	Pass
Zero O <sub>2</sub>	3/15/08	17:43	Oakton	2706384	Jun-08	0.03 @ 17.64	Pass

Remarks: ph/ORP probe SN:PP10242 (GWS)

Field-Form Filled Out By: GMM Date: 3/16/2008  
 QAQC Check By: CMC Date: 3/16/2008

## **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: 3/11/2008 Time: 13:35

Location:	Lake L9312, located southeast of Alpine pad, survey by pump house benchmarks							
Survey objective:	Determine FWS Elevation.					Weather Observations:		
Instrument Type:	LCMF Zeiss Ni2	Instrument ID:	#147298			-5°F, 10-15 mph winds, Clear		
Rod Type:	Fiberglass	Rod ID:	Sokkia Fiber Glass					
Bench Mark Information:						Survey Team Names		
Name	Agency Responsible	Elevation (ft)	Latitude (dd-mm.mmm)	Longitude (ddd-mm.mmm)		Chad Cormack, Horacio Toniolo		
L9312"P"	CP	11.72	na	na				
<b>Station</b>	<b>BS (ft)</b>	<b>HI (ft)</b>	<b>FS (ft)</b>	<b>Elevation (fasm)</b>	<b>Distance (ft)</b>	<b>Horizontal Angle</b>	<b>Vertical Angle</b>	<b>Remarks</b>
TBM "P"	1.550	13.27		11.72				Top of inlet pipe support
TBM "O"		13.27	1.82	11.45				Top of inlet pipe support. BM Elev=11.46'
99-32-59		13.27	1.27	14.54				Top of Pumphouse SE VSM. BM Elev = 14.57
L9312 WL		13.27	6.09	<b>7.18</b>				<b>Water Surface Level</b>
Turn on L9312 WL								
L9312 WL	6.18	13.36		7.18				
99-32-59		13.36	1.18	14.54				Inverted shot
TBM"O"		13.36	1.90	11.46				
TBM"P"		13.36	1.64	11.72				close survey to 0.00

Note:

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

**University of Alaska Fairbanks, Water and Environmental Research Center**

**Form F-011: Elevation Survey Form**

Project ID: North Slope Lakes Site Location/Lake ID: L9817  
 Survey Purpose: Water-Level Elevations Date: 3/12/2008 Time: 12:00

Location:	Near rebar on west side of lake. Water surface elevation taken near sample point #4							
Survey objective:	Lake water elevation survey				Weather Observations:			
Instrument Type:	Leica NA 720	Instrument ID:	5482332 (GWS owned)		-20 F, clear, 5 mph SW winds			
Rod Type:	Craine fiberglass 20'	Rod ID:						
Bench Mark Information:					Survey Team Names			
Name	Agency Responsible	Elevation (ft)	Latitude (dd-mm.mmm)	Longitude (ddd-mm.mmm)		Daniel Reichardt, Chad Cormack		
B	nr	54.98	na	na				
<b>Station</b>	<b>BS (ft)</b>	<b>HI (ft)</b>	<b>FS (ft)</b>	<b>Elevation (fasl)</b>	<b>Distance (ft)</b>	<b>Horizontal Angle</b>	<b>Vertical Angle</b>	<b>Remarks</b>
B	3.95	58.93		54.98				rebar survey control
C		58.93	3.00	55.93				rebar survey control
E		58.93	2.59	56.34				rebar survey control
Water surface		58.93	7.10	51.83				WL-L9817, #4
SH-WL		58.93	7.09	51.84				WL-L9817, #SH
								Turn point, moved instrument.
SH-WL	7.31	59.14		51.84				WL-L9817, #SH
Water surface		59.14	7.30	<b>51.84</b>				WL-L9817, #4
E		59.14	2.80	56.35				rebar survey control
C		59.14	3.19	55.95				rebar survey control
B		59.14	4.14	55.00				Survey closes within +0.02'

Note: Survey control rebar points A, D were not found, Lathe missing

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

**University of Alaska Fairbanks, Water and Environmental Research Center**

**Form F-011: Elevation Survey Form**

Project ID: North Slope Lakes Site Location/Lake ID: KDA 1,2,3  
 Survey Purpose: Water-Level Elevations Date: 3/14/2008 Time: 13:45

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: -30°F, sunny, 5mph south wind				
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, Michael Lilly		
BM1	BP	19.32	na	na				
<b>Station</b>	<b>BS (ft)</b>	<b>HI (ft)</b>	<b>FS (ft)</b>	<b>Elevation (fasi)</b>	<b>Distance (ft)</b>	<b>Horizontal Angle</b>	<b>Vertical Angle</b>	<b>Remarks</b>
BM1	0.64	19.96		19.32				
KDA3-SH		19.96	14.13	5.84				
KDA2-SH		19.96	14.52	5.45				
KDA2-ICE		19.96	13.22	6.75				
Turn on KDA2-Ice. Move to Inst.2								
KDA2-ICE	13.15	19.90		6.75				
KDA2-SH		19.90	14.45	<b>5.45</b>				<b>KDA2 WL=5.45'</b>
KDA3-SH		19.90	14.06	<b>5.84</b>				<b>KDA3 WL=5.84'</b>
BM1		19.90	0.58	19.32				close survey to 0.00
Move to Inst.3								
KDA2-SH'	9.05	14.50		5.45				
KDA1-SH		14.50	6.40	<b>8.10</b>				<b>KDA1 WL=8.10</b>
KDA1-ICE		14.50	6.04	8.46				
Turn on KDA3-ICE. Move to Inst.4								
KDA1-ICE	5.90	14.36		8.46				
KDA1-SH		14.36	6.27	8.09				
KDA2-SH'		14.36	8.90	5.46				close survey to 0.01

