Alpine Area Lakes Recharge Studies

2013

Submitted by

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ACRONYMS AND ABBREVIATIONS

ADF&G	Alaska Department of Fish and Game
ADNR	Alaska Department of Natural Resources
Baker	Michael Baker Jr., Inc.
BPMSL	British Petroleum Mean Sea Level
CPAI	ConocoPhillips Alaska, Inc.
CRD	Colville River Delta
GIS	Geographic information system
GPS	Global positioning system
HWM	High water mark
NAD83	North American Datum of 1983
NRCS	Natural Resources Conservation Service
Mgal	Million gallons
SWE	Snow water equivalent
TBM	Temporary benchmark
WGS84	World Geodetic System 1984
WSE	Water surface elevation

DEFINITIONS

Bankfull	the water level or stage at which a stream, river or lake is at the top of its banks, and any further rise would result in water moving into the flood plain
Freeboard	the distance from the top of the ice to the water surface
Recharge	replacement of water volumes withdrawn for facilities maintenance/construction of ice roads and pads during the winter season and lost naturally through evaporation and transpiration

1.0 INTRODUCTION

Conoco Phillips Alaska, Inc., (CPAI) withdraws water and ice from lakes within the Colville River Delta (CRD). The use of ice roads and pads during the winter months is necessary for maintenance and operations at the Alpine oil field. This temporary infrastructure supports overland transportation of resources. Winter seasonal construction of ice roads and pads requires withdrawal of millions of gallons of fresh water and ice chips from area lakes, typically between December and May.

To comply with stipulations of Alaska Department of Fish and Game (ADF&G) Fish Habitat Permits and Alaska Department of Natural Resources (ADNR) Temporary Water Use Permits, CPAI conducts studies at water withdrawal lakes to document seasonal recharge. Michael Baker Jr., Inc. (Baker) conducted late season snow surveys and spring lake recharge studies to monitor water levels and provide photo documentation for permit compliance. This report summarizes the hydrologic observations, measurements, and analyses undertaken for this project.

Baker was supported during field monitoring by CPAI Alpine Environmental Coordinators, Umiaq/LCMF, LLC, and Bristow Helicopters. All Baker and support team crew members are recognized for their contribution to an incident-free field effort.

1.1 STUDY OVERVIEW

The objectives of the 2013 Alpine Area Lakes Recharge Studies include collection and analysis of spring breakup recharge data at nine water withdrawal lakes.

For the purposes of this report, the lakes are grouped as Detailed Study Lakes and General Study Lakes. The 2013 study lakes include:

Detailed Study Lakes	General Study Lakes	
M9602	B8530	B8531/L9326
M9603	B8533	L9323
M9605	L9324	M9607

The monitoring locations of both the Detailed Study Lakes and General Study Lakes are shown in Figure 1.1.

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2013 ALPINE AREA LAKES

RECHARGE STUDIES

MONITORING LOCATIONS

FIGURE: 1.1

(SHEET 1 of 1)

For 2013, photo documentation of pre-breakup and breakup monitoring and photographic evidence of hydrologic connections were the only requirements necessary to determine lake recharge at all lakes. However, existing staff gages used to measure water surface elevations (WSE) from past studies were restored during spring breakup setup and data was collected when Baker field personnel were in the vicinity of these lakes. Lake recharge was determined using visual observations and photos focusing on key hydrologic features including peak water levels, hydraulic connectivity with other bodies of water, and inflow/outflow locations.

Late-season snow surveys and calculation of available recharge volumes were conducted for the Detailed Study Lakes: M9602, M9603, and M9605. Delineation of lake catchment basins and determination of basin-specific snow water equivalent (SWE) values were performed at these lakes to calculate the 2013 potential snowmelt contribution and estimated recharge volumes. Catchment basins were delineated prior to field investigations using available topography and aerial imagery. Basin-specific SWE was calculated using data collected during late-season snow surveys performed prior to breakup. Potential snowmelt contribution was calculated using SWE values and delineated catchment basin areas. Estimated recharge volumes were calculated using WSE data and delineated lake specific area.

1.2 Lake Recharge Background

Annual recharge of lakes in the CRD occurs as a result of three primary mechanisms: spring breakup flooding, snow melt, and precipitation. Of these, spring breakup flooding and snow melt were investigated for this report and are considered overland flow. Lake elevation, proximity to streams, and local topography typically dictate the recharge mechanism. Lakes located within annually inundated stream floodplains or otherwise hydraulically connected areas recharge primarily from spring breakup flood flows. Lakes not inundated by flood flow because of distance or topographical limitations depend solely on snowmelt runoff and precipitation for recharge.

Lake recharge varies annually. The magnitude of spring breakup flooding differs from year to year in terms of stage and discharge. If flood stage is relatively low, recharge may not occur depending on topography and elevation. In addition to spring flooding, flow extents are affected by the unpredictable establishment and release of ice jams during breakup. Presence and location of ice jams can determine whether or not a lake becomes hydraulically connected to a stream recharge source regardless of flood magnitude.

The amount of snowmelt runoff a lake receives depends on terrain, topography, and the properties of the snow in the catchment basin. SWE of a basin can be determined by the depth and density of snow available within a catchment in the spring when melting occurs and is directly proportional to the quantity of potential snowmelt recharge. SWE will vary with the type of terrain and may be presented as a weighted, basin-specific value. For lakes sharing similar topographical and climatological features with those previously studied, average SWE values may be multiplied by catchment basin area to calculate a conservative estimate of potential snowmelt recharge. This method was previously used for lakes M9602 and M9605 (Baker 2010); a comparison of the 2010 thru 2013 results is included in Section 4.1.5, along with the 2013 results for Lake M9603.

In this study, the lake catchment basin terrain is designated as lake or tundra. Lake areas were assumed to contribute all snowmelt based on analysis of snow survey data and estimated recharge volumes. However, all tundra snowmelt will not directly contribute to lake recharge because of variations in vegetation and topography relative to the lake. Lower wetlands areas, for example, may retain a portion of snowmelt making recharge contribution dependent on snowmelt quantities and wetland elevations relative to the lake. The quantity of snowmelt retained in tundra areas differs for each lake catchment basin.

Kane et al. (1999) performed a study in the Kuparuk River Basin to determine an average quantity of snowmelt retained in tundra areas of lake catchment basins as a percentage of total potential snowmelt contribution based on estimated recharge quantities. Study findings suggest applying an average runoff coefficient of 0.67 to tundra SWE as a reduction factor to account for snowmelt retention.

In 2007, Baker performed a recharge monitoring study for lakes within the CRD. Results suggested an average tundra SWE runoff coefficient of 0.67, further validating the value obtained by Kane et al. (Baker 2007). Similar topography and proximity to the CRD and Kuparuk River basins justifies using a runoff coefficient of 0.67 for calculating the total estimated snowmelt contribution for lakes M9602, M9603, and M9605.

2.0 PERMITS AND WATER USE

CPAI requires water sources for use in building ice roads and ice pads, drilling, drinking water, and general operations. ADNR, ADF&G, or both agencies grant permits on the condition of CPAI compliance with temporary water use requirements to regulate water withdrawal and maintain conditions supportive of fish habitat. To maintain fish habitat, lakes must seasonally recharge water volumes borrowed during the winter season and lost naturally through evaporation. Fish Habitat and Temporary Water Use permits stipulate the quantities of water that may be withdrawn each water year. Additionally, these permits specify the form of water that may be borrowed from each lake, which varies as either liquid only, specific quantities of liquid and ice, or a total of both without designation of individual quantities. A water year is defined as one year beginning and ending with spring breakup (June through May). Actual withdrawal quantities are reported by CPAI per water year; these numbers are compared to the maximum water withdrawal allowed. If two permits are issued for one lake, the maximum water withdrawal by CPAI is less than or equal to the lesser allowable quantity.

Lakes M9602 and M9605 were permitted for specific borrow quantities of liquid and ice. Lakes M9603, L9323, L9324, B8531/L9326, B8533, B8530, and M9607 are permitted for a total of both without designation of individual quantities. Ice aggregate removal is permitted only over naturally grounded portions of the lake that are 4 feet deep or shallower.

Water and ice was withdrawn from all nine study lakes during the 2012/2013 ice road construction season. During the 2012/2013 season, lakes M9602 and M9605 were used as water and ice sources. A minimal amount, 0.01 million gallons (Mgal), of water was withdrawn from Lake M9603.

Table 2.1 summarizes the permits regulating water use and purpose at the nine water withdrawal lakes. The permitted versus actual withdrawal volumes by form are included in Table 2.1 and are based on fourth quarter 2012 and first and second quarter 2013 water use reports (CPAI 2012, 2013a, and 2013b).

