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

Gathering snow depths at L9312-Alpine, Photo by D. Reichardt.

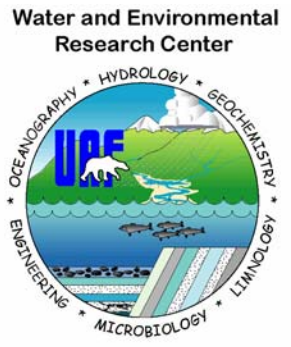
by

Jeff Derry, Dan Reichardt, Michael Lilly, and Amanda Blackburn

January 2007

North Slope Lakes Hydrologic Project

Report No. INE/WERC 07.04



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A report on research sponsored by:

- U.S. Department of Energy
- National Energy Technology Laboratory
- BP Exploration (Alaska), Inc.
- Conoco Phillips (Alaska), Inc.
- Bureau of Land Management
- Geo-Watersheds Scientific

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January 2007

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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), Conoco Phillips Alaska, Inc. (CPA), and Geo-Watersheds Scientific (GWS). The contents of the report do not necessarily reflect the views of 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, 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
	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	43560.0	square feet (ft^2)
Acre	0.405	hectare (ha)
square foot (ft^2)	3.587e-8	square mile (mi^2)
square mile (mi^2)	2.590	square kilometer (km^2)
	Volume	
gallon (gal)	3.785	liter (L)
gallon (gal)	3785.412	milliliter (mL)
cubic foot (ft^3)	28.317	liter (L)
Acre-ft	1233.482	cubic meter (m^3)
Acre-ft	325851.43	gallon(gal)
gallon(gal)	0.1337	cubic feet (ft^3)
	Velocity and Discharge	
foot per day (ft/d)	0.3048	meter per day (m/d)
Square foot per day (ft^2/d)	0.0929	square meter per day (m^2/d)
cubic foot per second (ft^3/s)	0.02832	cubic meter per second (m^3/sec)
	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)	0.00116	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 value in cubic meters per second (m^3/s) in parentheses.

Physical and Chemical Water-Quality Units:

Temperature:

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

$$°F = 1.8(°C) + 32$$

Electrical Conductance (Actual Conductivity and Specific Conductance):

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

$$SC25 = \frac{AC}{1 + r(T - 25)}$$

where:

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

AC = Actual Conductivity, in µS/cm

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

T = temperature of the sample, in °C

Milligrams per liter (mg/L) or micrograms per liter (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 (ppm).

Millivolt (mV):

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

Vertical Datum:

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

Horizontal Datum:

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

Abbreviations, Acronyms, and Symbols

AC	Actual conductivity
ADOT&PF	Alaska Department of Transportation and Public Facilities
ASTM	American Society for Testing and Materials
atm	atmospheres
C	Celsius
DO	Dissolved oxygen
DVM	digital voltage multi-meter
e-tape	electric tape
F	Fahrenheit (^{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.
- Conoco Phillips Alaska (CPA)
- Bureau of Land Management
- Alaska Department of Natural Resources
- The Nature Conservancy
- Northern Alaska Environmental Center

ACKNOWLEDGEMENTS

This project was funded by cooperative agreement number DE-FC26_01NT41248, from the U.S. Department of Energy's (DOE) Arctic Energy Office to the University of Alaska Fairbanks Arctic Energy Technology Development Laboratory (AETDL). Field coordination and logistics support were provided by BP Exploration (Alaska) Inc. and Conoco Phillips Alaska. Additional support was provided by other project cooperators, North Slope Borough, Bureau of Land Management (BLM), National Weather Service, and Geo-Watersheds Scientific (GWS), in the form of financial and in-kind match

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

INTRODUCTION

The University of Alaska Fairbanks (UAF) Water and Environmental Research Center (WERC) and Geo-Watersheds Scientific (GWS), together with project cooperators, initiated a study in the Fall of 2002 (Phase One) to obtain baseline information about the physical and chemical characteristics of North Slope tundra lakes. The project was extended in 2005 (Phase Two). The location of study lakes changed and was expanded to include other reservoirs so as to further develop the understanding and simulation tools necessary for water-source management. K113 is an un-pumped lake in the Kuparuk oilfield and is sampled on selected field trips during the year. L9312 is a natural lake studied in the Alpine operations area. L9817 is a natural lake in eastern NPRA, west of Nuiqsut. This lake has been used in previous years for ice-road construction, but was not used during winter 2005-06, nor will be used during the winter of 2006-07. Two reservoir systems (mine sites) were added to the study in 2005. Mine Site B, also known as Six-mile Lake, is located near the Milne Point facility at the intersection of the Spine Road with the Milne Point access road and has two cells connected to Milne Creek. The Kuparuk Reservoir System (Kuparuk Deadarm Lakes) has 9 reservoirs. The three southernmost reservoir cells (1-3) are included in the study to observe ground-water and surface-water interactions between each cells and the adjacent Kuparuk River.

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 purpose of this publication is to 1) report data collected for the month of December 2006, 2) summarize accomplished field trip objectives.

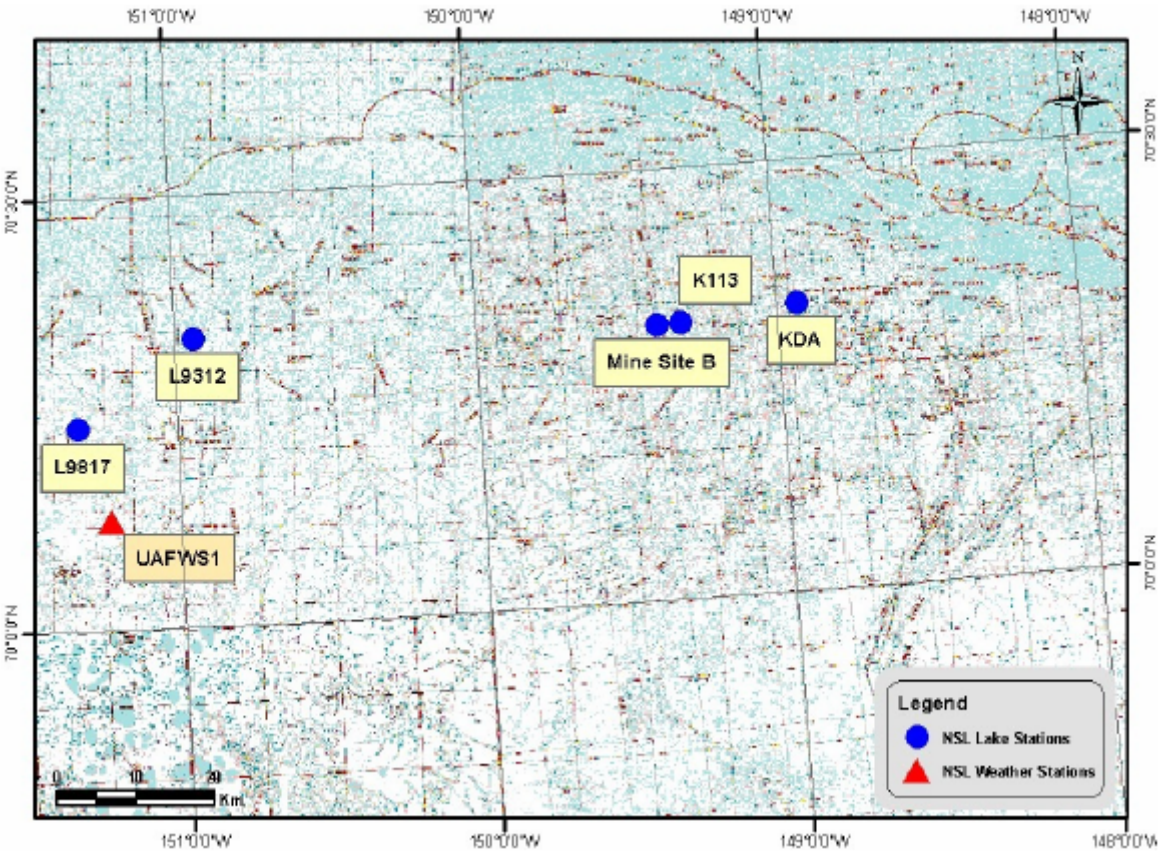

Figure 1. Location of study lakes in the NPR-A, Alpine, Kuparuk, and Prudhoe Bay field operating areas, North Slope, Alaska.

TRIP OBJECTIVES

The goal of each sampling trip is to collect physical and chemical data from each study lake. For each lake, a series of holes are drilled at designated sampling locations. Logistical, personnel, and weather constraints, can limit the amount of time available in the field for sampling. A project workplan was distributed before the trip outlining the sampling schedule (Lilly and others, 2006). In December 2006, we focused on the following locations/tasks:

1. Kuparuk Dead Arm Reservoirs: Prudhoe Bay operating area.
   - Water chemistry at KDA-1, KDA-2 and KDA-3.
   - Survey water levels to local elevation control.
   - Measure snow depth, ice thickness, and field water quality parameters.

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

Figure 2. M. Whitman and J. Derry conducting snow transects, photo by D.Reichardt.

PROCEDURES

Water Chemistry Sampling

All field work follows the specified health, safety, and environmental guidelines outlined by BPX and CPA (White and Lilly, 2006*a,b,c*). Using a gas powered auger, holes were drilled through the ice at specified locations at each study lake. Physical measurements of water depth (top of water to bottom of lake), ice thickness (top of ice to bottom of ice), freeboard (top of water to top of ice), and snow depth (top of ice to top of snow), were taken at each sampling location. Water quality parameters such as temperature, pH, turbidity, oxygen reduction potential (ORP), conductivity, and dissolved oxygen (DO) were obtained by using an In-Situ Troll 9000 (submersible meter), at multiple depths throughout the water column. The precision with which physical measurements were reported takes into account field conditions. The calibration of each parameter was checked before and after each day of sampling using the criteria in table 1.

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	InSitu QuickCal 224 mV	within 10%

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

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

Snow Surveys

Small-scale snow depth measurements were conducted in "L" shaped patterns on lake surface and/or tundra surface at predetermined locations. Snow depth measurements were taken every meter for twenty-five meters, then turning 90 degrees, and continuing for another twenty-five meters. Snow samples were also collected for density measurements with an Adirondack snow sampler. Five densities were collected from points on tundra and lake and averaged to establish a representative density. During the December trip a concentrated effort was put towards gathering more information on larger scale snow distributions at L9312. These larger-scale snow depth measurements were conducted along general east/west and north/south transects. Depth measurements were typically recorded every 10 feet (2 paces). Measurements at transition zones from tundra to lake were recorded at five feet increments (1 pace), and on homogeneous lake surfaces depths were recorded every 20 feet (4 paces).

SELECTED RESULTS

Snow depths and density on lake surfaces (table 2) in the Prudhoe Bay operating area are very similar, whilst lake L9312 in the Alpine operating area shows slightly more accumulation on the lake surface. Betty Pingo is a WERC and USDA operated meteorological station with a Wyoming precipitation gauge. The relatively long data records from Betty Pingo can be utilized in drawing comparisons and improving modeling efforts on the North Slope Lake sites. For the month of December snow densities are essentially the same at all study sites. Large-scale snow distribution at L9312 shows some interesting results. Transects show similar results as the snow courses with around 3.0 in (7.6cm) of snow depth on the lake and around 8.0 in (20.32cm) depth in tundra areas (table 3). However, transects reveal an interesting aspect of snow distribution that is an extremely critical factor in wind dominated arctic environments; and that is topographic controls creating deposition and erosion areas.