Note:

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

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

Project ID: North Slope Lakes Site Location/Lake ID: Mine Site B  
 Survey Purpose: Water-Level Elevations Date: 3/15/2008 Time: 14:00

Location:	Mine Site B aka 6 mile Lake							
Survey objective:	Determine lake water elevation in North and South Cells					Weather Observations:		
Instrument Type:	Leica NA720	Instrument ID:	5482372 (GWS owned)		-20°F, 5 mph wind, clear			
Rod Type:	Craine fiberglass 20'	Rod ID:	GWS owned					
Bench Mark Information:					Survey Team Names			
Name	Agency Responsible	Elevation (ft)	Latitude (dd-mm.mmm)	Longitude (ddd-mm.mmm)	Cormack, Lilly			
TBM_1	nr	100.00 Arbitrary	N70°19.308'	W149°23.882'				
<b>Station</b>	<b>BS (ft)</b>	<b>HI (ft)</b>	<b>FS (ft)</b>	<b>Elevation (fasl)</b>	<b>Distance (ft)</b>	<b>Horizontal Angle</b>	<b>Vertical Angle</b>	<b>Remarks</b>
TBM_1	4.70	104.70		100.00				
MSBN-SH		104.70	11.29	<b>93.42</b>				<b>WL MSBN=93.42'</b>
TBM 2		104.70	0.91	103.79				
TBM 3		104.70	1.29	103.41				
TBM 4		104.70	10.47	94.23				
Move instrument to ^2, turn on TBM 4								
TBM 4	10.49	104.72		94.23				
TBM 3		104.72	11.29	93.43				
TBM 2		104.72	1.25	103.47				
MSBN-SH		<del>104.72</del>	<del>0.87</del>	<del>103.85</del>				discard bad foresight
TBM_1		104.72	4.70	100.02				Survey leg closes within ±0.02
Move instrument to ^3 on island, turn on MSBN Water Level								
MSBN-NC-WL	9.55	102.98		93.43				
MSBN-SC-WL		102.98	8.90	94.08				
MSBS-SC-TP		102.98	8.40	<b>94.58</b>				<b>WL MSBS=94.58'</b>
Move instrument to ^4, turn on MSBS-SH. Water Surface has frozen in hole.								
MSBN-NC-WL	7.93	102.50		94.58				
MSBN-SC-WL		102.50	8.43	94.07				
MSBS-SC-TP		102.50	9.09	93.42				Survey leg closes within ±0.01

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



## **APPENDIX D. SNOW SURVEY FORMS**

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

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

Project ID: North Slope Lakes Site Location/Lake ID: L9312-WxStation  
 Survey Purpose: Determine snow water equivalent Date: 3/11/2008 Time: 12:15

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:	-5°F, Windy. Clear
Latitude:	N70°20.019'	Longitude:	W150°57.134'	Datum:	NAD83
Elevation:	Approximately 10 ft	Elevation Datum:	BPMSL	Reference Markers:	Orange snow poles
Drainage Basin:	Lake L9312	Slope Direction:	East	Vegetation Type:	Tussuck tundra
Slope Angle:	2°	Access Notes:		Other:	
Snow Depth Probe Type:	T-handle probe			Snow-Survey Team Names	
Snow Tube Type:	Arinodack snow tube			Chad Cormack, Horacio Toniolo	

**Snow Course Depths, in cm.**

	1	2	3	4	5
1	59.0	29.0	32.0	22.0	22.0
2	36.0	20.0	50.0	31.0	20.0
3	20.0	16.0	8.0	32.0	16.0
4	17.0	28.0	12.0	28.0	18.0
5	39.0	47.0	13.0	16.0	42.0
6	48.0	50.0	15.0	16.0	20.0
7	50.0	54.0	16.0	17.0	15.0
8	50.0	72.0	18.0	15.0	18.0
9	47.0	57.0	20.0	20.0	20.0
10	38.0	46.0	33.0	21.0	18.0

(cm)  
 Average snow depth = 29.3  
 Maximum snow depth = 72.0  
 Minimum snow depth = 8.0  
 Standard variation = 15.4

**Snow Sample Depths and Weights**

Bag #	Depth (cm)	Weight (gr)	Volume (cm <sup>3</sup> )	Density (gr/cm <sup>3</sup> )
A1	20.32	166.8	725.4	0.23
F1	48.26	499.4	1722.9	0.29
A5	17.78	200.9	634.7	0.32
A3	38.1	460.9	1360.2	0.34
F2	50.8	593.7	1813.6	0.33

Average Density = 0.30  
 Average Snow Water Equivalent (SWE) = 8.8 cm H2O  
 Average Snow Water Equivalent = 3.47 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: L9312\_Raft\_B  
 Survey Purpose: Determine snow water equivalent Date: 3/11/2008 Time: 13:30

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

**Snow Course Depths, in cm.**

	1	2	3	4	5
1	15.0	6.0	6.0	8.0	7.0
2	19.0	5.0	9.0	14.0	12.0
3	13.0	5.0	14.0	15.0	13.0
4	10.0	3.0	15.0	9.0	17.0
5	10.0	4.0	13.0	8.0	10.0
6	7.0	6.0	16.0	7.0	10.0
7	7.0	7.0	13.0	16.0	19.0
8	9.0	7.0	7.0	22.0	12.0
9	7.0	6.0	10.0	10.0	27.0
10	6.0	7.0	7.0	17.0	11.0