Table 2.1: Summary of Permitted and Actual Withdrawal Volumes

Lake	Permit		Permit Expiration	Water Use Purpose	Permitted Volume [1]			Withdrawal Volume [3]		
	ADF&G	ADNR			Liquid	Ice	Total Water [2]	Liquid	Ice	Total Water
					(Mgal)					
B8530	FG03-III-0383	TWUP A2008-180	12/16/2013	Ice Road/Pad	--	--	32	--	--	8.64
B8531/L9326	FG03-III-0382	TWUP A2008-180	12/16/2013	Ice Road/Pad	--	--	6.59	--	--	3.94
B8533	FH03-III-0377 # 1	TWUP A2011-153	12/5/2016	DS/Wells Spt, Ice Road/Pad, Drilling Make-up	--	--	32.22	--	--	28.64
L9323	FH03-III-0380 #3	TWUP A2008-181	12/16/2013	DS/Wells Spt, Dust Control, Ice Road/Pad	--	--	8.51	--	--	7.96
L9324	FG03-III-0381 #2	TWUP A2008-181	12/16/2013	Ice Road/Pad	--	--	1.65	--	--	0.82
M9602	FH05-III-0327	TWUP A2010-119	12/2/2015	Ice Road/Pad	0.78	30.63	31.41	0	1.32	1.32
M9603	FH05-III-0338 #1	TWUP A2011-154	12/8/2016	Ice Road/Pad	--	--	8.72	--	--	0.01
M9605	FH05-III-0328	TWUP A2010-119	12/2/2015	Ice Road/Pad	8.52	13.62	22.14	7.14	4	11.14
M9607	FH03-III-0384 #2	TWUP A2008-180	12/16/2013	Ice Road/Pad	--	--	5.47	--	--	2.72

Notes:
1. Per water year
2. Total permitted withdrawal may be either ice, water, or a combination
3. Total withdrawal volume between June 1, 2012 and May 31, 2013

3.0 STUDY METHODS

3.1 CATCHMENT BASIN AREA DELINEATION (DETAILED STUDY LAKES)

The catchment basins for lakes M9602, M9603, and M9605, including lake and tundra areas, were delineated using satellite imagery, topographic maps, and visual assessment of the local topography prior to the field study. Topographic data for this area is limited and as a result, the catchment basin delineation for all three lakes is subjective. In addition to limited topography, seasonal data about nearby water bodies such as wetlands and ponds, that potentially contribute to recharge flow in the lakes, is lacking. These areas have additional capacity and were not included within the catchment basin delineation.

3.2 WATER SURFACE ELEVATION SURVEYS

To estimate lake water recharge, changes in WSE were measured at each study lake except B8533. Gages were rehabilitated for 2013 and an additional gage was installed at Lake M9603. WSE monitoring was conducted at eight study lakes during the pre-breakup, breakup, and post-breakup periods.

A staff gage assembly consists of a metal gage faceplate mounted on a two-by-four timber. The timber is attached with U-bolts to a 1.5-inch wide angle iron driven approximately 2 feet into the ground. All gages installed are indirect-read staff gages; meaning, the values read on the gage faceplate do not directly correspond to a known elevation. Photo 3.1 shows the gage setup at Lake L9323. A tabulated list of gage and temporary benchmark (TBM) locations is included in Appendix A.

Photo 3.1: Staff gage at Lake L9323, pre-breakup; May 13, 2013

Standard differential leveling techniques were used to establish staff gage elevations with local TBMs. A single new TBM was installed when a preexisting TBM was farther than ¼ mile from the study lake. New TBMs were all given an assumed elevation of 100.00 feet.

Elevations of the staff gages at lakes L9323 and L9324 were based on preexisting TBMs tied to British Petroleum Mean Sea Level (BPMSL) elevations. Elevations of gages at the remaining six lakes were based on TBMs established in 2010 and 2013 with assumed elevations of 100.00 feet; therefore, WSE recorded at staff gages tied to assumed elevations are relative. A staff gage tied to an assumed elevation is used to illustrate a change in WSE for the specific lake, and does not provide BPMSL elevations.

Pre-breakup WSE was found at all lakes, except M9602, M9603, and M9605, by using an electric drill to auger a 2-inch sampling hole in the ice covering the lake. Pre-breakup WSEs at M9602, M9603, and M9605 was attempted, but under-ice water was not found. Ice surface elevation was determined through differential leveling. WSE was calculated by subtracting measured freeboard from the ice surface elevation at the sample hole. Freeboard was measured using a pocket rod.

During site visits, the observed water level on the gage faceplates was recorded at lakes accessible from the road system (L9323, L9324). Chalk was applied to the angle iron during each site visit to capture high water marks (HWM). Subsequent HWMs were recorded during site visits when floodwaters removed the chalk. Remaining lakes not accessible from the road system were limited to pre-breakup survey and post-breakup investigation. In some cases, HWMs were not evident.

When water levels were not sufficiently high to be recorded on the staff gage face plates, standard differential leveling techniques were used to measure WSE. The horizontal position of each staff gage and TBM was recorded using a handheld global positioning system (GPS) in North American Datum of 1983 (NAD83). Gage readings associated with local ponding were recorded, but were not used to generate the lake recharge hydrograph.

3.3 Snow Water Equivalent Surveys (Detailed Study Lakes)

3.3.1 Double Sampling Method

A double sampling method snow survey was conducted on lakes M9602, M9603, and M9605, as recommended in various industry papers and the 2007 CRD lakes recharge report (Baker 2007). Prior to fieldwork, snow sampling points were identified along predetermined transects.

Each snow survey transect was positioned to align across or perpendicular to snow features such as drifts and local topography (Woo 1997). For the double sampling method, measurements were recorded by measuring snow depth and mass at a smaller number of sample points, and by measuring snow depth at a larger number of sample points. While vegetation is not a major factor affecting snow distribution in the arctic, terrain has a major effect. Terrain-based snow surveys allow for more accurate determinations of mean catchment snow values and produces sufficient spatial snow information for most hydrological studies (Woo 1997). For the purposes of this study, terrain was identified in the field as either lake (based on the presence of ice) or tundra (based on the presence of vegetation) for each sample collected. Terrain was verified using existing maps in a geographic information system (GIS).

3.3.2 Sampling Transects and Points

Aerial imagery and topographic contours were used to delineate the lake catchment basins. Transects were aligned radiating outwards from the estimated center of the lake to the edge of the drainage basin to account for variability of drifted snow across the ice and at and over banks. Additional transects were selected to capture irregularities including basin arms or other departures from a classic bowl shape.

Sampling points were then established along transects at a uniform spacing of approximately 200 feet. The total number of sampling points was dependent on the length of each transect and the anticipated variability in snow within the terrain unit. By placing a sampling point at the intersection of transects and spacing sampling points at a uniform distance along transects, random sampling was accomplished. Each terrain type covered by a single transect included at least one snow mass sampling point. Sampling points were stored in two GPS units.

At lakes M9602 and M9605, isolated mechanically disturbed areas of snow of various size and shapes were encountered. Berms were formed by snow clearing to access lake surface ice for aggregate removal, and by the accumulation of snow drifts. Prior to the survey, additional snow had re-covered previously cleared lake surfaces though not necessarily to the median natural depth. Snowmelt contribution from the berms was considered an additional lake recharge source. To estimate berm quantities, snow mass and depths were sampled along representative transects and berm areas were found by recording circumnavigation tracks in a GPS unit. Berm snowmelt contribution calculations were performed assuming natural median snow depth on the cleared areas was reached at the time of investigation.

3.3.3 Snow Density Sampling

Density measurements were conducted according to procedures outlined in *National Resource Conservation Service (NRCS) Snow Survey Sampling Guide* (NRCS 2006) and *British of Columbia Snow Survey Manual* (BC Ministry of Environment 1981), using a $1^5/_8$-inch ID Model 3600 Mt. Rose (Standard Federal) snow sampling tube and scale (Photo 3.2). This sampler was chosen based on its common acceptance and use by the NRCS. Snow depth alone was sampled using a graduated snow pole. If shallow snow was encountered having a SWE of less than 2 inches, estimated by having a depth of less than twelve inches, bulk sampling was conducted (NRCS 2006). Bulk sampling is a grouping of multiple samples collected in the immediate area of the sample point, recording sample depth of each sample and averaging, then weighing pooled core samples (Photo 3.3). Bulk samples are then divided by the number of samples collected to determine an average weight for the sample location (Baker 2007).