	KDA	MSB	L9312	Betty Pingo
Lake	2.0; (5.1)	2.0; (5.1)	3.4; (8.6)	
Tundra			7.9; (20.1)	2.2; (5.5)
Density (%)	0.28	0.27	0.27	0.27

Table 2. Average density and snow depth from snow courses [in; (cm)]

	east/west	north/south
Lake	3.0; (7.6)	2.5; (6.3)
Tundra	8.5; (21.6)	8.2; (20.8)
Transition Zones	29.0; (73.7)	6.3; (15.9)

Table 3. Average snow depth from transect measurements at L9312 [in; (cm)]

For L9312 and for most lakes in the area, snow depositional sinks are located at the transition between lake and tundra. Additionally, nearly half of the perimeter of L9312 has a rather abrupt transition from tundra to the lake with a cliff-like or sharply sloping topography on the eastern side. To illustrate the importance of these transition areas, the east/west transect (figure 4), which includes the abrupt transition zone, is a third less in length than the north/south transect (figure 5), yet has close to two and half times the cumulative snow depth. Depending on the size of the watershed this can equate to a significant amount of snow water equivalent (SWE) being held in a relatively small area of the basin. Additionally, studies have indicated drift density is higher than lake snow density, thereby further increasing the water content in these zones (Benson and Sturm, 1993).

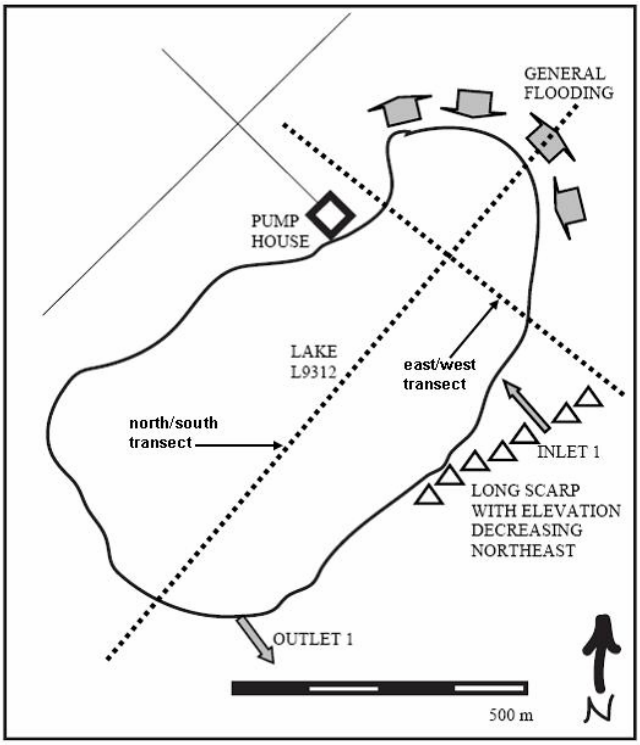

Figure 3. Lake L9312 snow depth transects.

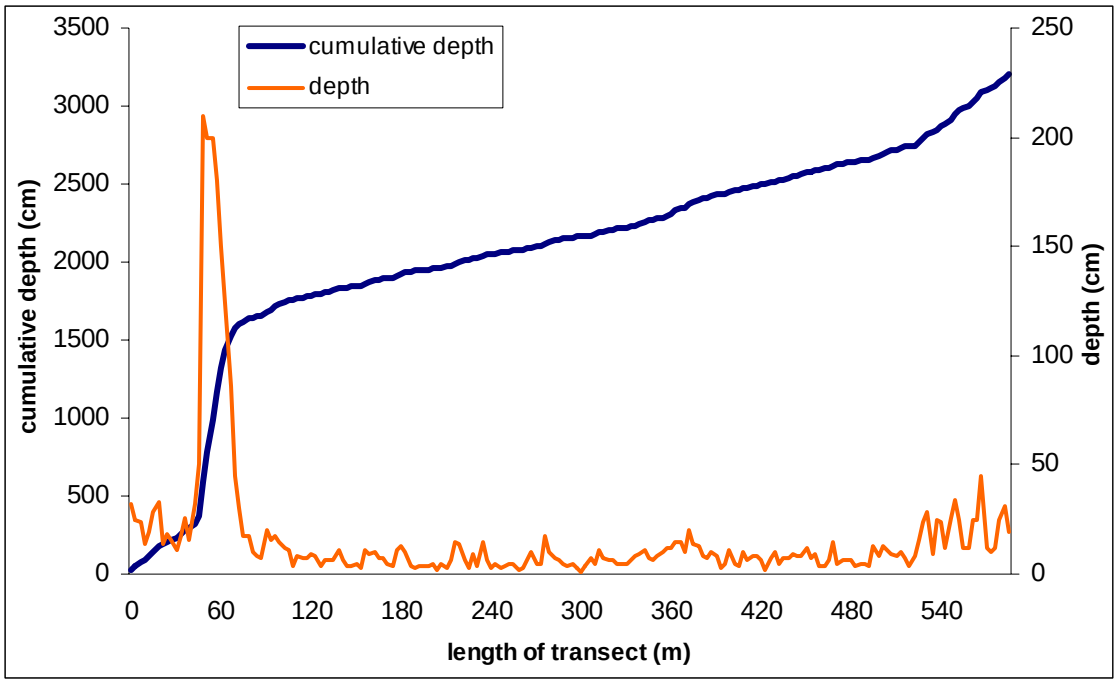

Figure 4. L9312: Cumulative snow depth, east/west transect.

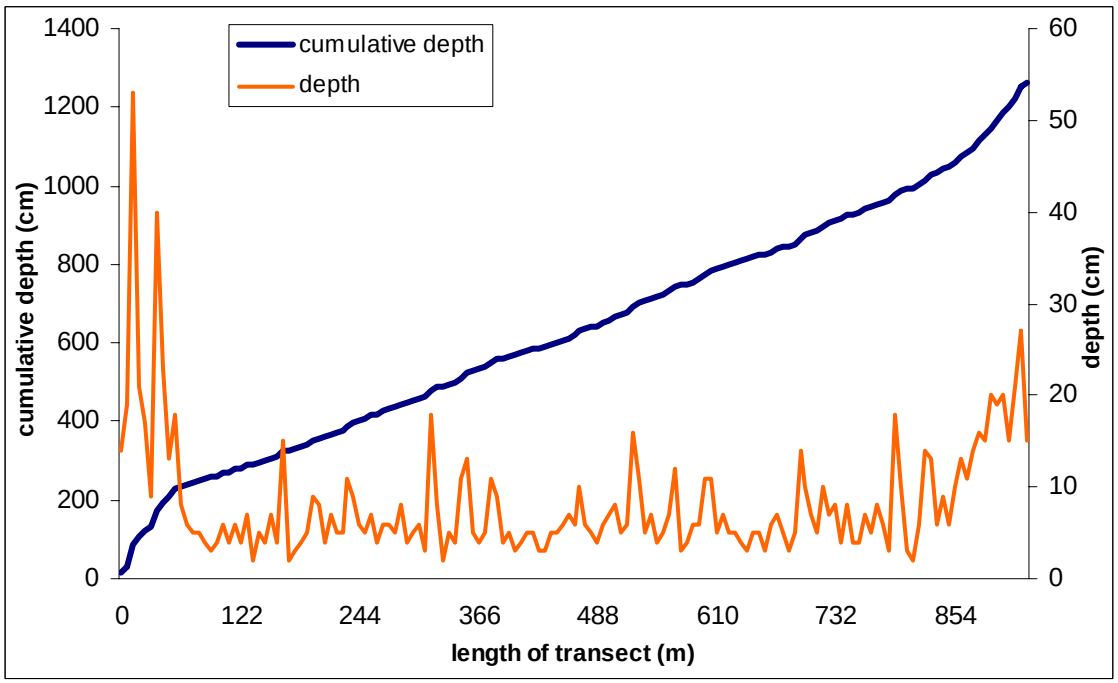

Figure 5. L9312: Cumulative snow depth, north/south transect.

SUMMARY

Sampling occurred at Kuparuk Deadarm Lakes, Mine Site B and L9312 during December field activities. Sampling was planned at L9817, however access was not possible due to tundra travel restrictions. As Table 4 demonstrates, water levels in KDA Reservoir 2 and Mine Site "B" are dropping at a rate of over 0.5 ft (0.15 m) per month. KDA Reservoir 1 and L9312 do not show a similarly rapid drop in level. KDA Reservoir 1 is not being pumped, while L9312 has a large surface area relative to the experienced pumping rate.

Table 4 summarizes conditions at "Priority Sampling Sites". Each lake we visit has one or more locations where we draw water samples from multiple depths for laboratory analysis. These locations have more historical data than other locations on the lakes, and have been chosen as representative of the deeper portion of the respective lakes.

Sampling Site	Ice Thickness [ft; (m)]	Median DO Concentration [mg/L]	Median Actual Conductivity [μS/cm]	Water level drop since mid November [ft; (m)]
KDA1-CT	2.50; (0.762)	15.42	123.4	0.01; (0.003)
KDA2-CT	2.00; (0.610)	15.38	120.6	0.63; (0.192)
MSBS-CT	2.20; (0.671)	10.4	229.1	0.63; (0.192)
MSBN-CT	2.09; (0.637)	10.8	219.4	0.82; (0.250)
L9312 Raft B	2.20; (0.671)	15.11	52.75	0.02; (0.006)

Table 4. Ice thickness, Median DO Concentration, Median Actual Conductance and Monthly Water Drop for North Slope lakes in mid-December.

Continuous monitoring of the water quality parameters and spatial distribution of snow cover at North Slope lakes throughout the winter will help in the understanding and development of simulation tools necessary for water resource management. As water levels drop due to freezing

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

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APPENDIX A. WATER QUALITY FIELD SAMPLING FORMS

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-CT

Sample Purpose: **Lake Water Quality** Date: 12/15/06 Time: 13:12

FIELD MEASUREMENTS

GPS Coord. Northing: N70°19.9026' Easting: W148°56.6748' Datum: NAD83

Measurements By: DAR Time: 13:12

Water Depth (ft): 20.71 Ice Thickness (ft): 2.50

Freeboard (ft): 0.22 Snow Depth (ft): 0.10

Elev. (BPMSL +/- .02): 8.31 Survey By: JD Date: 12/15/06 Time: 13:12

Water Sampling By: DAR/AJB Sample Depths BWS (ft): 1 3 Date: 12/15/06 Time: NR

2 10

WATER QUALITY METER INFORMATION 3 20

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 (pH Fail)

Parameters	**Field Measurements**									
Time:	13:25	13:26	13:28	13:30	13:31	13:33	13:36	13:45	13:54	
Depth BWS (ft):	3	4	5	7	9	11	13	15	17	
Temp (°C):	-0.38	-0.38	-0.34	-0.23	-0.14	-0.05	0.03	0.37	0.69	
pH:										
Barometeric (mmHg):	759.5	759.5	759.6	759.7	759.8	759.8	759.9	759.9	759.9	
Pressure (kPa):	7.628	10.325	13.236	19.302	25.409	31.165	37.061	43.316	49.317	
Conductivity (µS/cm):	123.4	123.4	123.2	123.8	122.9	122.9	122.8	122.9	124.9	
RDO (ppm): (mg/L)	15.61	15.61	15.61	15.59	15.54	15.47	15.42	14.89	11.11	
Turbidity (NTU):	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.3	-0.1	
ORP	236	235	237	235	235	235	236	236	241	

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):____3___**			**Depth BWS (ft):___10___**			**Depth BWS (ft):____20__**			**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 $CaCO_3$)	98	94	95	93	111	98	108	103	104	Digital titrator 10-4000 mg/L as CaCO3
Total iron--UF (mg/L)	-0.01	0.00	0.00	0.00	0.01	0.01	-0.01	ur	ur	Hach spec 0.02-3.00 mg/L
Filtered Iron--F tot Fe (mg/L)	0.00	0.00	-0.02	0.01	0.00	0.01	0.01	0.02	0.01	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 Log No:2006-12-15 131101. UR denotes "under range"