(cm)

Average snow depth = 10.7  
 Maximum snow depth = 27.0  
 Minimum snow depth = 3.0  
 Standard variation = 5.0

**Snow Sample Depths and Weights**

Bag #	Depth (cm)	Weight (gr)	Volume (cm <sup>3</sup> )	Density (gr/cm <sup>3</sup> )
H5	15.24	225.4	544.1	0.41
H4	10.16	135.9	362.7	0.37
H3	7.62	119.5	272.0	0.44
H2	17.78	240.8	634.7	0.38
H1	20.32	291.9	725.4	0.40

Average Density = 0.40  
 Average Snow Water Equivalent (SWE) = 4.3 cm H2O  
 Average Snow Water Equivalent = 1.69 inches H2O  
 Average Snow Water Equivalent = 0.14 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\_Sno1  
 Survey Purpose: Determine snow water equivalent Date: 3/11/2008 Time: 16:00

Location Description:	Started 5 meters north of L9312. Travelled 25 meters northerly towards East. Turned left 90° and travelled 25 meters South				
Survey objective:	Determine Snow Water Equivalent			Weather Observations:	-5°F, Windy, Clear
Latitude:	N 70° 19.995'	Longitude:	W 150° 56.918'	Datum:	NAD 83
Elevation:	7 ft	Elevation Datum:	BPMSL	Reference Markers:	Raft B is marked with lathe
Drainage Basin:	Lake L9312	Slope Direction:	Flat	Vegetation Type:	Ice
Slope Angle:	Flat	Access Notes:	Snowmobile	Other:	
Snow Depth Probe Type:	T-handle probe			Snow-Survey Team Names	
Snow Tube Type:	Arinodack snow tube			Chad Cormack, Horacio Toniolo	

**Snow Course Depths, in cm.**

	1	2	3	4	5
1	39.0	31.0	18.0	37.0	27.0
2	51.0	31.0	20.0	42.0	14.0
3	26.0	23.0	22.0	40.0	17.0
4	35.0	17.0	11.0	36.0	17.0
5	32.0	11.0	17.0	25.0	15.0
6	22.0	37.0	15.0	16.0	17.0
7	29.0	30.0	22.0	21.0	14.0
8	30.0	24.0	61.0	18.0	26.0
9	26.0	29.0	29.0	13.0	31.0
10	38.0	30.0	25.0	32.0	16.0

(cm)  
 Average snow depth = 26.1  
 Maximum snow depth = 61.0  
 Minimum snow depth = 11.0  
 Standard variation = 10.4

**Snow Sample Depths and Weights**

Bag #	Depth (cm)	Weight (gr)	Volume (cm <sup>3</sup> )	Density (gr/cm <sup>3</sup> )
Rover 1	35.56	422.5	1269.5	0.33
Yip 2	25.4	266.4	906.8	0.29
K2	30.48	368.2	1088.1	0.34
#1	45.72	516.1	1632.2	0.32
T2	21.59	177.9	770.8	0.23

Average Density = 0.30  
 Average Snow Water Equivalent (SWE) = 7.9 cm H2O  
 Average Snow Water Equivalent = 3.11 inches H2O  
 Average Snow Water Equivalent = 0.26 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-Tundra  
 Survey Purpose: Determine snow water equivalent Date: 3/12/2008 Time: nr

Location Description:	South side of lake done on tundra. Did "L" shape, started at South by shore and went West 25 x 25m for 1m increments				
Survey objective:	Snow depths and snow-water content for comparison with lake snow survey	Weather Observations:		clear, sunny 20F, 5mph SW wind	
Latitude:	N 70° 16.832	Longitude:	W 148° 53.856	Datum:	NAD83 Alaska
Elevation:	54.98	Elevation Datum:	BPMSL	Reference Markers:	Site staked with lathe
Drainage Basin:	L9312	Slope Direction:	Flat	Vegetation Type:	Tussock
Slope Angle:	Flat	Access Notes:	Hagglund	Other:	1 meter increments
Snow Depth Probe Type:	T-handle probe			Snow-Survey Team Names	
Snow Tube Type:	Arinodack snow tube			Chad Cormack, Dan Reichardt	

Snow Course Depths, in cm.

	1	2	3	4	5
1	36.0	29.0	22.0	33.0	24.0
2	28.0	34.0	29.0	24.0	19.0
3	23.0	50.0	27.0	21.0	21.0
4	27.0	52.0	24.0	25.0	17.0
5	24.0	17.0	32.0	24.0	23.0
6	17.0	23.0	25.0	23.0	23.0
7	21.0	17.0	27.0	21.0	29.0
8	18.0	19.0	23.0	21.0	38.0
9	23.0	20.0	20.0	30.0	39.0
10	19.0	16.0	21.0	26.0	28.0

(cm)  
 Average snow depth = 25.4  
 Maximum snow depth = 52.0  
 Minimum snow depth = 16.0  
 Standard variation = 7.6

Snow Sample Depths and Weights

Bag #	Depth (cm)	Weight (gr)	Volume (cm <sup>3</sup> )	Density (gr/cm <sup>3</sup> )
A1	22	163.3	785.4	0.21
A5	18	142.7	642.6	0.22
A3	34	232.6	1213.8	0.19
F1	16	99.1	571.2	0.17
T3	20	126.4	714.0	0.18