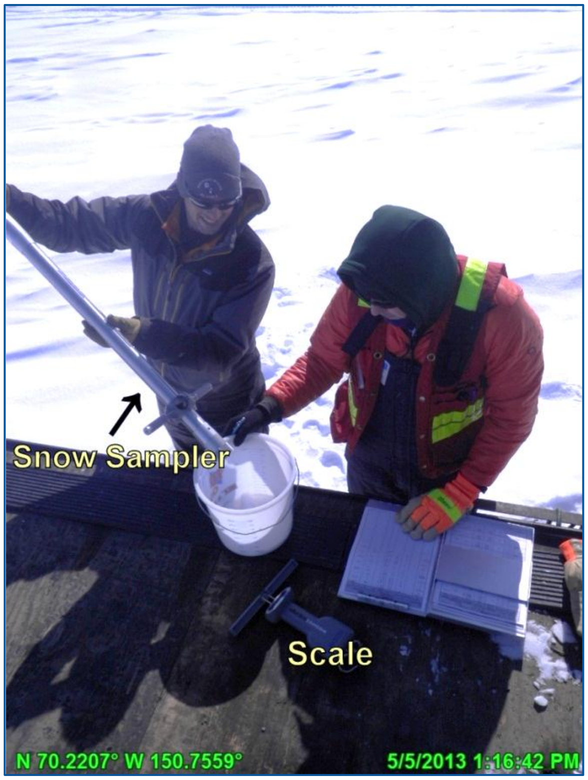


Photo 3.2: Model 3600 Mt. Rose Snow Sampler; May 5, 2013

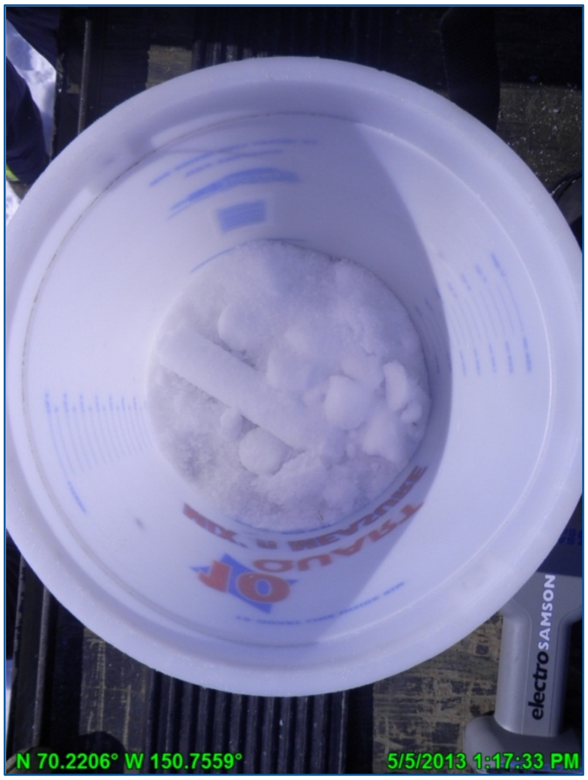


Photo 3.3: Bucket with pooled snow samples; May 5, 2013

3.3.4 SWE Lake Recharge Methods

The methods and equations used in this report for calculating SWE and the potential recharge contribution are the same used in the Baker 2007 report. Terrain-specific average snow depths were collected by field crews using the graduated snow pole (Photo 3.4) and snow sampler. To calculate the terrain specific snow depth for each lake catchment, Equation 1 was used.

Photo 3.4: Field crew taking snow depth measurements with a graduated snow pole; May 5, 2013

Equation 1 - Terrain Specific Snow Depth of Catchment

$$d_i = \left[\sum_{l=1}^{p} d_l\right] \Big/ p$$

$$d_i = Terrain\ Specific\ Snow\ Depth\ of\ Catchment\ (in)$$
$$l = Individual\ Sample$$
$$p = Total\ Number\ of\ Terrain\ Specific\ Depth\ Samples$$
$$d_l = Measured\ Snow\ Depth\ (in)$$

Terrain specific average snow densities were then calculated using the snow sampler's cross sectional area, core depth, and the weights of the snow samples using Equation 2.

Equation 2 – Terrain Specific Snow Density of Catchment

$$\rho_i = \left[\sum_{k=1}^{m} \left(\frac{M_{snow}}{A_{core} d_{snow}}\right)_k\right] \Big/ m$$

$$\rho_i = Terrain\ Specific\ Snow\ Density\ of\ Catchment\ (lb/in^3)$$
$$k = Individual\ Sample$$
$$m = Total\ Number\ of\ Terrain\ Specific\ Core\ Samples$$
$$M_{snow} = Measured\ Mass\ of\ Snow\ Sample\ (lb)$$
$$A_{core} = Area\ of\ Sampling\ Tube\ (in^2)$$
$$d_{snow} = Depth\ of\ Snow\ Sample\ (in)$$

Using the terrain specific snow densities, terrain specific SWE were then calculated using Equation 3.

Equation 3 – Terrain Specific SWE of Catchment

$$SWE_i = \frac{(\rho_i d_i)}{\rho_w}$$

$$SWE_i = Terrain\ Specific\ Snow\ Water\ Equivalent\ of\ Catchment\ (in)$$
$$\rho_i = Terrain\ Specific\ Snow\ Density\ (lb/in^3)$$
$$d_i = Terrain\ Specific\ Snow\ Depth\ (in)$$
$$\rho_w = Density\ of\ Fresh\ Water\ (lb/in^3)$$

An area weighted SWE was calculated for the catchment basins using Equation 4. This calculation is based on Woo (1997) and Rovansek, Kane, and Hinzman (1993).

Equation 4 – Catchment Specific, Area Weighted SWE

$$SWE_C = \frac{\left(\sum_{i=1}^{n} \rho_i d_i A_i \Big/ \sum_{i=1}^{n} A_i \right)}{\rho_w}$$

$$\begin{aligned}
&SWE_C = Catchment\ Specific\ Snow\ Water\ Equivalent\ (in) \\
&i = Terrain \\
&n = Total\ Terrains\ Sampled\ in\ Catchment \\
&\rho_i = Terrain\ Specific\ Snow\ Density\ \left(lb/in^3\right) \\
&d_i = Terrain\ Specific\ Snow\ Depth\ (in) \\
&A_i = Terrain\ Specific\ Area\ \left(ft^2\right) \\
&\rho_w = Density\ of\ Fresh\ Water\ \left(lb/in^3\right)
\end{aligned}$$

Total calculated potential snowmelt contribution (V_P) and estimated recharge (V_O) were found for each lake using Equation 5 and Equation 6. The 2007 delta-wide runoff coefficient of 0.67 was applied to snowmelt contributed from tundra areas to account for reduced tundra contribution.

Equation 5 –Total Calculated Potential Snowmelt Contribution, per Lake

$$V_P = C_1 \left(SWE_l\ A_l + 0.67\ SWE_t\ A_t \right)$$

$$\begin{aligned}
&V_P = Total\ Calculated\ Potential\ Snowmelt\ Contribution\ (gal) \\
&C_1 = Gallons\ of\ Water\ /\ ft^3\ /\ in \\
&SWE_l = Lake\ Specific\ Average\ Snow\ Water\ Equivalent\ (in) \\
&SWE_t = Tundra\ Specific\ Average\ Snow\ Water\ Equivalent\ (in) \\
&A_l = Lake\ Specific\ Area\ \left(ft^2\right) \\
&A_t = Tundra\ Specific\ Area\ \left(ft^2\right) \\
&0.67 = 2007\ Delta - wide\ Runoff\ Coefficient
\end{aligned}$$

Equation 6 – Estimated Recharge, per Lake

$$V_O = C_2 A_l WSE_\Delta$$

$$V_O = Estimated\ Recharge\ (gal)$$
$$C_2 = Gallons\ of\ Water\ /\ ft^3$$
$$A_l = Lake\ Specific\ Area\ (ft^2)$$
$$WSE_\Delta = Difference\ Between\ Pre-Breakup\ and\ Peak\ WSE\ (ft)$$

3.4 Lake Recharge Observations

Throughout breakup, each lake was monitored for changes in WSE. Aerial photographs were taken from a helicopter using a GPS camera. Photos were taken from various perspectives to capture the extent of snow melt, flow pattern, potential lake water recharge sources, and hydraulic connectivity with other water bodies. Written documentation of visual observations combined with time-stamped GPS photos support identification of each lake's recharge mechanism(s), extent, and timeline.

Hydrographs showing change in WSE over time were used to determine estimated lake recharge. Recession of floodwaters is evident in a negative slope after peak stage, indicating a lake has recharged over bankfull conditions and is discharging excess water by means of overbank flow. WSE was not monitored for a sufficient amount of time after post-breakup to establish a "plateau" on the hydrograph; a consistent WSE over time, which is indicative of bankfull elevation.

3.5 2011/2012 Ice Road Contributions

As-built drawings for the 2012/2013 ice road construction season were used to estimate the volume of ice road melt water recharge contributed to lakes M9602, M9603, and M9605 catchment basins. Ice road contributions were determined using an estimated value of one million gallons of water per mile of ice road (ASCG 2005).

4.0 STUDY RESULTS

4.1 DETAILED STUDY LAKES

The catchment basin delineations, snow survey, SWE, WSE, lake recharge results, and a comparison of historic results for the Detailed Study Lakes are presented in this section.

4.1.1 CATCHMENT BASIN DELINEATION

Catchment basin delineations for lakes M9602, M9603, and M9605 are presented in Figure 4.1 through Figure 4.3. Lake areas were taken from bathymetry reports (Appendix B)and GIS layers provided by CPAI.

Breakup processes during the 2013 season for Lake M9602 was similar to the 2012 breakup (Baker 2012). A small channel conveyed excess water out of Lake M9602 downstream into Lake M9601 (Photo 4.1) to the northeast until equalization between the two water bodies occurred. During 2013 breakup monitoring, no overland flow sources were identified as contributing to the recharge of Lake M9602 aside from local snowmelt. The catchment basin delineated in 2011 was not adjusted for the 2013 program.