Field-Form Filled Out By: A. Blackburn Date: 12/16/06

QAQC Check By: A. Blackburn Date: 12/21/06

University of Alaska Fairbanks, Water and Environmental Research Center

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

Project ID: **North Slope Lakes** Site Location/Lake ID: KDA1-CT

Sample Purpose: **Lake Water Quality** Date: 12/15/06 Time: 13:12

FIELD MEASUREMENTS

GPS Coord. Northing: N70°19.9026' Easting: W148°56.6748' Datum: NAD83

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Freeboard (ft): 0.22 Snow Depth (ft): 0.10

Elev. (BPMSL +/- .02): 8.31 Survey By: JD Date: 12/15/06 Time: 13:12

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2 10

WATER QUALITY METER INFORMATION 3 20

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 (pH Fail)

Parameters	**Field Measurements**									
Time:	14:07	14:13	14:22	14:26						
Depth BWS (ft):	18	19	20	bottom						
Temp (°C):	0.82	0.89	1.07	1.13						
pH:										
Barometeric (mmHg):	760.0	760.0	760.1	760.1						
Pressure (kPa):	52.613	55.204	58.274	61.317						
Conductivity (µS/cm):	126.3	127.3	131.2	133						
RDO (ppm): (mg/L)	9.66	8.78	5.48	4.64						
Turbidity (NTU):	-0.1	0.1	1	218						
ORP	243	244	245	198						

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: A. Blackburn Date: 12/16/06

QAQC Check By: A. Blackburn Date: 12/21/06

University of Alaska Fairbanks, Water and Environmental Research Center

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

Project ID: **North Slope Lakes** Site Location/Lake ID: KDA2-CT

Sample Purpose: **Lake Water Quality** Date: 12/15/06 Time: 11:06

FIELD MEASUREMENTS

GPS Coord. Northing: N70°19.9776' Easting: W148°56.4462' Datum: WGS84

Measurements By: DAR Time: 11:15

Water Depth (ft): 19.38 Ice Thickness (ft): 2.00

Freeboard (ft): 0.16 Snow Depth (ft): 0.15

Elev. (BPMSL +/- .02): 7.36 Survey By: JD, AJB Date: 12/15/06 Time: NR

Water Sampling By: DAR/AJB Sample Depths BWS (ft): 1 2.5 Date: 12/15/06 Time: 11:20

2 9

WATER QUALITY METER INFORMATION 3 19

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 (pH Fail)

Parameters	**Field Measurements**									
Time:	11:26	11:29	11:33	11:34	11:37	11:39	11:42	11:50	11:51	
Depth BWS (ft):	2	3	4	6	8	10	12	14	16	
Temp (°C):	-0.28	-0.3	-0.28	-0.32	-0.26	-0.22	-0.22	0.01	0.01	
pH:										
Barometeric (mmHg):	759.5	759.6	759.6	759.7	759.7	759.8	759.8	759.9	760	
Pressure (kPa):	4.474	7.498	10.362	16.415	22.420	28.334	34.214	40.195	46.265	
Conductivity (µS/cm):	121	120.6	120.3	120	119.9	119.9	119.6	119.6	122.7	
RDO (ppm): (mg/L)	15.33	15.38	15.43	15.51	15.53	15.53	15.5	15.4	12.11	
Turbidity (NTU):	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	0	
ORP	303	302	301	298	298	297	296	294	296	

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):___2.5___**			**Depth BWS (ft):___9___**			**Depth BWS (ft):____19__**			**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 $CaCO_3$)	88	104	101	98	90	94	127	119	120	Digital titrator 10-4000 mg/L as CaCO3
Total iron--UF (mg/L)	-0.01	-0.01	0.00	0.00	0.00	0.00	ur	ur	ur	Hach spec 0.02-3.00 mg/L
Filtered Iron--F tot Fe (mg/L)	0.01	0.01	0.01	0.01	0.05	0.05	0.05	0.01	0.00	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 Log No:2006-12-15 112255.

Field-Form Filled Out By: Blackburn Date: 12/15/06

QAQC Check By: A. Blackburn Date: 12/21/06

University of Alaska Fairbanks, Water and Environmental Research Center

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

Project ID: **North Slope Lakes** Site Location/Lake ID: KDA2-CT

Sample Purpose: **Lake Water Quality** Date: 12/15/06 Time: 11:06

FIELD MEASUREMENTS

GPS Coord. Northing: N70°19.9776' Easting: W148°56.4462' Datum: WGS84

Measurements By: DAR Time: 11:15

Water Depth (ft): 19.38 Ice Thickness (ft): 2.00

Freeboard (ft): 0.16 Snow Depth (ft): 0.15

Elev. (BPMSL +/- .02): 7.36 Survey By: JD, AJB Date: 12/15/06 Time: NR

Water Sampling By: DAR/AJB Sample Depths BWS (ft): 1 2.5 Date: 12/15/06 Time: 11:20

2 9

WATER QUALITY METER INFORMATION 3 19

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 (pH Fail)

Parameters	**Field Measurements**									
Time:	11:52	11:52	11:54	11:55						
Depth BWS (ft):	17	18	19	bottom						
Temp (°C):	0.80	0.98	0.98	1.25						
pH:										
Barometeric (mmHg):	760.1	760.1	760.2	760.2						
Pressure (kPa):	49.065	51.990	55.153	57.261						
Conductivity (µS/cm):	128	137.9	148.4	151.7						
RDO (ppm): (mg/L)	8.17	5.62	3.77	3.33						
Turbidity (NTU):	0.6	2.2	9.5	105.6						
ORP	298	297	296	169						

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: Blackburn Date: 12/15/06

QAQC Check By: A. Blackburn Date: 12/21/06

University of Alaska Fairbanks, Water and Environmental Research Center

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

Project ID: **North Slope Lakes** Site Location/Lake ID: KDA3-CT

Sample Purpose: **Lake Water Quality** Date: 12/15/06 Time: 16:00

FIELD MEASUREMENTS

GPS Coord. Northing: N70°20.025 Easting: W148°56.2044 Datum: NAD83

Measurements By: DAR Time: 16:20

Water Depth (ft): 23.08 Ice Thickness (ft): 2.25

Freeboard (ft): 0.05 Snow Depth (ft): 0.31

Elev. (BPMSL +/- .02): 7.36 Survey By: JD, AJB Date: 12/15/06 Time: NR

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

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 (pH fail)

Parameters	**Field Measurements**									
Time:	16:21	16:22	16:26	16:28	16:31	16:33	16:37	16:40	16:42	
Depth BWS (ft):	2	3	4	5	7	10	12	14	16	
Temp (°C):	-0.37	-0.39	-0.36	-0.31	-0.12	-0.05	-0.01	0.03	0.13	
pH:										
Barometeric (mmHg):	759.2	759.3	759.3	759.4	759.5	759.5	759.6	759.7	759.7	
Pressure (kPa):	4.648	7.592	10.189	13.299	19.188	28.058	34.139	40.435	46.18	
Conductivity (µS/cm):	115.3	114.1	114.2	114	113.6	113.4	113.2	113	113	
RDO (ppm): (mg/L)	15.2	15.22	15.25	15.26	15.17	15.11	15.05	14.93	14.79	
Turbidity (NTU):	-0.2	-0.3	-0.3	-0.3	-0.3	-0.3	-0.3	-0.1	-0.2	
ORP	240	239	239	239	239	239	239	240	239	

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: Pocket Situ Log 2006-12-15 161450

Field-Form Filled Out By: Reichardt Date: 12/15/06

QAQC Check By: A. Blackburn Date: 12/21/06

University of Alaska Fairbanks, Water and Environmental Research Center

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

Project ID: **North Slope Lakes** Site Location/Lake ID: KDA3-CT

Sample Purpose: **Lake Water Quality** Date: 12/15/06 Time: 16:00

FIELD MEASUREMENTS

GPS Coord. Northing: N70°20.025 Easting: W148°56.2044 Datum: NAD83

Measurements By: DAR Time: 16:20

Water Depth (ft): 23.08 Ice Thickness (ft): 2.25

Freeboard (ft): 0.05 Snow Depth (ft): 0.31

Elev. (BPMSL +/- .02): 7.36 Survey By: JD, AJB Date: 12/15/06 Time: NR

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

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 (pH fail)

Parameters	**Field Measurements**									
Time:	16:46	16:05	16:55	17:05	17:08	17:10				
Depth BWS (ft):	18	20	21	22	23	bottom				
Temp (°C):	0.36	0.66	0.82	1.07	1.19	1.21				
pH:										
Barometeric (mmHg):	759.7	759.8	759.8	759.8	759.7	759.8				
Pressure (kPa):	52.041	57.937	61.003	64.278	67.486	68.136				
Conductivity (µS/cm):	113.2	114.2	117	119	122.9	122.8				
RDO (ppm): (mg/L)	14.4	12.58	9.06	6.45	4.36	4.22				
Turbidity (NTU):	-0.3	-0.1	0.4	1.4	2.6	5.6				
ORP	240	245	249	251	253	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: Reichardt Date: 12/15/06

QAQC Check By: A. Blackburn Date: 12/21/06

University of Alaska Fairbanks, Water and Environmental Research Center

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

Project ID: **North Slope Lakes** Site Location/Lake ID: MSBN-CT

Sample Purpose: **Lake Water Quality** Date: 12/16/06 Time: 12:35

FIELD MEASUREMENTS

GPS Coord. Northing: N70.32134 Easting: W149.40015 Datum: WGS84

Measurements By: DAR Time: 12:40

Water Depth (ft): 34.3 Ice Thickness (ft): 2.09

Freeboard (ft): 0.12 Snow Depth (ft): 0.10

Elev. (BPMSL +/- .02): 95.09 Survey By: JD, DAR Date: 12/16/06 Time: 12:30

Water Sampling By: DAR Sample Depths BWS (ft): 1 2 Date: 12/16/06 Time: 12:48

2 24

WATER QUALITY METER INFORMATION 3 34

Calibration Information

Parameter (s)	Owner	Meter Make/Model	Serial No.	Pre-Sampling QAQC Check	Post-Sampling QAQC Check
Multi	GWS	InSitu Troll 9000	33033	Pass	Pass

Parameters	**Field Measurements**									
Time:	12:48	12:49	12:50	12:51	12:53	12:54	12:56	12:57	12:59	
Depth BWS (ft):	2	3	4	6	8	10	12	14	16	
Temp (°C):	-0.43	-0.41	-0.40	-0.37	-0.36	-0.36	-0.36	-0.35	-0.33	
pH:	7.61	7.62	7.63	7.64	7.62	7.64	7.64	7.62	7.60	
Barometeric (mmHg):	751.1	751.1	751.2	751.2	751.3	751.3	751.4	751.4	751.4	
Pressure (kPa):	4.492	7.539	10.345	16.257	22.189	28.258	34.187	40.324	46.126	
Conductivity (µS/cm):	221.0	220.2	220.0	219.5	219.4	219.3	219.1	218.80	218.60	
RDO (ppm): (mg/L)	11.24	11.25	11.24	11.24	11.23	1.23	11.23	11.20	11.12	
Turbidity (NTU):	0.2	0.1	0.1	0.1	0.2	0.1	0.2	0.1	0.2	
ORP	228	228	227	227	227	226	226	226	227	