Average Density = 0.19  
 Average Snow Water Equivalent (SWE) = 4.9 cm H2O  
 Average Snow Water Equivalent = 1.95 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: L9817-Lake  
 Survey Purpose: Determine snow water equivalent Date: 3/12/2008 Time: nr

Location Description:	Conducted on lake. L-shaped, 25 m by 25 m. Measurements took every 1 meter.				
Survey objective:	Snow depths and snow-water content for comparison with lake snow survey	Weather Observations:	clear, sunny 20F, 5mph SW wind		
Latitude:	N 70° 19.995'	Longitude:	W 150° 56.918'	Datum:	NAD 83
Elevation:	nr	Elevation Datum:	nr	Reference Markers:	Lathe # 1 on lake
Drainage Basin:		Slope Direction:	Flat	Vegetation Type:	Tussock
Slope Angle:	Flat	Access Notes:	Hagglund	Other:	1 meter increments
Snow Depth Probe Type:	T-handle probe			Snow-Survey Team Names	
Snow Tube Type:	Arinodack snow tube			Chad Cormack, Dan Reichardt	

Snow Course Depths, in cm.

	1	2	3	4	5
1	10.0	23.0	7.0	10.0	11.0
2	6.0	14.0	2.0	13.0	13.0
3	5.0	10.0	4.0	13.0	9.0
4	3.0	10.0	6.0	7.0	6.0
5	4.0	13.0	1.0	3.0	17.0
6	5.0	15.0	2.0	3.0	11.0
7	4.0	10.0	4.0	5.0	6.0
8	6.0	10.0	2.0	5.0	7.0
9	12.0	10.0	8.0	8.0	7.0
10	10.0	9.0	2.0	13.0	5.0

(cm)  
 Average snow depth = 8.0  
 Maximum snow depth = 23.0  
 Minimum snow depth = 1.0  
 Standard variation = 4.5

Snow Sample Depths and Weights

Bag #	Depth (cm)	Weight (gr)	Volume (cm <sup>3</sup> )	Density (gr/cm <sup>3</sup> )
1	6	64.3	214.2	0.30
T2	12	129.0	428.4	0.30
Rover 1	10	115.7	357.0	0.32
Yip 2	8	93.4	285.6	0.33

Average Density = 0.31  
 Average Snow Water Equivalent (SWE) = 2.5 cm H<sub>2</sub>O  
 Average Snow Water Equivalent = 0.98 inches H<sub>2</sub>O  
 Average Snow Water Equivalent = 0.08 feet H<sub>2</sub>O

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: 3/14/2008 Time: 13:00

Location Description:	At KDA2-CT snow course bears North 25 meters, then West 25 meters.				
Survey objective:	Determine Snow Water Equivalent			Weather Observations:	-35°F, 5 mph wind, clear
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			Chad Cormack, Horacio Toniolo	

**Snow Course Depths, in cm.**

	1	2	3	4	5
1	4.0	0.0	2.0	0.0	0.0
2	0.0	1.0	0.0	0.0	0.0
3	0.0	1.0	0.0	0.0	0.0
4	2.0	2.0	0.0	0.0	0.0
5	0.0	2.0	0.0	1.0	0.0
6	0.0	6.0	0.0	1.0	0.0
7	0.0	3.0	0.0	0.0	0.0
8	1.0	3.0	0.0	0.0	0.0
9	0.0	2.0	0.0	0.0	0.0
10	0.0	2.0	0.0	0.0	0.0

(cm)  
 Average snow depth = 0.7  
 Maximum snow depth = 6.0  
 Minimum snow depth = 0.0  
 Standard variation = 1.3

**Snow Sample Depths and Weights**

Bag #	Depth (cm)	Weight (gr)	Volume (cm <sup>3</sup> )	Density (gr/cm <sup>3</sup> )
*Not enough Snow for Densities				

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-CT  
 Survey Purpose: Determine snow water equivalent Date: 3/15/2008 Time: 11:15

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

**Snow Course Depths, in cm.**

	1	2	3	4	5
0	0.0	3.0	6.5	3.0	6.0
0	0.0	1.0	7.0	1.0	1.0
0	0.0	1.0	9.0	1.0	0.0
0	0.0	1.0	11.0	3.0	0.0
1	1.0	2.0	11.0	5.0	0.0
1	1.0	2.5	11.5	3.0	0.5
3	3.0	5.0	13.0	2.0	0.5
3	3.0	4.0	12.5	11.0	0.5
2	2.0	1.0	9.0	14.5	8.0
3	3.0	2.5	4.0	5.0	11.5

(cm)  
 Average snow depth = 4.1  
 Maximum snow depth = 14.5  
 Minimum snow depth = 0.0  
 Standard variation = 4.2

**Snow Sample Depths and Weights**

Bag #	Depth (cm)	Weight (gr)	Volume (cm <sup>3</sup> )	Density (gr/cm <sup>3</sup> )
1A	2.5	36.3	89.3	0.41
3E	4	46.2	142.8	0.32
5C	14	155.6	499.8	0.31
7C	5	56.3	178.5	0.32
Rondy 5	14	196.7	499.8	0.39

Average Density = 0.35  
 Average Snow Water Equivalent (SWE) = 1.4 cm H2O  
 Average Snow Water Equivalent = 0.57 inches H2O  
 Average Snow Water Equivalent = 0.05 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: 3/15/2008 Time: 12:00