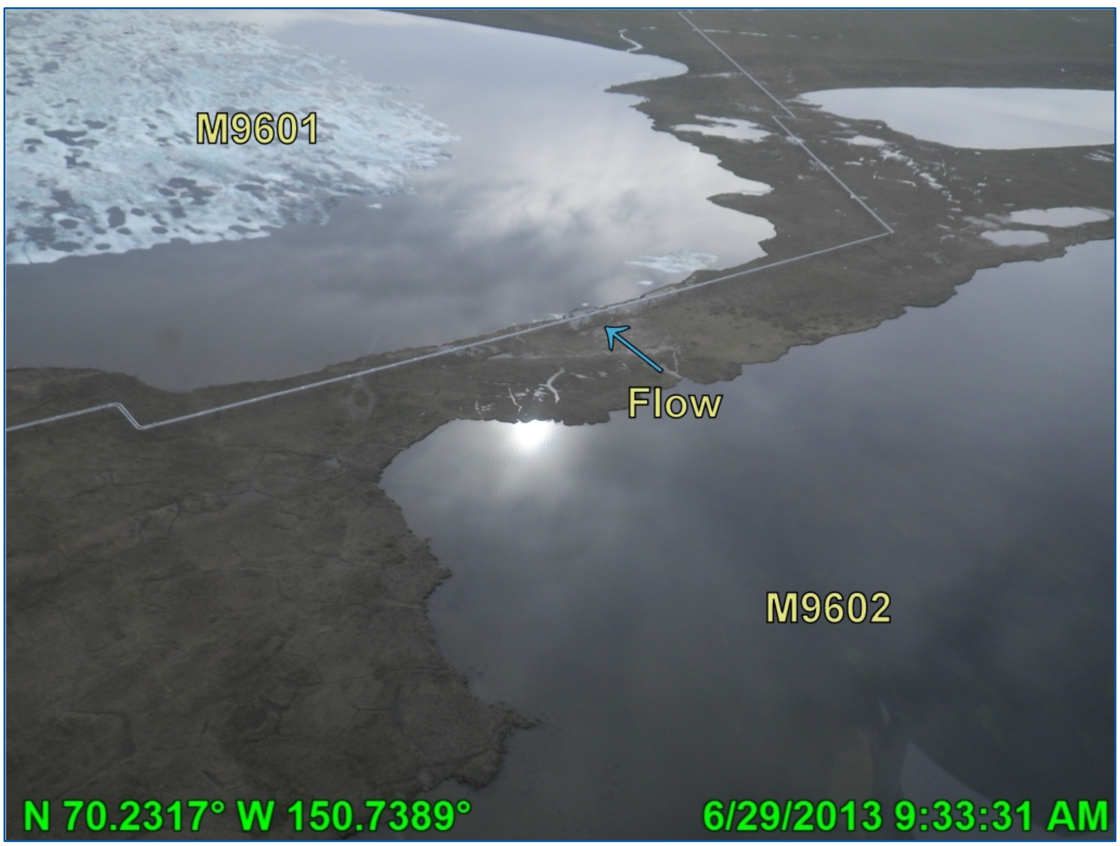


Photo 4.1: Outflow from Lake M9602 into Lake M9601, looking east; June 29, 2013

Lake M9603 was found to have both channelized inflow and outflow (Photo 4.2 and Photo 4.3) during the 2013 breakup season. Inflow was sourced from an unnamed water body to the south, and outflow was into Lake L9334/M9506 to the north. The M9603 catchment basin was delineated in 2013.

Photo 4.2: Inflow from unnamed waterbody south of M9603; looking southeast; June 29, 2013

Breakup processes during the 2013 season for Lake M9605 was comparable to the 2012 breakup (Baker 2012). Inflow was identified from a wetland to the south, and outflow was through a channel into an unnamed lake to the north (Photo 4.4). The catchment basin delineated in 2011 includes a portion of this southern wetland; the area of the basin is likely conservative.

Photo 4.3: Channel from Lake M9603 flowing north into L9334/M9506, looking northwest; June 29, 2013

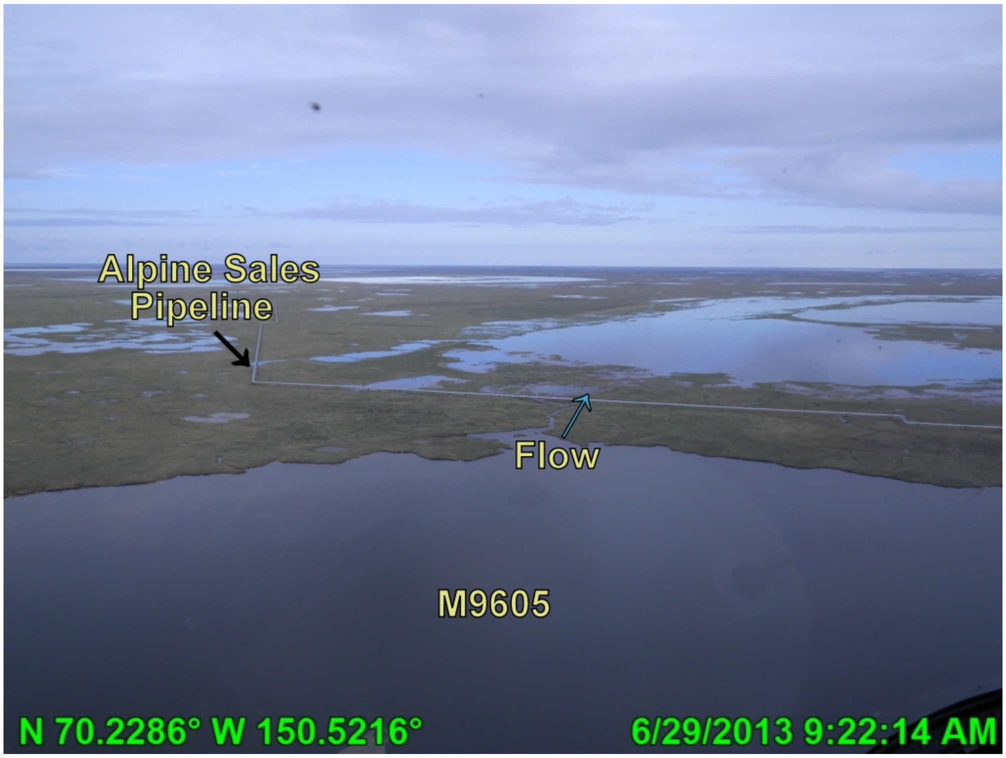
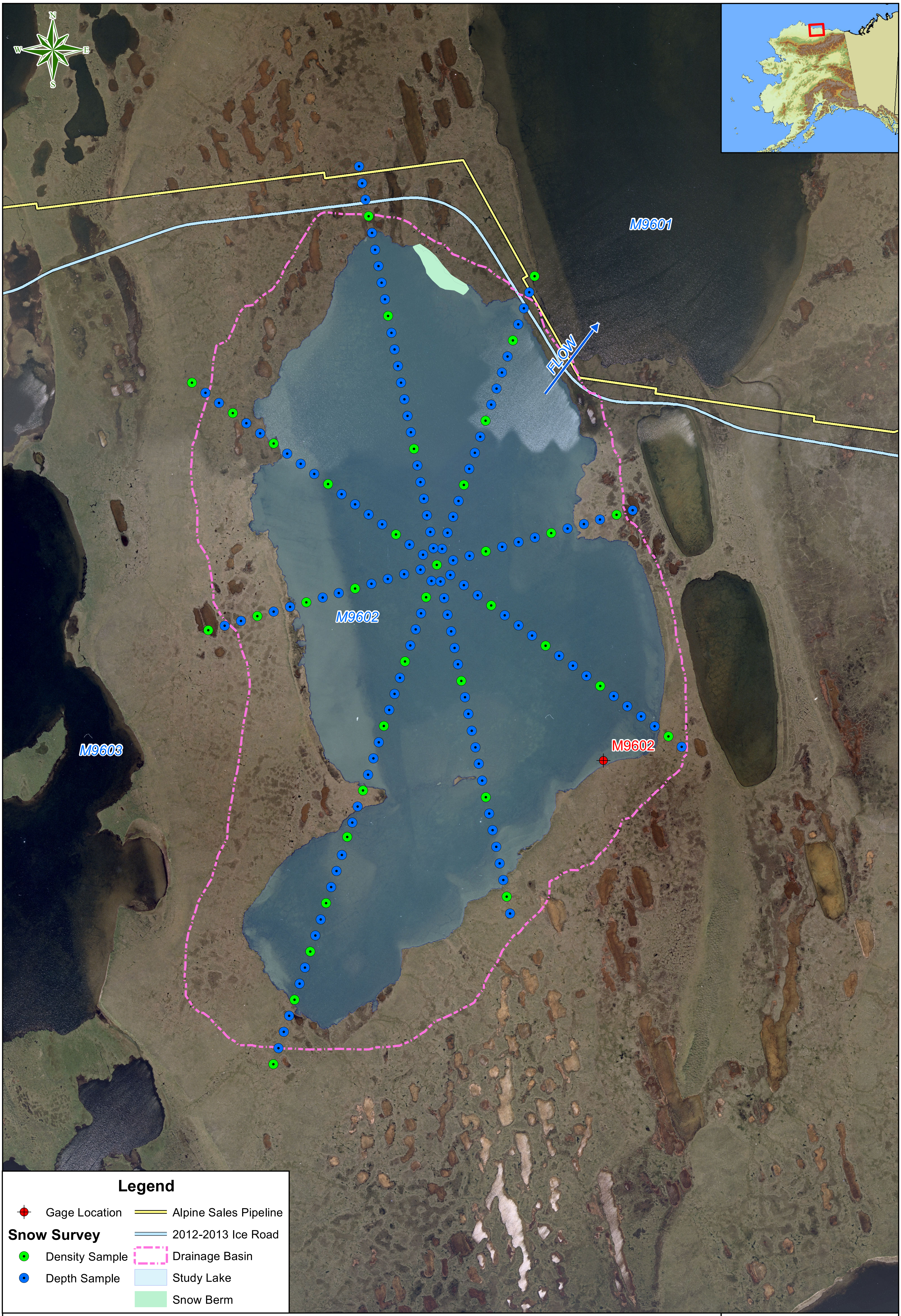


Photo 4.4: Channel from Lake M9605 flowing north into unnamed lake, looking northwest; June 29, 2013