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): 2**			**Depth BWS (ft): 24**			**Depth BWS (ft): 34**			**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 $CaCO_3$)	173	171	175	169	177	178	170	170	172	Digital titrator 10-4000 mg/L as CaCO3
Total iron--UF (mg/L)	0.16	0.22	0.18	0.2	0.21	0.23	0.68	0.74	0.69	Hach spec 0.02-3.00 mg/L
Filtered Iron--F tot Fe (mg/L)	UR	UR	UR	0.05	0.08	0.04	0.00	0.11	0.07	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: Pocket Situ Log 2006-12-16 123854. UR denotes "Under Range"

Field-Form Filled Out By: Blackburn Date: 12/16/06

QAQC Check By: A. Blackburn Date: 12/19/06

University of Alaska Fairbanks, Water and Environmental Research Center

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

Project ID: **North Slope Lakes** Site Location/Lake ID: MSBN-CT

Sample Purpose: **Lake Water Quality** Date: 12/16/06 Time: 12:35

FIELD MEASUREMENTS

GPS Coord. Northing: N70°19.280' Easting: W149°24.009' Datum: NAD83

Measurements By: DAR Time: 12:40

Water Depth (ft): 34.3 Ice Thickness (ft): 2.09

Freeboard (ft): 0.12 Snow Depth (ft): 0.10

Elev. (BPMSL +/- .02): 95.09 Survey By: JD, DAR Date: 12/16/06 Time: 12:30

Water Sampling By: DAR Sample Depths BWS (ft): 1 2 Date: 12/16/06 Time: 12:48

2 24

WATER QUALITY METER INFORMATION 3 34

Calibration Information

Parameter (s)	Owner	Meter Make/Model	Serial No.	Pre-Sampling QAQC Check	Post-Sampling QAQC Check
Multi	GWS	InSitu Troll 9000	33033	Pass	Pass

Parameters	**Field Measurements**									
Time:	13:01	13:05	13:09	13:12	13:15	13:18	13:21	13:28	13:34	
Depth BWS (ft):	18	20	22	24	26	28	30	32	33	
Temp (°C):	-0.31	-0.28	-0.18	-0.11	-0.02	0.12	0.41	0.66	0.74	
pH:	7.65	7.65	7.60	7.60	7.60	7.60	7.55	7.38	7.38	
Barometeric (mmHg):	751.5	751.6	751.7	751.7	751.7	751.8	751.8	751.8	751.8	
Pressure (kPa):	52.551	58.132	64.467	69.989	75.803	82.256	87.890	93.625	96.956	
Conductivity (µS/cm):	218.8	218.8	218.6	218.7	218.6	218.8	220.2	230.4	238.2	
RDO (ppm): (mg/L)	10.91	10.83	10.71	10.65	10.56	10.48	9.53	4.97	3.28	
Turbidity (NTU):	0.2	0.2	0.3	0.4	0.3	0.3	0.7	2.4	5.7	
ORP	226	224	224	224	223	223	223	225	225	
Hach LDO (UAF) mg/L										
Hach temp °C										

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

Probe:

Depth (ft)					
Temp (°C)					
pH					
Eh					

NORTH SLOPE LAB CHEMISTRY ANALYSIS

Parameter	**Depth BWS (ft):_____**			**Depth BWS (ft):_____**			**Depth BWS (ft):_____**			**Method**
	rep 1	rep 2	rep 3	rep 1	rep 2	rep 3	rep 1	rep 2	rep 3	
Oxygen (mg/L)										Hach spec 0.3-15 mg/L
Alkalinity (mg/L as $CaCO_3$)										Digital titrator 10-4000 mg/L as 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: Blackburn Date: 12/16/06

QAQC Check By: A. Blackburn Date: 12/19/06

University of Alaska Fairbanks, Water and Environmental Research Center

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

Project ID: **North Slope Lakes** Site Location/Lake ID: MSBN-CT

Sample Purpose: **Lake Water Quality** Date: 12/16/06 Time: 12:35

FIELD MEASUREMENTS

GPS Coord. Northing: N70.32134 Easting: W149.40015 Datum: WGS84

Measurements By: DAR Time: 12:40

Water Depth (ft): 34.3 Ice Thickness (ft): 2.09

Freeboard (ft): 0.12 Snow Depth (ft): 0.10

Elev. (BPMSL +/- .02): 95.09 Survey By: JD, DAR Date: 12/16/06 Time: 12:30

Water Sampling By: DAR Sample Depths BWS (ft): 1 2 Date: 12/16/06 Time: 12:48

2 24

WATER QUALITY METER INFORMATION 3 34

Calibration Information

Parameter (s)	Owner	Meter Make/Model	Serial No.	Pre-Sampling QAQC Check	Post-Sampling QAQC Check
Multi	GWS	InSitu Troll 9000	33033	Pass	Pass

Parameters	**Field Measurements**									
Time:	13:35	13:39								
Depth BWS (ft):	34	bottom								
Temp (°C):	0.78	0.83								
pH:	7.36	7.37								
Barometeric (mmHg):	751.9	751.9								
Pressure (kPa):	99.875	101.975								
Conductivity (µS/cm):	244.4	248.0								
RDO (ppm): (mg/L)	2.43	1.71								
Turbidity (NTU):	3.4	25.4								
ORP	225	26								
Hach LDO (UAF) mg/L										
Hach temp °C										

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

Probe:

Depth (ft)					
Temp (°C)					
pH					
Eh					

NORTH SLOPE LAB CHEMISTRY ANALYSIS

Parameter	**Depth BWS (ft):_____**			**Depth BWS (ft):_____**			**Depth BWS (ft):_____**			**Method**
	rep 1	rep 2	rep 3	rep 1	rep 2	rep 3	rep 1	rep 2	rep 3	
Oxygen (mg/L)										Hach spec 0.3-15 mg/L
Alkalinity (mg/L as $CaCO_3$)										Digital titrator 10-4000 mg/L as 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: Blackburn Date: 12/16/06

QAQC Check By: A. Blackburn Date: 12/19/06

University of Alaska Fairbanks, Water and Environmental Research Center

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

Project ID: **North Slope Lakes** Site Location/Lake ID: MSBS-CT

Sample Purpose: **Lake Water Quality** Date: 12/16/06 Time: 14:40

FIELD MEASUREMENTS

GPS Coord. Northing: N70.32024 Easting: W149.40034 Datum: WGS84

Measurements By: DAR Time: 15:20

Water Depth (ft): 28.02 Ice Thickness (ft): 2.20

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

Elev. (BPMSL +/- .02): 95.09 Survey By: JD, DAR Date: 12/16/06 Time: 12:30

Water Sampling By: AJB Sample Depths BWS (ft): 1 3 Date: 12/16/06 Time: 16:35

2 18

WATER QUALITY METER INFORMATION 3 27.5

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:	14:41	14:43	14:44	14:45	14:47	14:49	14:51	14:53	14:54	
Depth BWS (ft):	2.0	3.0	4.0	6.0	8.0	10.0	12.0	14.0	16.0	
Temp (°C):	-0.49	-0.48	-0.48	-0.48	-0.47	-0.41	-0.38	-0.30	-0.17	
pH:	7.61	7.61	7.59	7.58	7.61	7.62	7.64	7.62	7.59	
Barometeric (mmHg):	750.6	750.6	750.7	750.7	750.8	750.6	750.9	751.0	751.1	
Pressure (kPa):	5.668	7.625	10.295	15.964	22.388	27.868	34.170	40.060	46.422	
Conductivity (µS/cm):	230.7	229.4	229.3	229.2	228.9	228.3	227.9	227.6	227.5	
RDO (ppm): (mg/L)	10.75	10.75	10.74	10.72	10.70	10.62	10.54	10.49	10.36	
Turbidity (NTU):	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.4	
ORP	182	183	183	183	183	184	184	184	185	

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): 3**			**Depth BWS (ft): 18**			**Depth BWS (ft): 27.5**			**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 $CaCO_3$)	173	176	82	170	84	177	184	184	186	Digital titrator 10-4000 mg/L as CaCO3
Total iron--UF (mg/L)	0.18	0.17	0.16	0.16	0.17	0.16	2.7	2.8	2.34	Hach spec 0.02-3.00 mg/L
Filtered Iron--F tot Fe (mg/L)	0.03	0.03	0.04	0.03	0.05	0.04	1.18	0.80	1.01	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: Pocket Situ Log 2006-12-16 143146

Field-Form Filled Out By: Blackburn Date: 12/16/06

QAQC Check By: A. Blackburn Date: 12/19/06

University of Alaska Fairbanks, Water and Environmental Research Center

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

Project ID: **North Slope Lakes** Site Location/Lake ID: MSBS-CT

Sample Purpose: **Lake Water Quality** Date: 12/16/06 Time: 14:40

FIELD MEASUREMENTS

GPS Coord. Northing: N70.32024 Easting: W149.40034 Datum: WGS84

Measurements By: DAR Time: 15:20

Water Depth (ft): 28.02 Ice Thickness (ft): 2.20

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

Elev. (BPMSL +/- .02): 95.09 Survey By: JD, DAR Date: 12/16/06 Time: 12:30

Water Sampling By: AJB Sample Depths BWS (ft): 1 3 Date: 12/16/06 Time: 16:35

2 18

WATER QUALITY METER INFORMATION 3 27.5

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:	14:56	14:58	14:59	15:05	15:07	15:09	15:12			
Depth BWS (ft):	18	20	22	24	26	27.5	bottom			
Temp (°C):	-0.17	0.02	0.12	0.38	0.59	0.81	1.02			
pH:	7.6	7.58	7.54	7.42	7.33	7.31	7.47			
Barometeric (mmHg):	751.1	751.1	751.2	751.2	751.3	751.3	751.3			
Pressure (kPa):	52.071	57.938	64.043	70.015	75.935	80.539	83.614			
Conductivity (µS/cm):	227.6	227.7	228.5	234.0	240.2	247.4	376.7			
RDO (ppm): (mg/L)	10.17	9.92	9.24	6.17	5.04	3.99	2.06			
Turbidity (NTU):	0.4	0.5	0.7	1.4	2.0	3.3	91.9			
ORP	185	186	187	189	191	95	-48			

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: Blackburn Date: 12/16/06

QAQC Check By: A. Blackburn Date: 12/19/06

University of Alaska Fairbanks, Water and Environmental Research Center

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

Project ID: **North Slope Lakes** Site Location/Lake ID: MSBS-SJ

Sample Purpose: **Lake Water Quality** Date: 12/16/06 Time: 17:50

FIELD MEASUREMENTS

GPS Coord. Northing: n/a Easting: na Datum: na

Measurements By: DAR Time: 17:50

Water Depth (ft): JB Ice Thickness (ft): 4.30

Freeboard (ft): 0.05 Snow Depth (ft): trace

Elev. (BPMSL +/- .02): 95.09 Survey By: JD, DAR Date: 12/16/06 Time: 12:30

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

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
Conductivity, temp2	GWS	YSI Conductivity	B0064	n/a	Pass

Parameters	**Field Measurements**									
Time:	17:20	11:15	15:17	15:18	15:22	15:24	15:26	15:27	15:28	15:30
Depth BWS (ft):	2.0	3.0	4.0	6.0	8.0	10.0	12.0	14.0	15.0	bottom
Temp (°C):	0.1	0.1	0.2	0.2	0.2	0.2	0.3	0.4	0.5	0.6
Conductivity (uS/cm AC)	452.5	243.7	242.8	242.4	242.5	242.4	241.3	240.7	2401.1	225.7

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):___3___**			**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: Reichardt Date: 12/16/06