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

**Snow Course Depths, in cm.**

	1	2	3	4	5
1	36.0	48.5	33.0	23.0	10.0
2	37.0	46.0	32.0	19.0	10.5
3	36.5	38.0	25.0	21.0	20.0
4	22.5	41.0	20.0	23.0	19.5
5	19.0	41.0	23.0	36.5	22.5
6	21.0	43.0	15.0	33.0	16.0
7	25.0	39.5	22.0	28.5	15.0
8	41.0	40.0	23.5	26.0	13.0
9	42.0	36.0	28.0	11.5	8.0
10	44.0	39.5	33.0	13.5	30.0

(cm)

Average snow depth = 27.8  
 Maximum snow depth = 48.5  
 Minimum snow depth = 8.0  
 Standard variation = 10.9

**Snow Sample Depths and Weights**

Bag #	Depth (cm)	Weight (gr)	Volume (cm <sup>3</sup> )	Density (gr/cm <sup>3</sup> )
7B	30.5	417.3	1088.9	0.38
5B	25	236.1	892.5	0.26
1E	28	280.2	999.6	0.28
3D	25	193.9	892.5	0.22
13D	24		856.8	

Average Density = 0.29  
 Average Snow Water Equivalent (SWE) = 8.0 cm H2O  
 Average Snow Water Equivalent = 3.14 inches H2O  
 Average Snow Water Equivalent = 0.26 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: 3/15/2008 Time: 15:00

Location Description:	Approximately 30 feet from Wyoming Gage. Marked with lathe and rebar				
Survey objective:	Determine Snow Water Equivalent			Weather Observations:	-20°F, 5 mph wind, clear
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			Chad Cormack, Greta Myerchin	

**Snow Course Depths, in cm.**

	1	2	3	4	5
1	54.0	21.0	38.0	6.0	30.0
2	49.0	16.0	33.0	7.0	33.0
3	29.0	17.0	27.0	7.0	25.0
4	8.0	19.0	22.0	11.0	41.0
5	17.0	13.0	17.0	19.0	36.0
6	22.0	12.0	7.0	21.0	43.0
7	17.0	22.0	12.0	15.0	24.0
8	21.0	18.0	12.0	27.0	19.0
9	13.0	31.0	10.0	53.0	13.0
10	9.0	25.0	13.0	35.0	8.0

(cm)  
 Average snow depth = 21.9  
 Maximum snow depth = 54.0  
 Minimum snow depth = 6.0  
 Standard variation = 12.2

**Snow Sample Depths and Weights**

Bag #	Depth (cm)	Weight (gr)	Volume (cm <sup>3</sup> )	Density (gr/cm <sup>3</sup> )
H1	30	315.1	1071.0	0.29
H2	22	Torn Bag	785.4	
H3	18	250.9	642.6	0.39
H4	22	330.4	785.4	0.42
H5	32	372.2	1142.4	0.33

Average Density = 0.36  
 Average Snow Water Equivalent (SWE) = 7.8 cm H2O  
 Average Snow Water Equivalent = 3.09 inches H2O  
 Average Snow Water Equivalent = 0.26 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: Mile 1  
 Survey Purpose: Determine snow water equivalent Date: 3/13/2008 Time: 16:00

Location Description:	Upwind side of Ice Road				
Survey objective:	Determine Snow Water Equivalent			Weather Observations:	-20°F, 5 mph wind, clear
Latitude:	nr	Longitude:	nr	Datum:	nr
Elevation:	Approximately 10 ft	Elevation Datum:	BPMSL	Reference Markers:	Mile 1
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			Chad Cormack, Greta Myerchin	

Snow Course Depths, in cm.

	1	2	3	4	5
1	32.0	20.0	21.0	26.0	21.0
2	28.0	27.0	19.0	22.0	25.0
3	22.0	23.0	23.0	23.0	28.0
4	27.0	24.0	21.0	27.0	37.0
5	15.0	19.0	26.0	25.0	27.0
6	26.0	24.0	23.0	29.0	32.0
7	34.0	23.0	26.0	28.0	29.0
8	29.0	17.0	27.0	21.0	27.0
9	29.0	17.0	22.0	25.0	26.0
10	29.0	22.0	29.0	27.0	24.0

(cm)  
 Average snow depth = 25.1  
 Maximum snow depth = 37.0  
 Minimum snow depth = 15.0  
 Standard variation = 4.3

Snow Sample Depths and Weights

Bag #	Depth (cm)	Weight (gr)	Volume (cm <sup>3</sup> )	Density (gr/cm <sup>3</sup> )
1A	17	155.6	606.9	0.26
1B	22	175.9	785.4	0.22
1C	19	158.5	678.3	0.23
1D	22	160.3	785.4	0.20
1E	25	245.0	892.5	0.27

Average Density = 0.24  
 Average Snow Water Equivalent (SWE) = 6.0 cm H2O  
 Average Snow Water Equivalent = 2.35 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: Mile 3  
 Survey Purpose: Determine snow water equivalent Date: 3/13/2008 Time: 16:00

Location Description:	Upwind side of Ice Road				
Survey objective:	Determine Snow Water Equivalent			Weather Observations:	-20°F, 5 mph wind, clear
Latitude:	nr	Longitude:	nr	Datum:	nr
Elevation:	Approximately 10 ft	Elevation Datum:	BPMSL	Reference Markers:	Mile 11
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			Chad Cormack, Horacio Toniolo	

Snow Course Depths, in cm.