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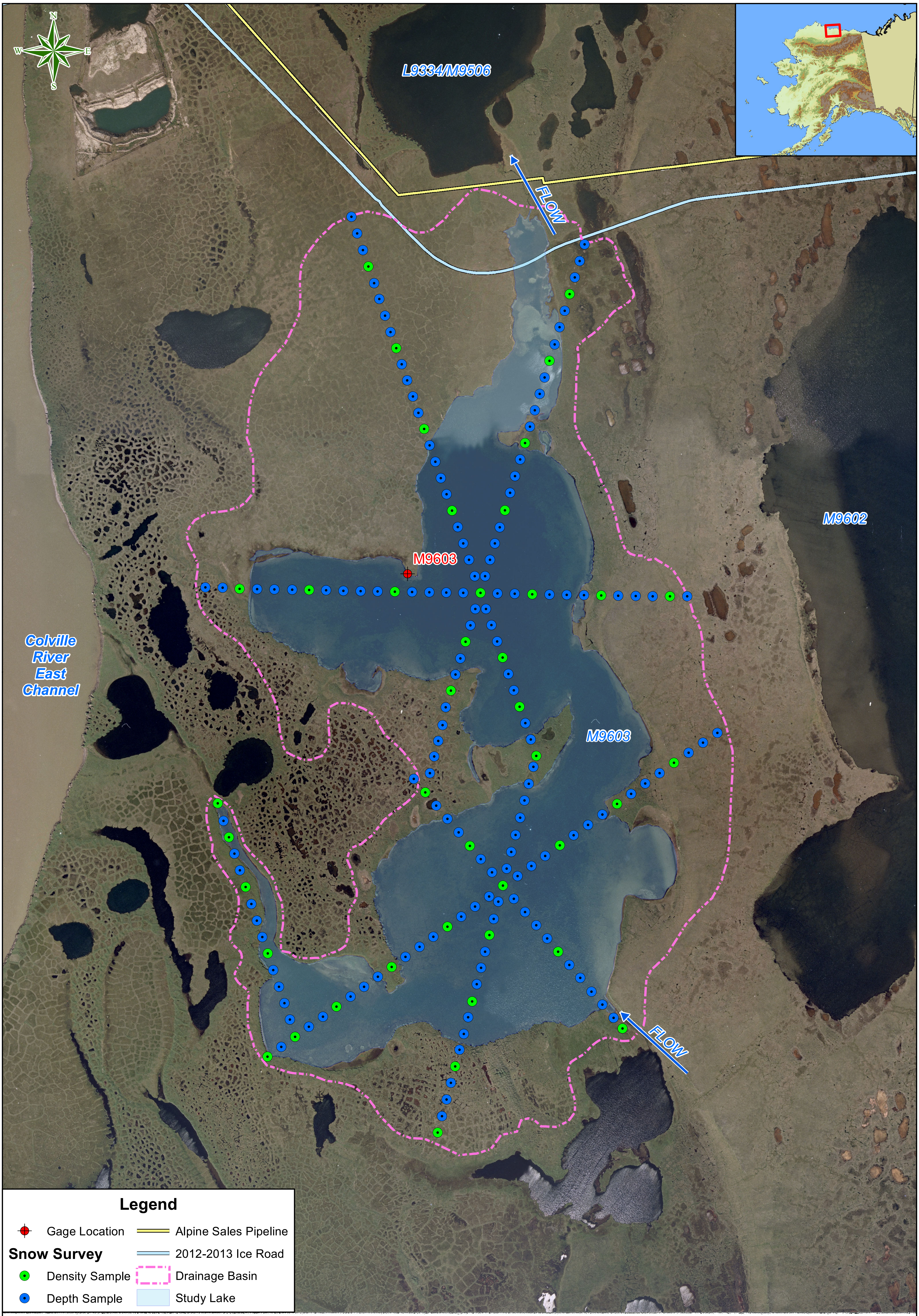
M9602
DRAINAGE BASIN DELINEATION
& SNOW SURVEY LOCATIONS
FIGURE: 4.1
(SHEET 1 of 1)



Feet
0 500 1,000

ConocoPhillips Alaska

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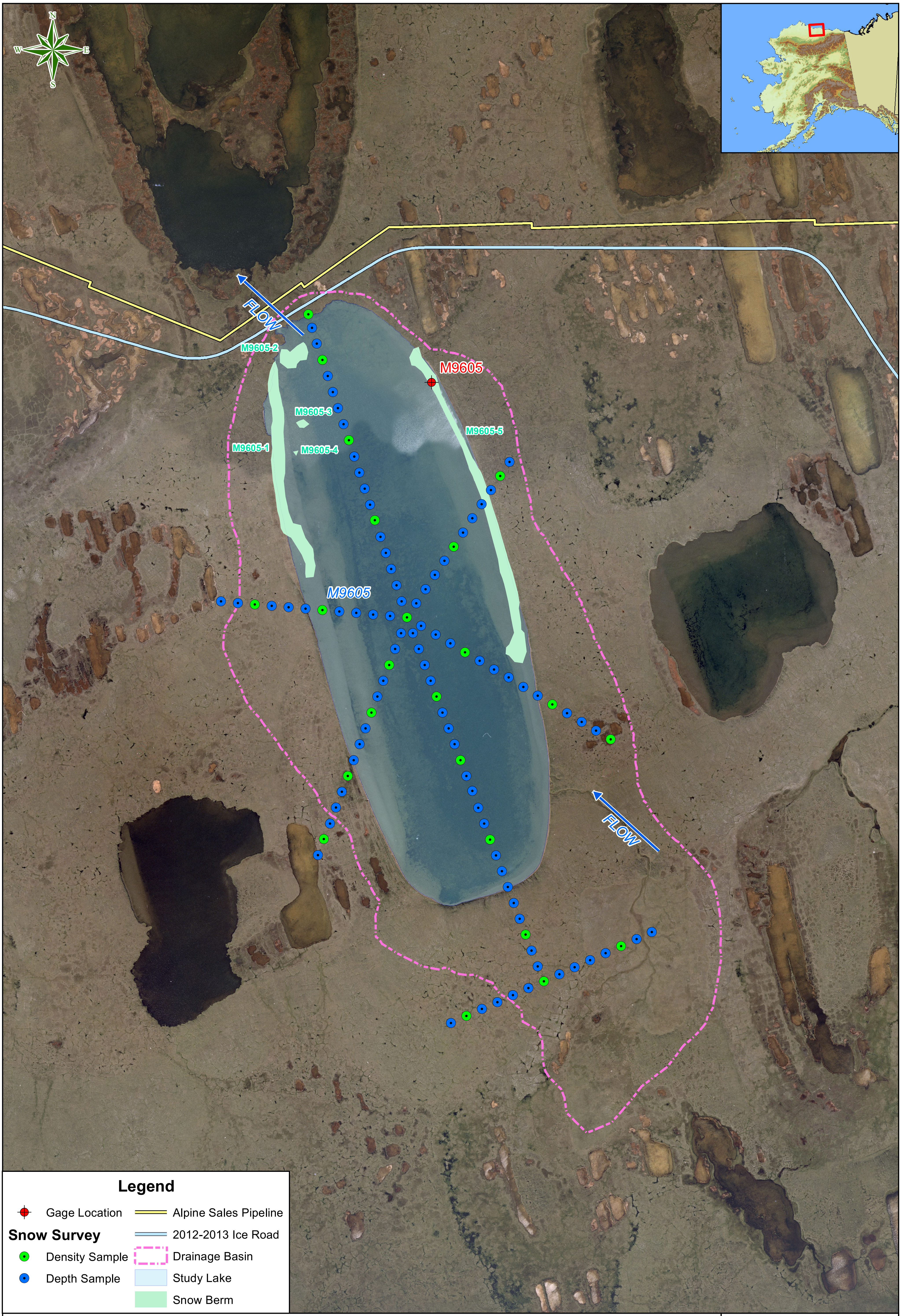
M9603

DRAINAGE BASIN DELINEATION & SNOW SURVEY LOCATIONS

FIGURE: 4.2

(SHEET 1 of 1)



ConocoPhillips Alaska

Feet
0 500 1,000

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M9605

DRAINAGE BASIN DELINEATION & SNOW SURVEY LOCATIONS

FIGURE: 4.3

(SHEET 1 of 1)

4.1.2 Snow Survey and Snow Water Equivalent

Snow surveys were conducted at Lake M9602 on May 5, at Lake M9603 on May 14, and at Lake M9605 on May 4. Snow surveys were conducted prior to CRD spring breakup setup. Seasonal snow cover conditions at lakes M9602 and M9605 in 2013 were generally consistent with results found by Baker in 2011 (Baker 2011). Snow cover on lakes was thinner, denser, and comprised less SWE than on nearby tundra. Overall snow depths measured in 2013 were greater than measurements made in 2012. In general, tundra snow cover was thicker, while lake snow cover varied. Snow was less dense over both lake and tundra; as a result the catchment basins have less overall SWE than in 2012.

Evidence of berms and drifts at Lake M9605 is presented in Photo 4.5 and Photo 4.6. The largest berms were present on the east and west banks of Lake M9605. Lake M9602 had a smaller berm along the east bank. No berms were present on Lake M9603. Berm snowmelt contribution calculations were performed assuming natural median snow depth on the cleared areas that was reached at the time of investigation. Overall depth and density of the berms was greater than adjacent naturally accumulated snow resulting in an increased SWE for these features. The SWE summaries for lakes M9602, M9603, and M9605 and their respective berms are presented in Table 4.1. Comprehensive snow survey data sheets are included in Appendix C.