QAQC Check By: Reichardt Date: 1/17/07

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: 12/16/06 Time: 16:35

FIELD MEASUREMENTS

GPS Coord. Northing: N70°19.186' Easting: W149°24.234' Datum: WGS84

Measurements By: DAR Time: 16:35

Water Depth (ft): 20.02 Ice Thickness (ft): 2.45

Freeboard (ft): 0.15 Snow Depth (ft): 0.00

Elev. (BPMSL +/- .02): 95.09 Survey By: JD, DAR Date: 12/16/06 Time: 12:30

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

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	**Field Measurements**									
Time:	16:49	16:50	16:51	16:53	16:54	16:55	16:58	17:04	17:11	
Depth BWS (ft):	3	4	5	7	9	11	13	15	17	
Temp (°C):	-0.5	-0.51	-0.5	-0.5	-0.51	-0.5	-0.42	-0.3	-0.15	
pH:	7.63	7.59	7.62	7.63	7.61	7.63	7.6	7.64	7.58	
Barometeric (mmHg):	749.9	749.9	750	750	750.1	750.1	750.1	750.3	750.3	
Pressure (kPa):	7.401	10.454	13.330	19.521	25.344	31.476	37.068	43.211	49.429	
Conductivity (µS/cm):	235.8	235.8	235.8	235.7	235.8	235.9	235	234.7	234.3	
RDO (ppm): (mg/L)	10.93	10.89	10.86	10.83	10.83	10.83	10.71	10.57	10.35	
Turbidity (NTU):	0.3	0.3	0.3	0.3	0.3	0.2	0.3	0.3	0.4	
ORP	161	162	161	162	163	164	165	167	170	

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: Reichardt Date: 12/16/06

QAQC Check By: A.Blackburn Date: 12/19/06

University of Alaska Fairbanks, Water and Environmental Research Center

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

Project ID: **North Slope Lakes** Site Location/Lake ID: MSBS-SW

Sample Purpose: **Lake Water Quality** Date: 12/16/06 Time: 16:35

FIELD MEASUREMENTS

GPS Coord. Northing: N70°19.186' Easting: W149°24.234' Datum: WGS84

Measurements By: DAR Time: 16:35

Water Depth (ft): 20.02 Ice Thickness (ft): 2.45

Freeboard (ft): 0.15 Snow Depth (ft): 0.00

Elev. (BPMSL +/- .02): 95.09 Survey By: JD, DAR Date: 12/16/06 Time: 12:30

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

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	**Field Measurements**									
Time:	17:15	17:23	17:30							
Depth BWS (ft):	19.0	20	bottom							
Temp (°C):	-0.04	0.02	0.06							
pH:	7.55	7.53	7.48							
Barometeric (mmHg):	750.4	750.4	750.4							
Pressure (kPa):	55.590	58.285	59.75							
Conductivity (µS/cm):	234.30	235.2	237							
RDO (ppm): (mg/L)	9.94	8.87	8.67							
Turbidity (NTU):	0.50	1.4	9.6							
ORP	172	150	51							

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: Reichardt Date: 12/16/06

QAQC Check By: A.Blackburn Date: 12/19/06

University of Alaska Fairbanks, Water and Environmental Research Center

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

Project ID: **North Slope Lakes** Site Location/Lake ID: MSBS-W

Sample Purpose: **Lake Water Quality** Date: 12/16/06 Time: 15:08

FIELD MEASUREMENTS

GPS Coord. Northing: N70°19.232' Easting: W149°24.089' Datum: WGS84

Measurements By: DAR Time: 15:08

Water Depth (ft): 15.3 Ice Thickness (ft): 2.60

Freeboard (ft): 0.30 Snow Depth (ft): 0.20

Elev. (BPMSL +/- .02): 95.09 Survey By: JD, DAR Date: 12/16/06 Time: 12:30

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

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
[DO], temp1	UAF	Hach LDO HQ20	602000121	Pass	Pass
Conductivity, temp2	GWS	YSI Conductivity	B0064	n/a	Pass

Parameters	**Field Measurements**									
Time:	15:14	11:15	15:17	15:18	15:22	15:24	15:26	15:27	15:28	15:30
Depth BWS (ft):	2.0	3.0	4.0	6.0	8.0	10.0	12.0	14.0	15.0	bottom
Temp1 (°C):	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.2	0.2	0.2
Temp2 (°C):	0.1	0.1	0.2	0.2	0.2	0.2	0.3	0.4	0.5	0.6
LDO (mg/L)	12.3	11.7	11.6	11.5	11.4	1.3	11.3	10.9	10.8	10.6
Conductivity (uS/cm AC)	244.7	243.7	242.8	242.4	242.5	242.4	241.3	240.7	2401.1	225.7

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: Reichardt Date: 12/16/06

QAQC Check By: Reichardt Date: 1/16/07

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 - B

Sample Purpose: **Lake Water Quality** Date: 12/19/06 Time: 9:20

FIELD MEASUREMENTS

GPS Coord. Northing: N70°19.995' Easting: W150°56.918' Datum: WGS84

Measurements By: Reichardt Time: 9:20

Water Depth (ft): 11.35 Ice Thickness (ft): 2.20

Freeboard (ft): 0.15 Snow Depth (ft): 0.10

Elev. (BPMSL): 95.94 Survey By: J. Derry Date: 12/19/06 Time: 11:40

Water Sampling By: DAR Sample Depths BWS (ft): 1 3 Date: 12/19/06 Time: 10:25

2 6

WATER QUALITY METER INFORMATION 3 11

Calibration Information

Parameter (s)	Owner	Meter Make/Model	Serial No.	Pre-Sampling QAQC Check	Post-Sampling QAQC Check
Multi	UAF	InSitu Troll 9000	33205	pass (pH fail)	pass (pH Fail)

Parameters	**Field Measurements**									
Time:	9:32	9:35	9:36	9:37	9:39	9:41	9:53	10:06	10:14	10:17
Depth BWS (ft):	3	4	5	6	7	8	9	10	11	Bottom
Temp (°C):	0.23	0.27	0.39	0.56	0.97	1.08	1.51	1.73	1.94	1.97
pH:										
Barometeric (mmHg):	740.5	740.5	740.6	740.7	740.7	740.8	740.8	740.8	740.9	740.9
Pressure (kPa):	7.509	10.220	13.527	16.442	19.349	22.234	25.484	28.353	31.315	33.072
Conductivity (µS/cm):	53.06	52.93	52.57	52.37	51.85	51.70	51.48	54.70	61.59	69.61
RDO (ppm): (mg/L)	15.56	15.70	15.71	15.68	15.33	14.88	11.36	5.67	2.60	1.93
Turbidity (NTU):	1.5	1.3	1.4	1.3	1.3	1.4	1.6	1.8	6.3	32.0
ORP	181	183	183	184	184	190	194	197	123	86

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):____3__**			**Depth BWS (ft):_6__**			**Depth BWS (ft):__11__**			**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 $CaCO_3$)	45	36	33	31	31	35	47	47	57	Digital titrator 10-4000 mg/L as CaCO3
Total iron--UF (mg/L)	0.01	0.00	0.00	0.01	0.00	0.00	2.81	2.86	2.82	Hach spec 0.02-3.00 mg/L
Filtered Iron--F tot Fe (mg/L)	0.03	0.06	0.07	0.04	0.02	0.02	2.37	2.31	2.46	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: Reichardt Date: 12/19/06

QAQC Check By: jeff derry Date: 12/20/06

University of Alaska Fairbanks, Water and Environmental Research Center

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

Project ID: **North Slope Lakes** Site Location/Lake ID: L9312-A

Sample Purpose: **Lake Water Quality** Date: 12/19/06 Time: 13:30

FIELD MEASUREMENTS

GPS Coord. Northing: N70°20.053' Easting: W150°56.600' Datum: WGS84

Measurements By: DAR/JED Time: 13:32

Water Depth (ft): 10.35 Ice Thickness (ft): 1.9

Freeboard (ft): 0.1 Snow Depth (ft): 0.8

Elev. (BPMSL): 95.94 Survey By: J. Derry Date: 12/19/06 Time: 11:40

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

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	UAF	InSitu Troll 9000	33205	pass (pH fail)	pass (pH Fail)

Parameters	**Field Measurements**									
Time:	12:02	12:04	12:05	12:07	12:11	12:17	12:23	12:31	12:43	12:46
Depth BWS (ft):	2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10.0	Bot
Temp (°C):	0.10	0.12	0.24	0.52	0.73	0.95	1.13	1.29	1.46	1.53
pH:										
Barometeric (mmHg):	740.9	741.0	741.0	741.1	741.1	741.1	741.1	741.1	741.1	741.1
Pressure (kPa):	5.212	7.573	10.550	13.447	16.360	19.375	22.633	25.638	28.223	30.366
Conductivity (µS/cm):	54.11	54.16	53.64	53.03	52.75	52.43	54.60	57.86	60.27	62.86
RDO (ppm): (mg/L)	15.85	15.88	15.86	15.80	15.20	14.29	11.16	7.51	5.14	4.35
Turbidity (NTU):	1.3	1.6	1.4	1.4	1.4	1.7	3.0	5.3	8.1	195.2
ORP	188	189	190	191	193	197	204	207	183	-18

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)										
Alkalinity (mg/L as $CaCO_3$)										
Total iron--UF (mg/L)										
Filtered Iron--F tot Fe (mg/L)										
Ammonia (mg/L NH_3-N)****										
Ammonia/ Iron dilution										

Remarks:

Field-Form Filled Out By: Reichardt Date: 12/19/06

QAQC Check By: jeff derry Date: 12/20/06

University of Alaska Fairbanks, Water and Environmental Research Center

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

Project ID: **North Slope Lakes** Site Location/Lake ID: L9312-Screen

Sample Purpose: **Lake Water Quality** Date: 12/19/06 Time: 13:30

FIELD MEASUREMENTS

GPS Coord. Northing: N70°20.003' Easting: W150°57.005' Datum: WGS84

Measurements By: DAR Time: 13:37

Water Depth (ft): 11.3 Ice Thickness (ft): 2.25

Freeboard (ft): 0.2 Snow Depth (ft): 0.3

Elev. (BPMSL): 95.94 Survey By: J. Derry Date: 12/19/06 Time: 11:40

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

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	UAF	InSitu Troll 9000	33205	pass (pH fail)	pass (pH Fail)

Parameters	**Field Measurements**									
Time:	13:44	13:46	13:47	13:48	13:52	14:02	14:08	14:19	14:22	
Depth BWS (ft):	3.0	4.0	5.0	6.0	8.0	9.0	10.0	11.0	Bot	
Temp (°C):	0.15	0.28	0.43	0.59	1.15	1.48	1.72	1.89	1.92	
pH:										
Barometeric (mmHg):	740.9	740.9	740.9	740.9	741.0	740.8	740.8	740.8	740.9	
Pressure (kPa):	7.611	10.381	13.432	16.503	22.704	25.377	28.351	31.435	32.681	
Conductivity (µS/cm):	55.29	54.30	54.04	53.62	52.54	51.71	56.15	62.90	72.47	
RDO (ppm): (mg/L)	15.29	15.29	15.18	15.04	13.85	8.63	4.13	1.52	1.15	
Turbidity (NTU):	1.3	1.4	1.3	1.5	1.7	1.6	2.3	7.2	286.1	
ORP	178	180	182	182	188	196	196	101	56	

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)										
Alkalinity (mg/L as $CaCO_3$)										
Total iron--UF (mg/L)										
Filtered Iron--F tot Fe (mg/L)										
Ammonia (mg/L NH_3-N)****										
Ammonia/ Iron dilution										

Remarks: Log 2006-12-19 134020 (UAF)