	1	2	3	4	5
1	26.0	39.0	34.0	30.0	27.0
2	26.0	37.0	29.0	27.0	27.0
3	21.0	22.0	36.0	22.0	20.0
4	32.0	29.0	35.0	28.0	20.0
5	52.0	27.0	35.0	27.0	18.0
6	45.0	22.0	28.0	26.0	18.0
7	29.0	29.0	29.0	34.0	21.0
8	28.0	47.0	36.0	33.0	27.0
9	33.0	44.0	26.0	30.0	30.0
10	36.0	37.0	25.0	29.0	33.0

(cm)  
 Average snow depth = 30.0  
 Maximum snow depth = 52.0  
 Minimum snow depth = 18.0  
 Standard variation = 7.3

Snow Sample Depths and Weights

Bag #	Depth (cm)	Weight (gr)	Volume (cm <sup>3</sup> )	Density (gr/cm <sup>3</sup> )
3A	14	90.6	499.8	0.18
3B	26	190.3	928.2	0.21
3C	27.5	195.9	981.8	0.20
3D	23	174.7	821.1	0.21
3E	18	163.6	642.6	0.25

Average Density = 0.21  
 Average Snow Water Equivalent (SWE) = 6.3 cm H2O  
 Average Snow Water Equivalent = 2.49 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: Mile 5  
 Survey Purpose: Determine snow water equivalent Date: 3/13/2008 Time: 16:00

Location Description:	Upwind side of Ice Road				
Survey objective:	Determine Snow Water Equivalent			Weather Observations:	-20°F, 5 mph wind, clear
Latitude:	nr	Longitude:	nr	Datum:	nr
Elevation:	Approximately 10 ft	Elevation Datum:	BPMSL	Reference Markers:	Mile 5
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			Chad Cormack, Greta Myerchin	

**Snow Course Depths, in cm.**

	1	2	3	4	5
1	22.0	30.0	21.0	23.0	22.0
2	29.0	31.0	26.0	35.0	23.0
3	25.0	31.0	18.0	22.0	24.0
4	29.0	29.0	18.0	22.0	19.0
5	33.0	39.0	23.0	31.0	19.0
6	38.0	33.0	27.0	28.0	20.0
7	40.0	40.0	29.0	24.0	16.0
8	37.0	32.0	32.0	28.0	14.0
9	28.0	31.0	31.0	25.0	16.0
10	20.0	34.0	25.0	21.0	23.0

(cm)  
 Average snow depth = 26.7  
 Maximum snow depth = 40.0  
 Minimum snow depth = 14.0  
 Standard variation = 6.6

**Snow Sample Depths and Weights**

Bag #	Depth (cm)	Weight (gr)	Volume (cm <sup>3</sup> )	Density (gr/cm <sup>3</sup> )
5A	17	128.2	606.9	0.21
5B	29	293.9	1035.3	0.28
5C	29	279.5	1035.3	0.27
5D	28	316.7	999.6	0.32
5E				

Average Density = 0.27  
 Average Snow Water Equivalent (SWE) = 7.2 cm H2O  
 Average Snow Water Equivalent = 2.85 inches H2O  
 Average Snow Water Equivalent = 0.24 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: Mile 7 - Oblidiwok Station  
 Survey Purpose: Determine snow water equivalent Date: 3/13/2008 Time: 16:00

Location Description:	Oblidiwok Weather Station				
Survey objective:	Determine Snow Water Equivalent			Weather Observations:	-20°F, 5 mph wind, clear
Latitude:	nr	Longitude:	nr	Datum:	nr
Elevation:	Approximately 10 ft	Elevation Datum:	BPMSL	Reference Markers:	Oblidiwok Weather Station
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			Chad Cormack, Greta Myerchin	

**Snow Course Depths, in cm.**

	1	2	3	4	5
1	24.0	18.0	16.0	14.0	24.0
2	33.0	29.0	15.0	33.0	21.0
3	18.0	16.0	17.0	42.0	16.0
4	23.0	15.0	21.0	46.0	10.0
5	31.0	16.0	14.0	48.0	10.0
6	38.0	29.0	17.0	40.0	9.0
7	42.0	39.0	22.0	43.0	7.0
8	39.0	43.0	9.0	34.0	9.0
9	24.0	33.0	15.0	35.0	10.0
10	23.0	26.0	25.0	27.0	10.0

(cm)  
 Average snow depth = 24.4  
 Maximum snow depth = 48.0  
 Minimum snow depth = 7.0  
 Standard variation = 11.6

**Snow Sample Depths and Weights**

Bag #	Depth (cm)	Weight (gr)	Volume (cm <sup>3</sup> )	Density (gr/cm <sup>3</sup> )
7A	17	144.0	606.9	0.24
7B	18	167.6	642.6	0.26
7C	19	135.6	678.3	0.20
7D	46	522.6	1642.2	0.32
7E	7	51.7	249.9	0.21

Average Density = 0.24  
 Average Snow Water Equivalent (SWE) = 6.0 cm H2O  
 Average Snow Water Equivalent = 2.35 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: Mile 11  
 Survey Purpose: Determine snow water equivalent Date: 3/12/2008 Time: 16:00

Location Description:	Upwind side of Ice Road				
Survey objective:	Determine Snow Water Equivalent			Weather Observations:	-20°F, 5 mph wind, clear
Latitude:	nr	Longitude:	nr	Datum:	nr
Elevation:	Approximately 10 ft	Elevation Datum:	BPMSL	Reference Markers:	Mile 11
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			Chad Cormack, Horacio Toniolo	

Snow Course Depths, in cm.