Table 4.1: Detailed Study Lakes Snow Survey Summary

Lake	Area[1] (ft^2)		Average Snow Depth (in)		Average Density (lb/in^3)		Average SWE (in)		Catchment Basin Weighted SWE[2] (in)
	Lake	Tundra	Lake	Tundra	Lake	Tundra	Lake	Tundra	
M9602	28,546,385	14,804,295	10.3	18.7	0.009	0.008	2.65	4.23	3.19
M9603	20,327,419	24,885,239	14.7	23.5	0.009	0.008	3.52	5.18	4.44
M9605	14,534,808	17,921,388	8.0	19.6	0.009	0.008	2.04	4.06	3.16
Notes:	1. Calculated from delineated drainage basins determined from aerial imagery minus the area encompassed by berms 2. Specific to feature per lake and tundra contribution based on respective areas.								

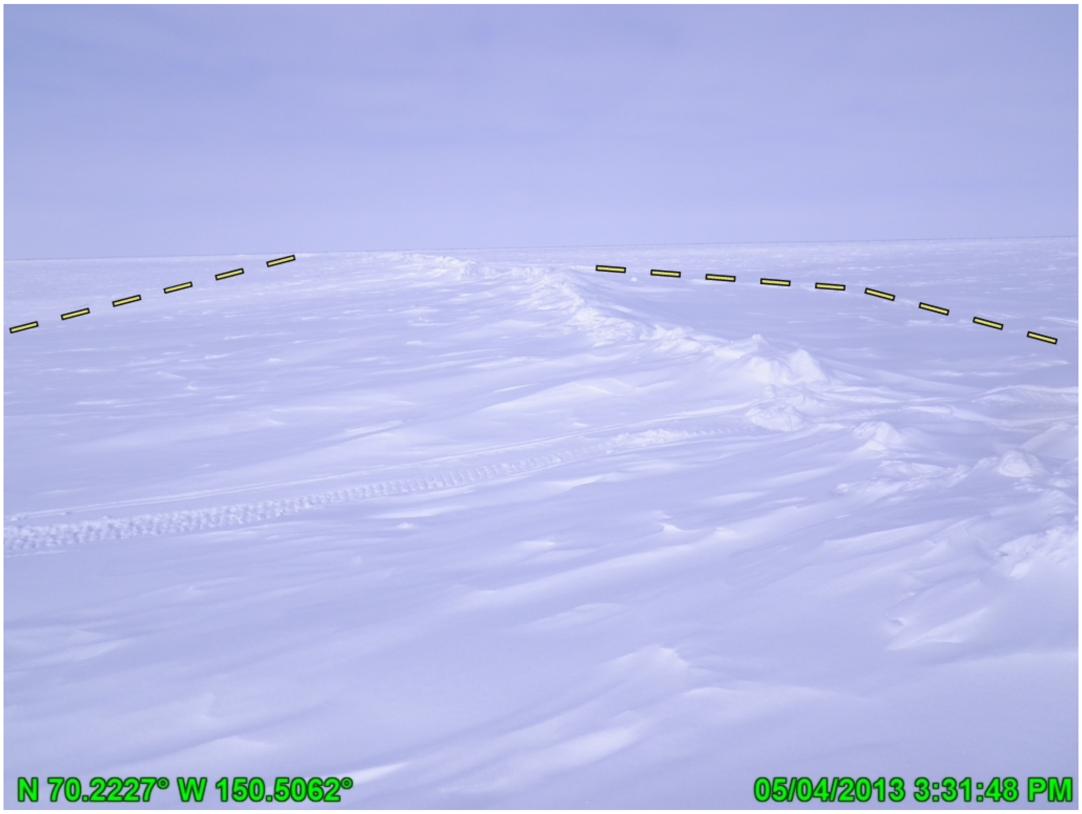


Photo 4.5: West side berm, approximate extents, and associated snow drifts at Lake M9605, looking north; May 4, 2013

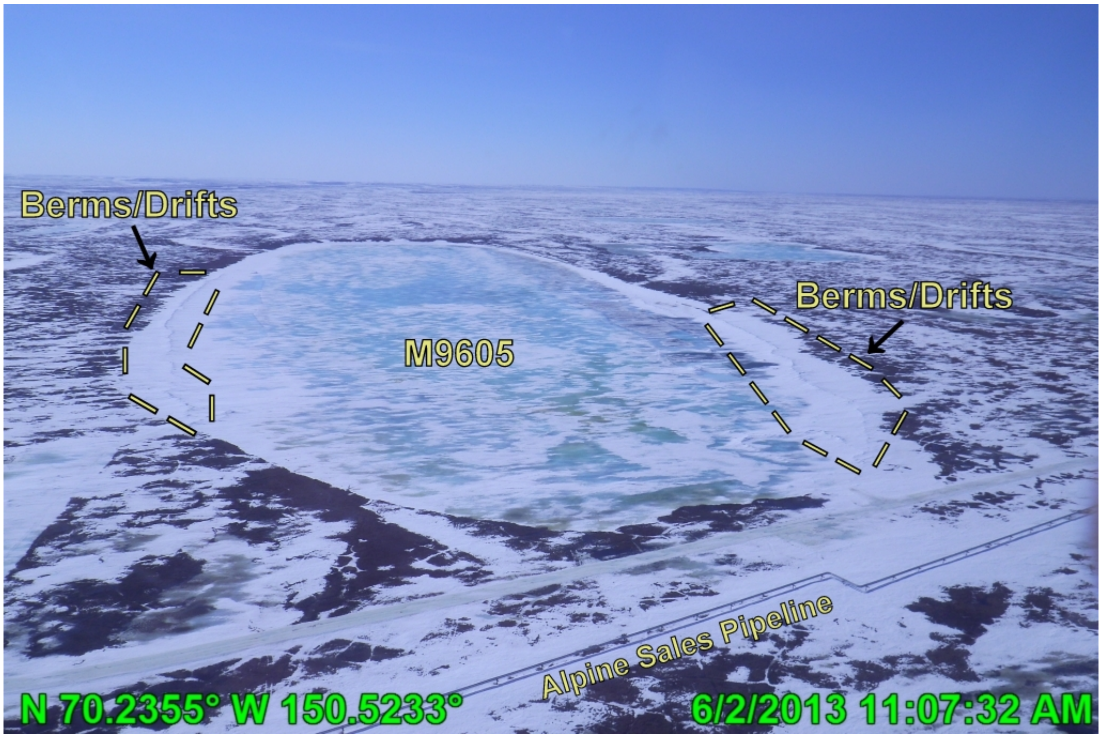


Photo 4.6: Aerial view of berms and associated drifts at Lake M9605, looking south; June 2, 2013

4.1.3 Water Surface Elevation

WSE was measured after spring breakup at lakes M9602, M9603 and M9605. Multiple attempts to measure pre-breakup WSE through holes drilled into the lake ice were unsuccessful. Only grounded ice was encountered at the drill locations and therefore WSEs were not acquired. Top of ice elevations were substituted for pre-breakup WSE for analysis. Top of ice elevations vary from actual WSE depending on ice thickness, snow cover and location and therefore should only be used as an approximation.

Spring breakup melting of ice and snow at lakes M9602 and M9605 occurred more slowly than other study lakes because they are outside of the CRD and lack significant channelized and overland flow. Substantial ice and snow covered the lake surfaces, and no flow was observed into or out of M9602 and M9605 during CRD breakup monitoring. Lake M9603 basin was inundated by Colville River East Channel overbank flooding during spring breakup, accelerating the melting of ice and snow in the lake basin (Photo 4.7).

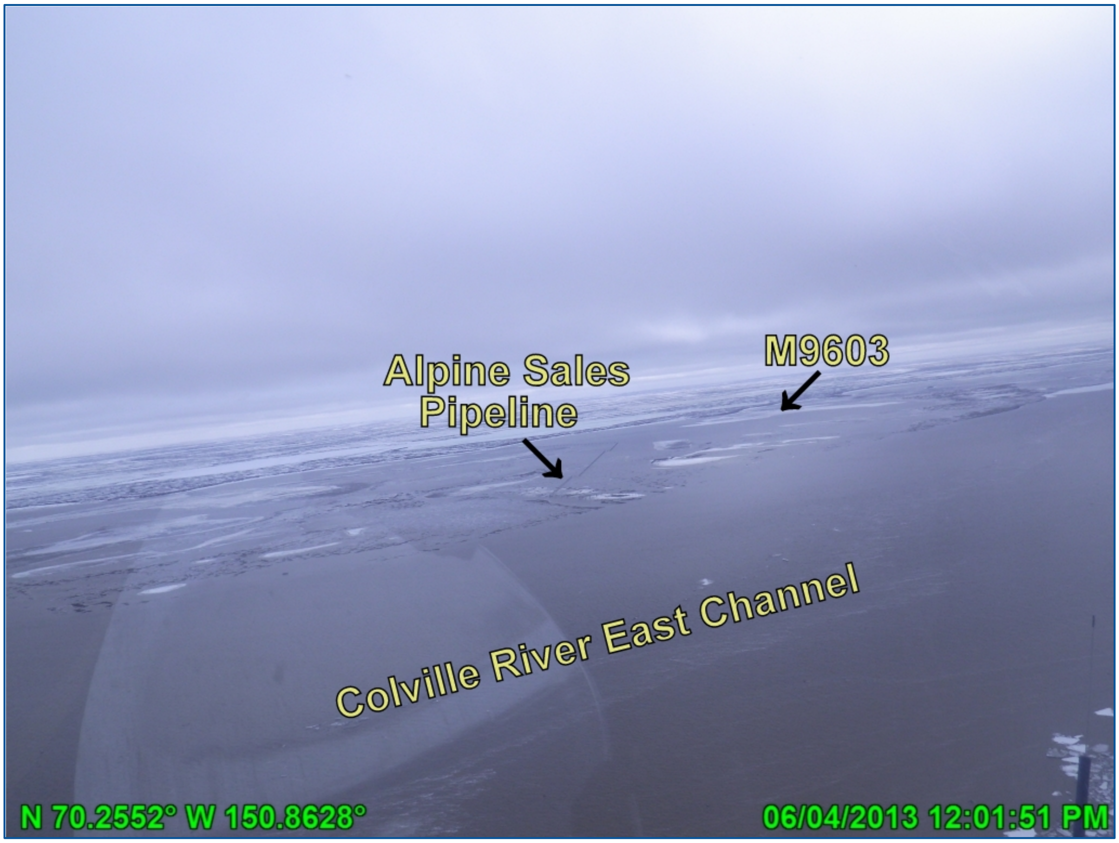


Photo 4.7: Lake M9603 basin inundated by spring breakup flooding, looking southeast; June 4, 2013