Field-Form Filled Out By: Blackburn Date: 12/19/06

QAQC Check By: Reichardt Date: 12/20/06

University of Alaska Fairbanks, Water and Environmental Research Center

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

Project ID: **North Slope Lakes** Site Location/Lake ID: L9312-SH-shore Mid

Sample Purpose: **Lake Water Quality** Date: 12/19/06 Time: 15:39

FIELD MEASUREMENTS

GPS Coord. Northing: N70°20.023' Easting: W150°57.134' Datum: WGS84

Measurements By: DAR Time: 15:39

Water Depth (ft): 8.5 Ice Thickness (ft): 2.4

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

Elev. (BPMSL): 95.94 Survey By: J. Derry Date: 12/19/06 Time: 11:40

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

2

WATER QUALITY METER INFORMATION 3

Calibration Information

Parameter (s)	Owner	Meter Make/Model	Serial No.	Pre-Sampling QAQC Check	Post-Sampling QAQC Check
Multi	UAF	InSitu Troll 9000	33205	pass (pH fail)	pass (pH Fail)

Parameters	**Field Measurements**									
Time:	15:39	15:42	15:44	15:49	15:52	15:58	16:01			
Depth BWS (ft):	3.0	4.0	5.0	6.0	7.0	8.0	Bot			
Temp (°C):	0.17	0.18	0.34	0.59	0.80	0.99	1.11			
pH:										
Barometeric (mmHg):	740.5	740.5	740.5	740.4	740.5	740.4	740.4			
Pressure (kPa):	7.334	10.215	13.469	16.473	19.326	22.577	24.784			
Conductivity (µS/cm):	57.61	57.10	56.49	55.57	55.18	55.49	56.02			
RDO (ppm): (mg/L)	13.66	13.62	13.32	12.01	10.49	7.86	5.71			
Turbidity (NTU):	1.5	1.3	1.5	1.7	1.8	2.7	5.8			
ORP	161	166	171	179	184	189	185			

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)										
Alkalinity (mg/L as $CaCO_3$)										
Total iron--UF (mg/L)										
Filtered Iron--F tot Fe (mg/L)										
Ammonia (mg/L NH_3-N)****										
Ammonia/ Iron dilution										

Remarks:

Field-Form Filled Out By: Blackburn Date: 12/19/06

QAQC Check By: Reichardt Date: 12/20/06

University of Alaska Fairbanks, Water and Environmental Research Center

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

Project ID: **North Slope Lakes** Site Location/Lake ID: L9312-SH

Sample Purpose: **Lake Water Quality** Date: 12/19/06 Time: 14:47

FIELD MEASUREMENTS

GPS Coord. Northing: N70°20.017' Easting: W150°57.076' Datum: WGS84

Measurements By: DAR Time: 14:47

Water Depth (ft): 10 Ice Thickness (ft): 2.4

Freeboard (ft): 0.25 Snow Depth (ft): 0.2

Elev. (BPMSL): 95.94 Survey By: J. Derry Date: 12/19/06 Time: 11:40

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

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	UAF	InSitu Troll 9000	33205	pass (pH fail)	pass (pH Fail)

Parameters	**Field Measurements**									
Time:	14:54	14:58	15:00	15:02	15:09	15:18	15:25	15:28		
Depth BWS (ft):	3.0	4.0	5.0	6.0	8.0	9.0	10.0	Bot		
Temp (°C):	0.14	0.21	0.40	0.56	1.15	1.34	1.51	1.52		
pH:										
Barometeric (mmHg):	740.5	740.5	740.6	740.6	740.6	740.6	740.6	740.7		
Pressure (kPa):	7.465	10.335	13.311	16.335	22.328	25.441	28.375	29.138		
Conductivity (µS/cm):	-	56.03	55.39	55.01	54.45	55.39	57.77	57.78		
RDO (ppm): (mg/L)	-	14.79	14.54	14.24	9.21	6.41	2.66	2.19		
Turbidity (NTU):	-	1.4	1.4	1.6	2.0	2.3	4.4	20.5		
ORP	-	175	177	179	192	184	159	140		

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)										
Alkalinity (mg/L as $CaCO_3$)										
Total iron--UF (mg/L)										
Filtered Iron--F tot Fe (mg/L)										
Ammonia (mg/L NH_3-N)****										
Ammonia/ Iron dilution										

Remarks: Log 2006-12-19 143711

Field-Form Filled Out By: Blackburn Date: 12/19/06

QAQC Check By: Reichardt Date: 12/20/06

APPENDIX B. WATER QUALITY METER CALIBRATION FORMS

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: Prudhoe SRT Lab

Sample Purpose: **Lake Water Quality**

WATER QUALITY METER INFORMATION

Meter Make: In-Situ Model: Troll 9000

Owner: GWS S/N: 33033

CALIBRATION AND QUALITY ASSURANCE INFORMATION

Pre/Post-Sampling QA

Parameter	Date	Time	Standard	Lot No.	Exp.	Meter Reading	Temp (^{o}C)	Pass/Fail
pH	12/14/06	18:00	Oakton 4.01	2610411	10/1/08	4.07	11.93	Pass
pH	12/14/06	18:00	Oakton 7.00	2616412	10/1/08	7.00	12.80	Pass
pH	12/14/06	18:00	Oakton 10.00	2610413	4/1/08	10.06	12.67	Pass
ORP	12/14/06	18:00	InSitu QuickCal	30006B	5/1/07	235	11.68	Pass
RDO - 100% DO	12/14/06	18:00	Bubbled Nanopure	n/a	n/a	9.53	16.74	Pass
RDO - Zero DO	12/14/06	18:00	HANNA HI7040	G1012	2/1/11	0.00	n/a	Pass
Conductivity	12/14/06	18:00	Oakton 447uS	2609077	9/1/07	368.6	11.51	Pass

Remarks: Barometer = 759.7 mm Hg. ORP read in mV, RDO read in mg/L, Conductivity read in uS/cm AC. Pre sample cal check KDA.

Field-Form Filled Out By:	Blackburn	Date:	12/14/2006			
QAQC Check By:	Reichardt	Date:	12/21/2006			

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: Prudhoe SRT Lab

Sample Purpose: **Lake Water Quality**

WATER QUALITY METER INFORMATION

Meter Make: In-Situ Model: Troll 9000

Owner: GWS S/N: 33033

CALIBRATION AND QUALITY ASSURANCE INFORMATION

Pre/Post-Sampling QA

Parameter	Date	Time	Standard	Lot No.	Exp.	Meter Reading	Temp (^{o}C)	Pass/Fail
pH	12/14/06	18:00	Oakton 4.01	2610411	10/1/08	4.07	11.93	Pass
pH	12/14/06	18:00	Oakton 7.00	2616412	10/1/08	7.00	12.80	Pass
pH	12/14/06	18:00	Oakton 10.00	2610413	4/1/08	10.06	12.67	Pass
ORP	12/14/06	18:00	InSitu QuickCal	30006B	5/1/07	235	11.68	Pass
RDO - 100% DO	12/14/06	18:00	Bubbled Nanopure	n/a	n/a	9.53	16.74	Pass
RDO - Zero DO	12/14/06	18:00	HANNA HI7040	G1012	2/1/11	0.00	n/a	Pass
Conductivity	12/14/06	18:00	Oakton 447uS	2609077	9/1/07	368.6	11.51	Pass

Remarks: Barometer = 759.7 mm Hg. ORP read in mV, RDO read in mg/L, Conductivity read in uS/cm AC. Pre sample cal check KDA.

Field-Form Filled Out By:	Blackburn	Date:	12/14/2006			
QAQC Check By:	Reichardt	Date:	12/21/2006			

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: Prudhoe SRT Lab

Sample Purpose: **Lake Water Quality**

WATER QUALITY METER INFORMATION

Meter Make: In-Situ Model: Troll 9000

Owner: GWS S/N: 33033

CALIBRATION AND QUALITY ASSURANCE INFORMATION

Pre/Post-Sampling QA

Parameter	Date	Time	Standard	Lot No.	Exp.	Meter Reading	Temp (^{o}C)	Pass/Fail
pH	12/15/06	22:01	Oakton 4.01	2610411	10/1/08	3.99	11.93	Pass
pH	12/15/06	22:02	Oakton 7.00	2616412	10/1/08	6.96	12.80	Pass
pH	12/15/06	22:04	Oakton 10.00	2610413	4/1/08	9.96	12.67	Pass
ORP	12/15/06	22:06	InSitu QuickCal	30006B	5/1/07	241	11.68	Pass
RDO - 100% DO	12/15/06	21:31	Bubbled Nanopure	n/a	n/a	10.06	16.74	Pass
RDO - Zero DO	12/15/06	21:36	HANNA HI7040	G1012	2/1/11	0.02	n/a	Pass
Conductivity	12/15/06	21:36	Oakton 447uS	2609077	9/1/07	333.6	11.51	Pass

Remarks: ORP read in mV, RDO read in mg/L, Conductivity read in uS/cm AC. Pre sample cal check for MSB.

Field-Form Filled Out By:	Blackburn	Date:	12/15/2006			
QAQC Check By:	Reichardt	Date:	12/21/2006			

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: Prudhoe SRT Lab

Sample Purpose: **Lake Water Quality**

WATER QUALITY METER INFORMATION

Meter Make: In-Situ Model: Troll 9000

Owner: GWS S/N: 33033

CALIBRATION AND QUALITY ASSURANCE INFORMATION

Pre/Post-Sampling QA

Parameter	Date	Time	Standard	Lot No.	Exp.	Meter Reading	Temp (^{o}C)	Pass/Fail
pH	12/15/06	22:01	Oakton 4.01	2610411	10/1/08	4.09	10.28	Pass
pH	12/15/06	22:02	Oakton 7.00	2616412	10/1/08	7.08	10.81	Pass
pH	12/15/06	22:04	Oakton 10.00	2610413	4/1/08	10.23	n/a	Fail
ORP	12/15/06	22:06	InSitu QuickCal	30006B	5/1/07	241	11.68	Pass
RDO - 100% DO	12/15/06	21:31	Bubbled Nanopure	n/a	n/a	10.06	16.74	Pass
RDO - Zero DO	12/15/06	21:36	HANNA HI7040	G1012	2/1/11	0.02	n/a	Pass
Conductivity	12/15/06	21:36	Oakton 447uS	2609077	9/1/07	333.6	11.51	Pass

Remarks: ORP read in mV, RDO read in mg/L, Conductivity read in uS/cm AC. Post sample cal check for KDA.

Field-Form Filled Out By:	Blackburn	Date:	12/15/2006			
QAQC Check By:	Reichardt	Date:	12/21/2006			

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: Prudhoe SRT Lab

Sample Purpose: **Lake Water Quality**

WATER QUALITY METER INFORMATION

Meter Make: In-Situ Model: Troll 9000

Owner: GWS S/N: 33033

CALIBRATION AND QUALITY ASSURANCE INFORMATION

Pre/Post-Sampling QA

Parameter	Date	Time	Standard	Lot No.	Exp.	Meter Reading	Temp (^{o}C)	Pass/Fail
pH	12/16/06	22:30	Oakton 4.01	2610411	10/1/08	1.01	11.04	Pass
pH	12/16/06	22:33	Oakton 7.00	2616412	10/1/08	6.97	11.30	Pass
pH	12/16/06	22:36	Oakton 10.00	2610413	4/1/08	10.00	10.10	Pass
ORP	12/16/06	22:18	InSitu QuickCal	30006B	5/1/07	237	13.85	Pass
RDO - 100% DO	12/16/06	22:08	Bubbled Nanopure	n/a	n/a	9.98	17.95	Pass
RDO - Zero DO	12/16/06	22:14	HANNA HI7040	G1012	2/1/11	-0.01	n/a	Pass
Conductivity	12/16/06	22:27	Oakton 447uS	2609077	9/1/07	334.9	11.78	Pass

Remarks: Barometer = 751.5 mm Hg. ORP read in mV, RDO read in mg/L, Conductivity read in uS/cm AC. Post sample cal check for MSB.