	1	2	3	4	5
1	47.0	26.0	46.0	47.0	37.0
2	40.0	35.0	33.0	40.0	30.0
3	32.0	33.0	41.0	40.0	36.0
4	38.0	44.0	48.0	51.0	33.0
5	25.0	36.0	46.0	48.0	38.0
6	31.0	38.0	48.0	44.0	36.0
7	25.0	37.0	47.0	53.0	34.0
8	25.0	50.0	44.0	44.0	30.0
9	36.0	46.0	46.0	40.0	26.0
10	21.0	45.0	45.0	41.0	39.0

(cm)  
 Average snow depth = 38.8  
 Maximum snow depth = 53.0  
 Minimum snow depth = 21.0  
 Standard variation = 7.8

Snow Sample Depths and Weights

Bag #	Depth (cm)	Weight (gr)	Volume (cm <sup>3</sup> )	Density (gr/cm <sup>3</sup> )
11A	38	315.2	1356.6	0.23
11B	24	201.3	856.8	0.23
11C	38	354.4	1356.6	0.26
11D	37	340.0	1320.9	0.26
11E	23.5	204.8	839.0	0.24

Average Density = 0.25  
 Average Snow Water Equivalent (SWE) = 9.6 cm H2O  
 Average Snow Water Equivalent = 3.76 inches H2O  
 Average Snow Water Equivalent = 0.31 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: Mile 13  
 Survey Purpose: Determine snow water equivalent Date: 3/12/2008 Time: 16:00

Location Description:	Upwind side of Ice Road				
Survey objective:	Determine Snow Water Equivalent			Weather Observations:	-20°F, 5 mph wind, clear
Latitude:	nr	Longitude:	nr	Datum:	nr
Elevation:	Approximately 10 ft	Elevation Datum:	BPMSL	Reference Markers:	Mile 13
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			Chad Cormack, Horacio Toniolo	

**Snow Course Depths, in cm.**

	1	2	3	4	5
1	40.0	31.0	22.0	35.0	65.0
2	40.0	29.0	16.0	37.0	74.0
3	33.0	45.0	36.0	38.0	71.0
4	33.0	28.0	18.0	33.0	68.0
5	29.0	43.0	22.0	24.0	62.0
6	29.0	41.0	26.0	49.0	58.0
7	32.0	36.0	12.0	45.0	55.0
8	39.0	46.0	18.0	47.0	53.0
9	43.0	36.0	22.0	62.0	48.0
10	38.0	15.0	33.0	64.0	49.0

(cm)  
 Average snow depth = 39.4  
 Maximum snow depth = 74.0  
 Minimum snow depth = 12.0  
 Standard variation = 15.3

**Snow Sample Depths and Weights**

Bag #	Depth (cm)	Weight (gr)	Volume (cm <sup>3</sup> )	Density (gr/cm <sup>3</sup> )
13A	40	333.8	1428.0	0.23
13B	29.5	241.5	1053.2	0.23
13C	26	230	928.2	0.25
13D	35	339.3	1249.5	0.27
13E	46	593.1	1642.2	0.36

Average Density = 0.27  
 Average Snow Water Equivalent (SWE) = 10.6 cm H2O  
 Average Snow Water Equivalent = 4.16 inches H2O  
 Average Snow Water Equivalent = 0.35 feet H2O

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



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

Project ID: North Slope Lakes Site Location/Lake ID: Mile 15  
 Survey Purpose: Determine snow water equivalent Date: 3/12/2008 Time: 16:00

Location Description:	Upwind side of Ice Road				
Survey objective:	Determine Snow Water Equivalent			Weather Observations:	-20°F, 5 mph wind, clear
Latitude:	nr	Longitude:	nr	Datum:	nr
Elevation:	Approximately 10 ft	Elevation Datum:	BPMSL	Reference Markers:	Mile 15
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			Chad Cormack, Horacio Toniolo	

Snow Course Depths, in cm.

	1	2	3	4	5
1	50.0	15.0	43.0	56.0	30.0
2	43.0	26.0	46.0	36.0	38.0
3	44.0	28.0	50.0	35.0	45.0
4	25.0	30.0	49.0	31.0	65.0
5	18.0	33.0	39.0	40.0	71.0
6	79.0	36.0	35.0	50.0	57.0
7	45.0	44.0	35.0	47.0	27.0
8	29.0	47.0	43.0	44.0	24.0
9	25.0	43.0	44.0	33.0	25.0
10	18.0	50.0	46.0	27.0	27.0

(cm)  
 Average snow depth = 39.3  
 Maximum snow depth = 79.0  
 Minimum snow depth = 15.0  
 Standard variation = 13.1

Snow Sample Depths and Weights

Bag #	Depth (cm)	Weight (gr)	Volume (cm <sup>3</sup> )	Density (gr/cm <sup>3</sup> )
15A	50	535.4	1785.0	0.30
15B	12	209.2	428.4	0.49
15C	21	220.5	749.7	0.29
15D	21	156.6	749.7	0.21
15E	32	325.9	1142.4	0.29

Average Density = 0.32  
 Average Snow Water Equivalent (SWE) = 12.4 cm H2O  
 Average Snow Water Equivalent = 4.88 inches H2O  
 Average Snow Water Equivalent = 0.41 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: Mile 17  
 Survey Purpose: Determine snow water equivalent Date: 3/12/2008 Time: 16:00

Location Description:	Upwind side of Ice Road				
Survey objective:	Determine Snow Water Equivalent			Weather Observations:	-20°F, 5 mph wind, clear
Latitude:	nr	Longitude:	nr	Datum:	nr
Elevation:	Approximately 10 ft	Elevation Datum:	BPMSL	Reference Markers:	Mile 17
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			Chad Cormack, Horacio Toniolo	

Snow Course Depths, in cm.