Final WSEs for Lakes M9602, M9603 and M9605 were measured on June 29 at which point all snow and ice in the catchment basins had melted. Prominent HWMs in the form of scum lines were observed on the gage plates at M9602 and M9605. Although the scum lines provide evidence that water levels were at the associated elevation, they do not necessarily represent the peak stage. A HWM was not observed at Lake M9603 as the gage was likely submerged by the overbank flooding from the Colville River East Channel.

WSE data and graphic representations for the Detailed Study Lakes are presented in Table 4.2 through Table 4.4.

Table 4.2: WSE Data for Lake M9602

Date and Time	WSE (feet)	Observations
5/12/13 11:30 AM	95.71*	Top of ice elevation. Grounded ice; **Pre-breakup** WSE not measured.
6/5/13 12:00 AM	96.35	HWM (scum line on gage plate observed 6/26/13)- date and time estimated[3]
6/29/13 9:35 AM	96.05	**Post Breakup -** No inflow; channalized flow into Lake M9601 (north)

*** Pre-breakup WSE was not measured. Value represents the top of ice elevation.**

Notes:

1. Elevations are assumed based on TBM M9602-X at 100.00 feet, installed by Baker in May 2011.
2. Dashed line indicates a substantial time interval between observations and that the change in WSE is not likely direct.
3. HWM defined by scum line is evidence that water level was at this elevation, however, it is not a clear indicator of peak stage.

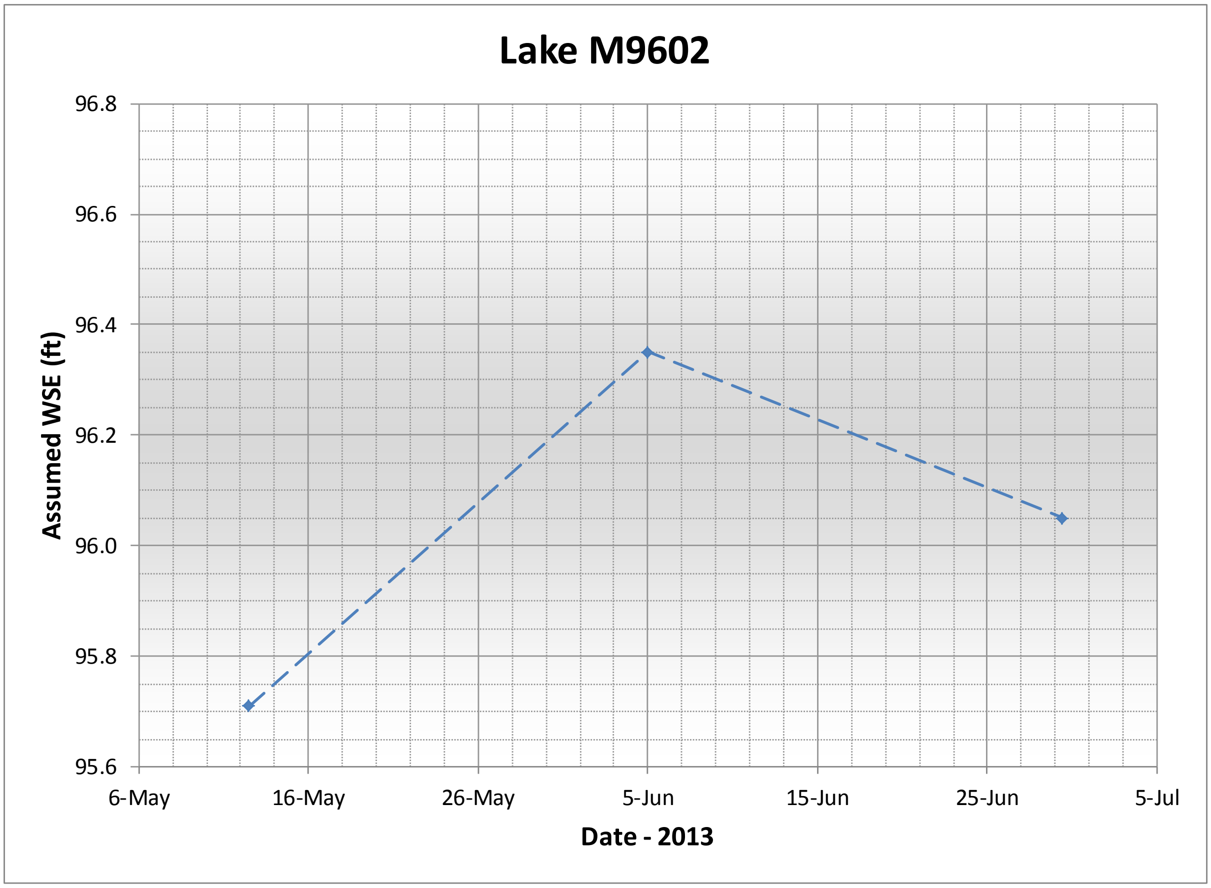


Table 4.3: WSE Data for Lake M9603

Date and Time	WSE (feet)	Observations
5/14/13 11:30 AM	96.79*	Top of ice elevation. Grounded ice; **Pre-breakup** WSE not measured.
6/29/13 9:46 AM	96.74	**Post Breakup -** No HWM. No inflow. Channelized outflow into Lake L9334/M9506 (north)

*** Pre-breakup WSE was not measured. Value represents the top of ice elevation.**

A HWM was not captured. Observed inundation from Colville River East Channel floodwater suggest WSE peaked between the pre- and post-breakup recordings.

Notes:

1. Elevations are assumed based on TBM M9605-X at 100.00 feet, installed by Baker in May 2011.
2. Dashed line indicates a substantial time interval between observations and that the change in WSE is not likely direct.