Field-Form Filled Out By:	Blackburn	Date:	12/16/2006			
QAQC Check By:	Reichardt	Date:	12/21/2006			

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: Prudhoe SRT Lab

Sample Purpose: **Lake Water Quality**

WATER QUALITY METER INFORMATION

Meter Make: In-Situ Model: Troll 9000

Owner: GWS S/N: 33205

CALIBRATION AND QUALITY ASSURANCE INFORMATION

Pre/Post-Sampling QA

Parameter	Date	Time	Standard	Lot No.	Exp.	Meter Reading	Temp (^{o}C)	Pass/Fail
pH	12/18/06	15:38	Oakton 4.01	2610411	10/1/08	4.01	13.09	Pass
pH	12/18/06	15:33	Oakton 7.00	2610412	10/1/08	6.99	13.18	Pass
pH	12/18/06	15:40	Oakton 10.00	2610413	4/1/08	10.13	13.38	Fail
ORP	12/18/06	15:43	InSitu QuickCal	30006B	5/1/07	244	12.75	Pass
RDO - 100% DO	12/18/06	15:11	Bubbled Nanopure	n/a	n/a	100%	n/a	Pass
RDO - Zero DO	12/18/06	15:23	HANNA HI7040	G1012	2/1/11	-0.02	n/a	Pass
Conductivity	12/18/06	15:46	Oakton 447uS	2609077	9/1/07	372.3	n/a	Pass

Remarks: Barometer = ORP read in mV, RDO read in mg/L, Conductivity read in uS/cm AC. Pre sample cal check for L9312.

Field-Form Filled Out By:	Blackburn	Date:	12/18/2006			
QAQC Check By:	Reichardt	Date:	12/21/2006			

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: Prudhoe SRT Lab

Sample Purpose: **Lake Water Quality**

WATER QUALITY METER INFORMATION

Meter Make: In-Situ Model: Troll 9000

Owner: GWS S/N: 33205

CALIBRATION AND QUALITY ASSURANCE INFORMATION

Pre/Post-Sampling QA

Parameter	Date	Time	Standard	Lot No.	Exp.	Meter Reading	Temp (^{o}C)	Pass/Fail
pH	12/19/06	17:41	Oakton 4.01	2610411	10/1/08	4.16	12.23	Fail
pH	12/19/06	17:41	Oakton 7.00	2610412	10/1/08	7.14	12.04	Fail
pH	12/19/06	17:43	Oakton 10.00	2610413	4/1/08	10.29	12.15	Fail
ORP	12/19/06	17:46	InSitu QuickCal	30006B	5/1/07	237	13.15	Pass
RDO - 100% DO	12/19/06	17:10	Bubbled Nanopure	n/a	n/a	100%	n/a	Pass
RDO - Zero DO	12/19/06	17:40	HANNA HI7040	G1012	2/1/11	0.06	n/a	Pass
Conductivity	12/19/06	17:46	Oakton 447uS	2609077	9/1/07	336.8	12.32	Pass

Remarks: Barometer = ORP read in mV, RDO read in mg/L, Conductivity read in uS/cm AC. Post sample cal check for L9312.

Field-Form Filled Out By:	Blackburn	Date:	12/19/2006			
QAQC Check By:	Reichardt	Date:	12/21/2006			

APPENDIX C. ELEVATION SURVEY FORMS

University of Alaska Fairbanks, Water and Environmental Research Center

Form F-011: Elevation Survey Form

Project ID: **North Slope Lakes** Site Location/Lake ID: Kuparuk Dead Arm

Survey Purpose: **Water-Level Elevations** Date: 12/14/2006 Time: 15:00

Location:	Kuparuk Deadarm Reservoirs Cells 1, 2, 3							
Survey objective:	Lake water elevation survey					Weather Observations:		
Instrument Type:	Leica NA720	Instrument ID:	5482372 (GWS owned)			high overcast, visibility unrestricted, getting dark minus 7 F at 3 mph		
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)		Jeff Derry Amanda Blackburn		
BM #1 WO040768	BP	19.32	N70 20.065 NAD27	N70 20.065 NAD27				
Station	**BS (ft)**	**HI (ft)**	**FS (ft)**	**Elevation (fasl)**	**Distance (ft)**	**Horizontal Angle**	**Vertical Angle**	**Remarks**
BM#1	1.16	20.48		19.32				Shot to flagged benchmark
KDA3		20.48	13.13	7.35				All measurements are to water level.
KDA2		20.48	13.12	7.36				
								Turn point, Moved instrument.
KDA2	13.40	20.76		**7.36**				**WS Elevation for Reservoir #2**
KDA3		20.76	13.40	**7.36**				**WS Elevation for Reservoir #3**
BM#1		20.76	1.45	19.31				Survey closes within + 0.01'
KDA2	8.39	15.75		7.36				Used water level of KDA2 to acquire KDA1
KDA1		15.75	7.44	8.31				
								Turn point. Moved on KDA1
KDA1	7.65	15.96		**8.31**				**WS Elevation for Reservoir #1**
KDA2		15.96	8.6	7.36				Close survey to 0.00
Note: Field notes use temperary datum for BM #1 = 100.00 ft.								
KDA2-S1 is in NW Corner of Resevoir 2, KDA3-S1 is in SW Corner of Resevoir 3, BM #1 is set in dirt west of dike with pink flagging. KDA2-S2 is in SE Corner of Resevoir 2. KDA1-S1 is in NE corner of Resevoir 1.								

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: 12/16/2006 Time: 16:18

Location:	Mine Site B, NE corner of North Cell, temporary datum							
Survey objective:	Lake water elevation survey					Weather Observations:		high overcast, visibility unrestricted, light weak.
Instrument Type:	Leica NA720		Instrument ID:	5482372 (GWS owned)		minus 5 F at 3 mph		
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)		Dan Reichardt, Jeff Derry		
TBM_1	nr	100 Temp.	na	na				

Station	**BS (ft)**	**HI (ft)**	**FS (ft)**	**Elevation (fasl)**	**Distance (ft)**	**Horizontal Angle**	**Vertical Angle**	**Remarks**
TBM_1	6.45	106.45		100.00				Top of Post embedded in gravel
MSB_N		106.45	11.40	95.05				Water Level towards middle of north cell
TBM_4		106.45	5.04	101.41				Top of cut pipe embedded in gravel
TBM_3		106.45	2.96	103.49				Top of weld on side of support post
TBM_2		106.45	2.59	103.86				Top of weld on side of support post
								Turn point. Moved on TBM_2
TBM_2	2.23	106.09		103.86				
TBM_3		106.09	2.60	103.49				
TBM_4		106.09	4.68	101.41				
MSB_N		106.09	11.00	95.09				**priority**
TBM_1		106.09	6.08	100.01				Close survey to 0.01
MSB_N	8.38	103.47		95.09				north and south cells. Set up on island
MSB_S		103.47	8.37	95.10				
								Turn point. Moved on MSB_S
MSB_S	8.36	103.46		95.10				
MSB_N		103.46	8.36	95.10				Close survey to 0.01
Note: Field notes use temperary datum for TBM_1 = 100.00 ft.								

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: L9312

Survey Purpose: **Water-Level Elevations** Date: 12/19/2006 Time: 12:30

Location:	L9312, Survey to LCMF BM elevations. Point "P" is 11.72'							
Survey objective:	Lake water elevation survey					Weather Observations:		overcast
Instrument Type:	Leica NA720		Instrument ID:	5482372 (GWS owned)		minus 10 F at 5 mph		
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)		Jeff Derry Matthew Whitman		
P	LCMF	11.72	na	na				

Station	**BS (ft)**	**HI (ft)**	**FS (ft)**	**Elevation (fasl)**	**Distance (ft)**	**Horizontal Angle**	**Vertical Angle**	**Remarks**
P	2.32	14.04		11.72				
O		14.04	2.54	11.50				0.04 high
PH-VSM		14.04	-0.56	14.60				0.03' high
Water Surface		14.04	6.38	7.66				**WS Elevation for L9312**
								Turn point. Moved on Water Surface
Water Surface	5.91	13.57		7.66				
PH-VSM		13.57	-1.03	14.60				close point to 0.00
O		13.57	2.07	11.50				close point to 0.00
P		13.57	1.85	11.72				close survey 0.00'
Note:								
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

APPENDIX D. SNOW SURVEY FORMS

University of Alaska Fairbanks, Water and Environmental Research Center

Form F-012: Snow Depth and Water Content Survey Form

Project ID: **North Slope Lakes Project** Site Location/Lake ID: **Kuparuk Dead Arm**

Survey Purpose: **Snow Depth and Water Content** Date: 12/15/2006 Time: 14:00

Location Description:	Located at center of Lake 2 near KDA2-CT. "L" shaped pattern, first going north, then going west 1 meter for 25 meters.				
Survey objective:	Snow depths and snow-water content for lake recharge estimates			Weather Observations:	High overcast, low wind, dark.
Latitude:		Longitude:		Datum:	
Elevation:	nr	Elevation Datum:		Reference Markers:	Site staked with lathe
Drainage Basin:	Kuparuk	Slope Direction:	flat	Vegetation Type:	Snow Survey located on ice
Slope Angle:	Flat	Access Notes:	none	Other:	1 meter increments
Snow Depth Probe Type:		T-handle snow depth probe,		Snow-Survey Team Names	
Snow Tube Type:	Adirondak, 6.74 cm diameter cutter, area = 35.7 cm^2			Jeff Derry	

Snow Course Depths, in cm.

	1	2	3	4	5
1	7.0	6.0	8.0	4.0	9.0
2	6.0	6.0	9.0	3.0	1.0
3	7.0	6.0	13.0	4.0	1.0
4	7.0	5.0	11.0	1.0	2.0
5	6.0	6.0	11.0	6.0	2.0
6	5.0	5.0	7.0	5.0	3.0
7	4.0	1.0	5.0	7.0	1.0
8	4.0	6.0	3.0	7.0	1.0
9	7.0	7.0	3.0	8.0	4.0
10	8.0	5.0	1.0	5.0	1.0

	(cm)
Average snow depth =	**5.2**
Maximum snow depth =	13.0
Minimum snow depth =	1.0
Standard variation =	2.9

Snow Sample Depths and Weights

Bag #	Depth (cm)	Weight (gr)	Volume (cm^3)	Density (gr/cm^3)
DW4-1	24.77	247.0	884.3	0.28
DW4-2	17.78	214.0	634.7	0.34
DW4-3	5.08	31.0	181.4	0.17
DW4-4	17.78	220.0	634.7	0.35
DW4-5	10.16	105.0	362.7	0.29
			Average Density =	**0.28**
			Average Snow Water Equivalent (SWE) =	**1.5** cm H2O
			Average Snow Water Equivalent =	**0.58** 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 Project**	Site Location/Lake ID:	**Betty Pingo**
Survey Purpose:	**Snow Depth and Water Content**	Date: 12/15/2006	Time: 6:00pm

Location Description:	App. 150 yards north-west of Wyoming gauge. L-shaped, 25 m by 25 m. Measurments took every 1 meter.				
Survey objective:	Snow depths and snow-water content for comparison with lake snow survey				
Latitude:		Longitude:	W 148° 53.856	Datum:	NAD83 Alaska Titled BP0611 - Jeff's GPS
Elevation:		Elevation Datum:		Reference Markers:	Wyoming precipitation gauge
Drainage Basin:		Slope Direction:	Flat	Vegetation Type:	Tussock
Slope Angle:	Flat	Access Notes:	truck	Other:	1 meter increments
Snow Depth Probe Type:		T-handle snow depth probe		Snow-Survey Team Names	
Snow Tube Type:	Adirondak, 6.74 cm diameter cutter, area = 35.7 cm^2			Jeff Derry, Dan Reichardt	

Snow Course Depths, in cm.