	1	2	3	4	5
1	38.0	40.0	9.0	37.0	23.0
2	31.0	27.0	22.0	30.0	26.0
3	30.0	21.0	23.0	18.0	38.0
4	23.0	13.0	26.0	41.0	34.0
5	24.0	20.0	37.0	34.0	40.0
6	30.0	17.0	41.0	33.0	28.0
7	35.0	20.0	29.0	21.0	39.0
8	47.0	20.0	31.0	13.0	29.0
9	50.0	22.0	37.0	16.0	36.0
10	23.0	22.0	48.0	18.0	51.0

(cm)  
 Average snow depth = 29.2  
 Maximum snow depth = 51.0  
 Minimum snow depth = 9.0  
 Standard variation = 10.0

Snow Sample Depths and Weights

Bag #	Depth (cm)	Weight (gr)	Volume (cm <sup>3</sup> )	Density (gr/cm <sup>3</sup> )
17A	19	128.4	678.3	0.19
17B	24.5	203.2	874.7	0.23
17C	28	227.7	999.6	0.23
17D	29.5	238.3	1053.2	0.23
17E	29	240.5	1035.3	0.23

Average Density = 0.22  
 Average Snow Water Equivalent (SWE) = 6.5 cm H2O  
 Average Snow Water Equivalent = 2.55 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: Mile 19  
 Survey Purpose: Determine snow water equivalent Date: 3/12/2008 Time: 16:00

Location Description:	Upwind side of Ice Road				
Survey objective:	Determine Snow Water Equivalent			Weather Observations:	-20°F, 5 mph wind, clear
Latitude:	nr	Longitude:	nr	Datum:	nr
Elevation:	Approximately 10 ft	Elevation Datum:	BPMSL	Reference Markers:	Mile 19
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			Chad Cormack, Horacio Toniolo	

Snow Course Depths, in cm.

	1	2	3	4	5
1	36.0	55.0	54.0	46.0	45.0
2	40.0	48.0	61.0	45.0	41.0
3	41.0	57.0	61.0	38.0	37.0
4	48.0	55.0	62.0	36.0	60.0
5	53.0	61.0	60.0	50.0	78.0
6	54.0	53.0	63.0	57.0	55.0
7	53.0	55.0	54.0	48.0	44.0
8	51.0	58.0	53.0	48.0	47.0
9	47.0	52.0	56.0	44.0	51.0
10	69.0	55.0	52.0	44.0	40.0

(cm)  
 Average snow depth = 51.4  
 Maximum snow depth = 78.0  
 Minimum snow depth = 36.0  
 Standard variation = 8.6

Snow Sample Depths and Weights

Bag #	Depth (cm)	Weight (gr)	Volume (cm <sup>3</sup> )	Density (gr/cm <sup>3</sup> )
19A	42	414.3	1499.4	0.28
19B	55	668.8	1963.5	0.34
19C	63.5	681.8	2267.0	0.30
19D	56	530.4	1999.2	0.27
19E	49	533.9	1749.3	0.31

Average Density = 0.30  
 Average Snow Water Equivalent (SWE) = 15.3 cm H2O  
 Average Snow Water Equivalent = 6.03 inches H2O  
 Average Snow Water Equivalent = 0.50 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: Mile 20+ Rendezvous  
 Survey Purpose: Determine snow water equivalent Date: 3/12/2008 Time: 16:00

Location Description:	Upwind side of Ice Road				
Survey objective:	Determine Snow Water Equivalent			Weather Observations:	-20°F, 5 mph wind, clear
Latitude:	nr	Longitude:	nr	Datum:	nr
Elevation:	Approximately 10 ft	Elevation Datum:	BPMSL	Reference Markers:	Mile 20
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			Chad Cormack, Horacio Toniolo	

Snow Course Depths, in cm.

	1	2	3	4	5
1	52.0	31.0	37.0	34.0	39.0
2	40.0	34.0	26.0	46.0	20.0
3	27.0	24.0	20.0	44.0	21.0
4	27.0	31.0	30.0	44.0	22.0
5	39.0	35.0	24.0	45.0	14.0
6	41.0	34.0	50.0	44.0	26.0
7	38.0	40.0	51.0	43.0	21.0
8	37.0	49.0	37.0	50.0	18.0
9	33.0	37.0	29.0	47.0	33.0
10	46.0	52.0	29.0	21.0	36.0

(cm)  
 Average snow depth = 35.0  
 Maximum snow depth = 52.0  
 Minimum snow depth = 14.0  
 Standard variation = 10.1

Snow Sample Depths and Weights

Bag #	Depth (cm)	Weight (gr)	Volume (cm <sup>3</sup> )	Density (gr/cm <sup>3</sup> )
R1	36.8	340.6	1313.8	0.26
R2	40	305.1	1428.0	0.21
R3	50	471.8	1785.0	0.26
R4	46.2	453.7	1649.3	0.28
R5	33	290.4	1178.1	0.25

Average Density = 0.25  
 Average Snow Water Equivalent (SWE) = 8.8 cm H2O  
 Average Snow Water Equivalent = 3.47 inches H2O  
 Average Snow Water Equivalent = 0.29 feet H2O

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