	1	2	3	4	5
1	2.0	10.0	6.0	8.0	2.0
2	1.0	12.0	6.0	8.0	5.0
3	2.0	15.0	8.0	7.5	3.0
4	5.0	13.5	6.0	5.0	1.0
5	5.0	11.0	8.0	0.0	1.0
6	5.0	9.0	5.0	0.5	2.0
7	5.0	5.0	5.5	0.0	3.0
8	5.5	2.0	6.0	0.5	10.0
9	9.0	6.0	1.0	2.0	12.0
10	9.5	5.0	5.0	0.5	11.0

	(cm)
Average snow depth =	**5.5**
Maximum snow depth =	15.0
Minimum snow depth =	0.0
Standard variation =	3.8

Snow Sample Depths and Weights

Bag #	Depth (cm)	Weight (gr)	Volume (cm^3)	Density (gr/cm^3)
DW3-1	5.08	40.0	181.4	0.22
DW3-2	5.08	58.0	181.4	0.32
DW3-3	5.08	57.0	181.4	0.31
DW3-4	12.7	124.0	453.4	0.27
DW3-5	12.7	94.0	453.4	0.21
		Average Density =		**0.27**
		Average Snow Water Equivalent (SWE) =		**1.5** cm H2O
		Average Snow Water Equivalent =		**0.58** 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 Project** Site Location/Lake ID: **Mine Site B**
Survey Purpose: **Snow Depth and Water Content** Date: 12/16/2006 Time: 15:00

Location Description:	Located at center of north cell near MSBN-CT. "L" shaped pattern, first going west 1 meter for 25 meters and then north 1 meter for 25 meters.				
Survey objective:	Snow depths and snow-water content for lake recharge estimates			Weather Observations:	High overcast, low wind, dark.
Latitude:		Longitude:		Datum:	NAD27 Alaska
Elevation:		Elevation Datum:		Reference Markers:	Center of north cell
Drainage Basin:	Mine Site B	Slope Direction:	Flat	Vegetation Type:	Ice Surface
Slope Angle:	Flat	Access Notes:	none	Other:	1 meter increments
Snow Depth Probe Type:		T-handle snow depth probe,		Snow-Survey Team Names	
Snow Tube Type:	Adirondak, 6.74 cm diameter cutter, area = 35.7 cm^2			Jeff Derry	

Snow Course Depths, in cm.

	1	2	3	4	5
1	4.0	5.0	5.0	5.0	8.0
2	5.0	1.0	4.0	5.0	6.0
3	9.0	1.0	2.0	5.0	5.0
4	9.0	5.0	1.0	4.0	5.0
5	9.0	2.0	2.0	2.0	8.0
6	6.0	5.0	7.0	3.0	7.0
7	3.0	6.0	6.0	5.0	8.0
8	4.0	6.0	6.0	5.0	6.0
9	8.0	7.0	6.0	7.0	2.0
10	5.0	4.0	6.0	6.0	2.0

	(cm)
Average snow depth =	**5.1**
Maximum snow depth =	9.0
Minimum snow depth =	1.0
Standard variation =	2.1

Snow Sample Depths and Weights

Bag #	Depth (cm)	Weight (gr)	Volume (cm^3)	Density (gr/cm^3)
DW4-1	7.62	64.0	272.0	0.24
DW4-2	7.62	62.0	272.0	0.23
DW4-3	21.59	219.0	770.8	0.28
DW4-4	21.59	230.0	770.8	0.30
DW4-5	16.51	166.0	589.4	0.28

Average Density = **0.27**
Average Snow Water Equivalent (SWE) = **1.3** cm H2O
Average Snow Water Equivalent = **0.53** inches H2O
Average Snow Water Equivalent = **0.04** 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 Project** Site Location/Lake ID: **L9312**
Survey Purpose: **Snow Depth and Water Content** Date: 12/19/2006 Time: NR

Location Description:	Did "L" shape, started at lake between belford gauge and snow sensor. Went North, then West.				
Survey objective:	Snow depths and snow-water content for lake recharge estimates			Weather Observations:	overcast
Latitude:	N 70º19.9444'	Longitude:	W 150º 57.047'	Datum:	NAD27 Alaska
Elevation:	NR	Elevation Datum:	BPMSL	Reference Markers:	Site marked with GPS
Drainage Basin:	L9312	Slope Direction:	flat	Vegetation Type:	snow depth on ice surface
Slope Angle:	Flat	Access Notes:		Other:	1 meter increments
Snow Depth Probe Type:		T-handle snow depth probe,		Snow-Survey Team Names	
Snow Tube Type:	Adirondak, 6.74 cm diameter cutter, area = 35.7 cm^2			Jeff Derry, Dan Reichardt	

Snow Course Depths, in cm.

	1	2	3	4	5
1	13	16	24	29	30
2	14	14	15	14	48
3	15	19	13	16	24
4	8.5	16	19	9	24
5	15	16	14	21	17
6	13	15	8	14	15
7	15	27	14	11	26
8	17	29	15	12	22
9	13	30	13	26	44
10	18	25	28	11	41

	(cm)
Average snow depth =	**19.3**
Maximum snow depth =	48.0
Minimum snow depth =	8.0
Standard variation =	8.7

Snow Sample Depths and Weights

Bag #	Depth (cm)	Weight (gr)	Volume (cm^3)	Density (gr/cm^3)
DW3-1				
DW3-2				
DW3-3				
DW3-4				
DW3-5				

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)

L9312: Snow depth transects:

Project ID: **North Slope Lakes Project** Site Location/Lake ID: **L9312**
Survey Purpose **Snow Depth and Water Content** Date: 12/19/2006 Time: 3:00:00 PM

Location Description:	Transects conducted in north/southerly and east/westerly direction. East/west starts at lathe on easterly side of lake and heads towards east side of pump house. North/south begins at closest orange pole marking snow course at southerly end of lake and heading towards Alpine.			
Survey objective:	Snow depths and snow-water content for lake recharge estimates		Weather Observations:	Visibility unrestricted.
Elevation:	100' approximately		Reference Markers:	Lathe and orange snow course pole
Drainage Basin:	L9312	Slope Direction: Flat	Vegetation Type:	snow depth on ice surface and tundra

EAST/WEST TRANSECT

increment (ft)	depth (cm)		increment (ft)	depth (cm)	increment (ft)	depth (cm)	increment (ft)	depth (cm)	increment (ft)	depth (cm)
0	32	Begin on Tundra	480	4	960	5	1440	5	1920	12
10	25		490	4	970	4	1450	7	1930	25
20	24		500	5	980	5	1460	7	1940	31
30	14		510	3	990	3	1470	9	1950	19
40	19		520	11	1000	1	1480	8		
50	28		530	9	1010	4	1490	8		
60	33		540	10	1020	7	1500	12		
70	14		550	7	1030	5	1510	7		
80	18		560	7	1040	11	1520	9		
90	16		570	5	1050	7	1530	4		
100	11		580	4	1060	6	1540	4		
110	17		590	11	1070	6	1550	6		
120	26		600	13	1080	5	1560	15		
130	16		610	10	1090	5	1570	5		
140	32		620	4	1100	5	1580	6		
150	50	Begin Transition z	630	3	1110	6	1590	6		
160	210		640	4	1120	8	1600	6		
170	200		650	4	1130	9	1610	4		
180	200		660	4	1140	11	1620	5		
190	180		670	5	1150	7	1630	5		
200	150		680	2	1160	6	1640	4		
210	125		690	5	1170	8	1650	13		
220	86		700	3	1180	10	1660	8		
230	45		710	6	1190	12	1670	13		
240	30		720	15	1200	12	1680	11		
250	17		730	14	1210	15	1690	9		
260	17		740	6	1220	15	1700	8		
270	10	Transition to lake	750	3	1230	10	1710	10		
280	8		760	9	1240	20	1720	7		
290	7		770	4	1250	14	1730	4		
300	20		780	15	1260	13	1740	8		
310	16		790	6	1270	8	1750	16	Begin Transition zone	
320	17		800	3	1280	7	1760	24		
330	15		810	5	1290	10	1770	28		
340	12		820	3	1300	8	1780	9		
350	11		830	4	1310	3	1790	25		
360	4		840	5	1320	5	1800	24		
370	8		850	5	1330	11	1810	12		
380	7		860	2	1340	5	1820	26		
390	7		870	3	1350	4	1830	34		
400	9		880	6	1360	10	1840	25		
410	8		890	10	1370	6	1850	12	Transition to tundra	
420	4		900	5	1380	8	1860	12		
430	6		910	5	1390	8	1870	25		
440	6		920	17	1400	6	1880	25		
450	6		930	10	1410	2	1890	45		
460	11		940	7	1420	7	1900	12		
470	6		950	6	1430	10	1910	10		

L9312: Snow depth transects:

Project ID:	**North Slope Lakes Project**	Site Location/Lake ID:	**L9312**
Survey Purpose	**Snow Depth and Water Content**	Date: 12/19/2006	Time: 3:00:00 PM

Location Description:	Transects conducted in north/southerly and east/westerly direction. East/west starts at lathe on easterly side of lake and heads towards east side of pump house. North/south begins at closest orange pole marking snow course at southerly end of lake and heading towards Alpine.			
Survey objective:	Snow depths and snow-water content for lake recharge estimates		Weather Observations:	Visibility unrestricted.
Elevation:	100' approximately		Reference Markers:	Lathe and orange snow course pole
Drainage Basin:	L9312	Slope Direction: Flat	Vegetation Type:	snow depth on ice surface and tundra

NORTH/SOUTH TRANSECT

increment (ft)	depth (cm)		increment (ft)	depth (cm)	increment (ft)	depth (cm)	
0	14		1180	5	2360	10	
20	19	Begin on Tundra	1200	4	2380	7	
40	53		1220	5	2400	8	
60	21		1240	11	2420	4	
80	17		1260	9	2440	8	
100	9		1280	4	2460	4	
120	40	Begin Transition zone	1300	5	2480	4	
140	23		1320	3	2500	7	
160	13		1340	4	2520	5	
180	18		1360	5	2540	8	
200	8		1380	5	2560	6	
220	6		1400	3	2580	3	
240	5		1420	3	2600	18	
260	5	Transition to lake	1440	5	2620	10	
280	4		1460	5	2640	3	
300	3		1480	6	2660	2	
320	4		1500	7	2680	6	
340	6		1520	6	2700	14	
360	4		1540	10	2720	13	
380	6		1560	6	2740	6	
400	4		1580	5	2760	9	
420	7		1600	4	2780	6	
440	2		1620	6	2800	10	Begin Transition zone
460	5		1640	7	2820	13	
480	4		1660	8	2840	11	
500	7		1680	5	2860	14	
520	4		1700	6	2880	16	
540	15		1720	16	2900	15	
560	2		1740	11	2920	20	
580	3		1760	5	2940	19	Transition to tundra
600	4		1780	7	2960	20	
620	5		1800	4	2980	15	
640	9		1820	5	3000	21	
660	8		1840	7	3020	27	
680	4		1860	12	3040	15	
700	7		1880	3			
720	5		1900	4			
740	5		1920	6			
760	11		1940	6			
780	9		1960	11			
800	6		1980	11			
820	5		2000	5			
840	7		2020	7			
860	4		2040	5			
880	6		2060	5			
900	6		2080	4			
920	5		2100	3			
940	8		2120	5			
960	4		2140	5			
980	5		2160	3			
1000	6		2180	6			
1020	3		2200	7			
1040	18		2220	5			
1060	8		2240	3			
1080	2		2260	5			
1100	5		2280	14			
1120	4		2300	10			
1140	11		2320	7			
1160	13		2340	5			