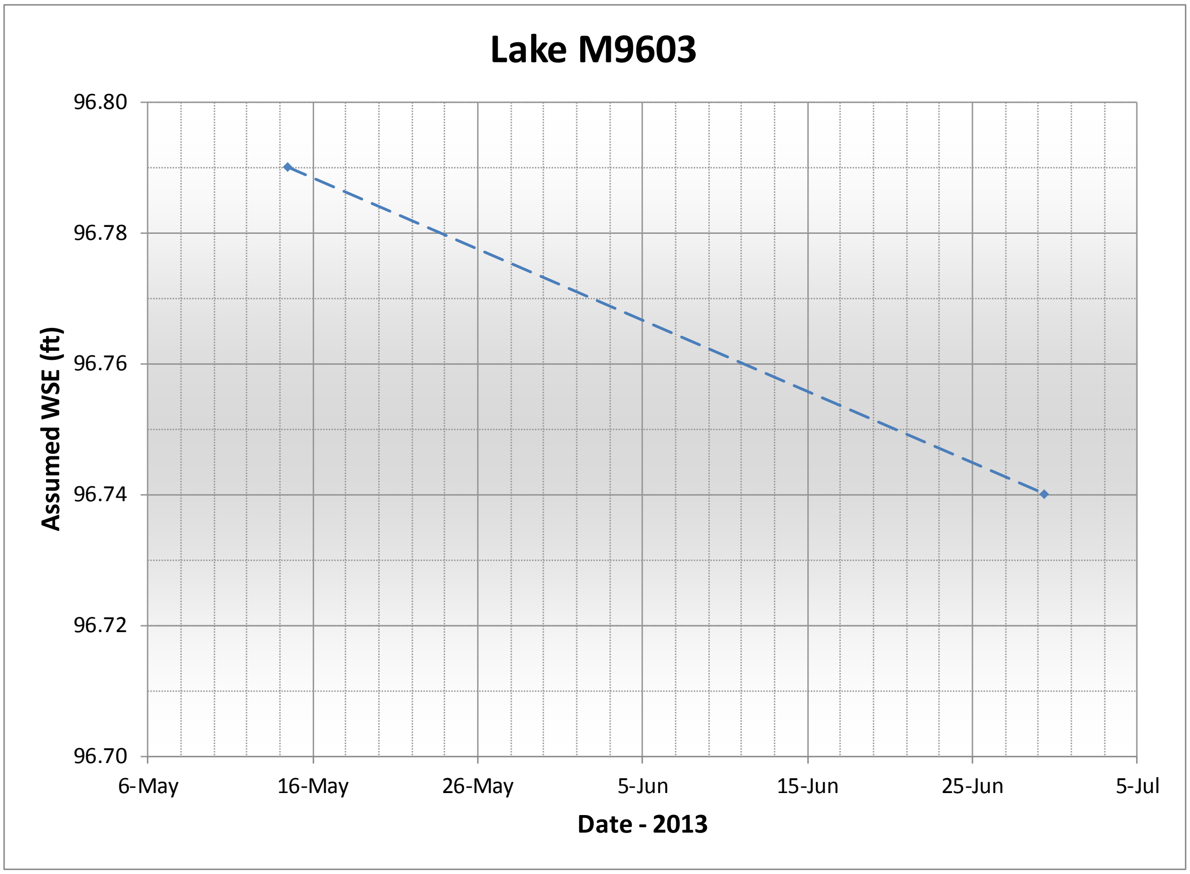


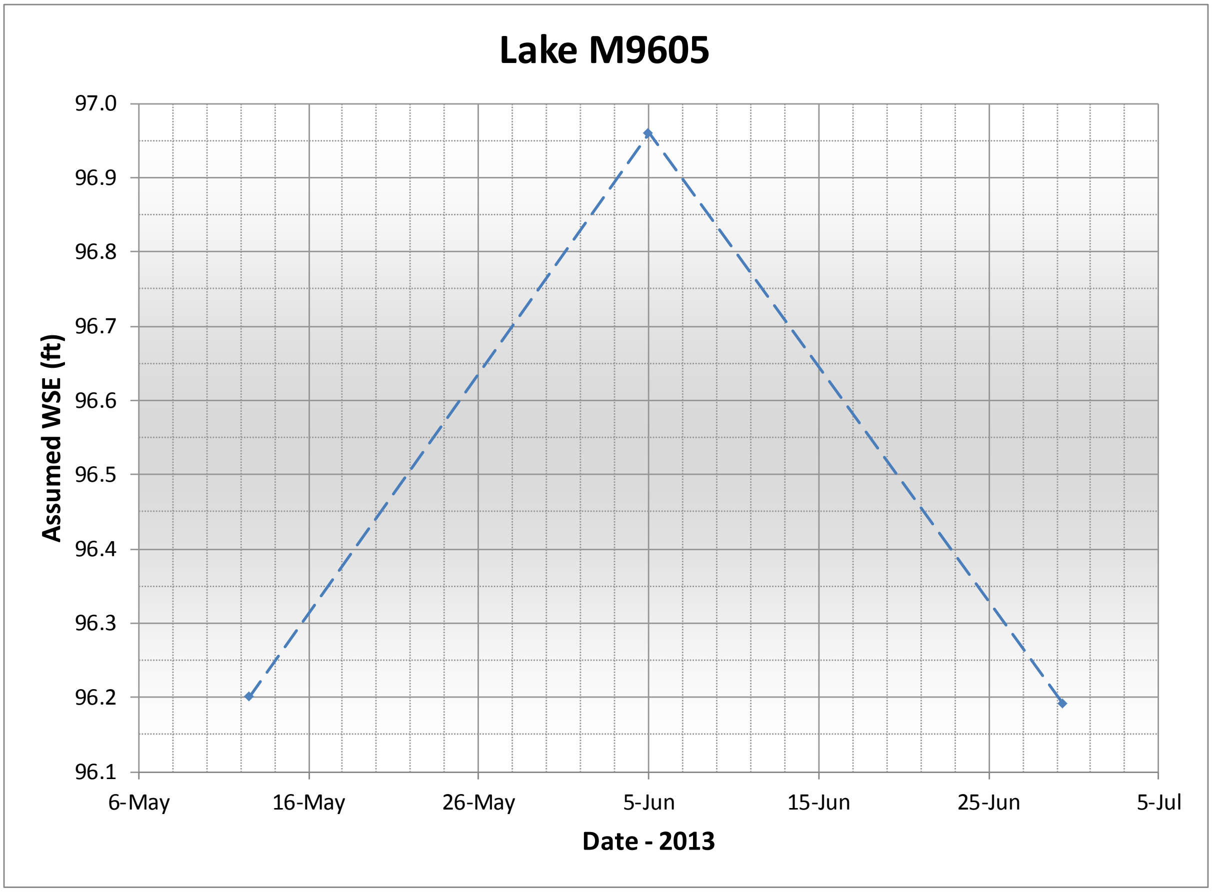
Table 4.4: WSE Data for Lake M9605

Date and Time	WSE (feet)	Observations
5/12/13 12:30 PM	96.20*	Top of ice elevation. Grounded ice; **Pre-breakup** WSE not measured.
6/5/13 12:00 AM	96.96	HWM (scum line on gage plate observed 6/26/13)- date and time estimated[3]
6/29/13 9:25 AM	96.19	**Post Breakup -** No inflow; outflow through small drainage into unamed lake (north)

*** Pre-breakup WSE was not measured. Value represents the top of ice elevation.**

Notes:

1. Elevations are assumed based on TBM M9605-X at 100.00 feet, installed by Baker in May 2011.
2. Dashed line indicates a substantial time interval between observations and that the change in WSE is not likely direct.
3. HWM defined by scum line is evidence that water level was at this elevation, however, it is not a clear indicator of peak stage.



4.1.4 Lake Recharge

Potential snowmelt contributions were calculated for lakes M9602, M9603 and M9605 based on SWE and lake areas. Estimates of potential snowmelt contribution for mechanically formed berms and associated drifted snow accumulation were also determined. Potential snowmelt contribution values are presented below in Table 4.5.

During the 2013 monitoring season, Lake M9602 recharged over bankfull conditions as observed by channelized outflow to M9601 (Photo 4.1), and the rise and recession of WSE presented in the hydrograph (Table 4.2). Lake M9603 recharged over bankfull as observed by floodwater inundation from the Colville River East Channel, channelized inflow from the south (Photo 4.2) and channelized outflow into Lake L9934/M9506 to the north (Photo 4.3). Lake M9605 recharged over bankfull as observed by channelized outflow to an unnamed lake to the north (Photo 4.4), and the rise and recession of WSE presented in the hydrograph (Table 4.4).

Estimated recharge volume was determined by multiplying the lake surface area by the difference between observed HWM elevation and pre-breakup top of ice elevation for Lakes M9602 and M9605. The actual pre-breakup WSE is likely below the top of ice elevation; therefore using the top of ice elevation provides a conservative estimate of recharge volume. Since no HWM was recorded for Lake M9603, and the pre-breakup top of ice elevation was essentially equal to the post-breakup WSE, the estimated recharge volume would have been zero. The observed inundation of Lake M9603 from Colville River East Channel floodwater clearly indicates recharge. To avoid confusion, the estimated recharge volume for M9603 was omitted from Table 4.5. These values are presented with calculated potential snowmelt contributions along with permitted and actual water use quantities for lakes M9602, M9603 and M9605 in Table 4.5.

Table 4.5: Detailed Study Lakes Spring Breakup Recharge Summary

Lake	Calculated Potential Snowmelt Contribution[1]				Estimated Recharge[2]	Permitted Annual Water Use[3]	Actual Water Use[4]
	Lake	Tundra	Ice Road	Total			
	(Mgal)						
M9602	47.2	26.1	0.2	75.1	119.6	31.41	1.32
M9602 Berm	1.4	0.2	-				
M9603	44.6	53.9	0.3	98.8	N/A	8.72	0.01
M9605	18.5	30.4	0.1	61.1	82.6	22.14	11.14
M9605 Berm 1	3.2	0.4	-				
M9605 Berm 5	8.1	0.5	-				

Notes:

1.Using the 2007 delta-wide runoff coefficient (0.67) and 2013 SWE.

2. Area of lake surface multiplied by the difference between peak WSE and the pre-breakup top of ice elevation.

3. Per AK DNR Fish Habitat Permit FH05-III-0327 Amendment #2 for Lake M9602, FH05-III-0338 Amendment #1 for Lake M9603, and FH05-III-0328 Amendment #2 for Lake M9605.

4. Total combined liquid and ice as water equivalent per CPAI water use report.

4.1.5 Discussion of Historic Results

Potential snowmelt contributions to lakes M9602 and M9605 calculated in 2013 are greater than 2010 calculations (Table 4.6). Values from 2010 were based on empirical data and are considered conservative. Drainage basin delineations were refined in 2011; the same delineations for M9602 and M9605 were used in 2013. Overall snow depths measured in 2013 were more than measured in 2012. For 2013, M9603 was included in the detailed study lakes. This is the first year of study at this lake, and it is included in Table 4.6 for future comparison.

Table 4.6: Comparison of Historical Results

Comparison of Historical Calculated Potential Snowmelt Contributions				
Lake	2010 [1]	2011 [2]	2012 [2]	2013 [2]
	(Mgal)			
M9602	48.3	101.1	77.5	75.1
M9603 [3]	N/A	N/A	N/A	98.8
M9605	40.6	61.8	67.6	61.1

Notes:
1. Determined based on empirical data
2. Determined based on measured data
3. M9603 was added as a detailed study lake in 2013

4.2 General Study Lakes

The WSE data and lake recharge results for the General Study Lakes are presented in this section.

4.2.1 Water Surface Elevation

WSE was measured before, during, and after spring breakup at lakes L9323, L9324, B8531/L9326, B8530, and M9607. WSE at B8533 was not measured; recharge was determined by visual observation and aerial photographs. Photos were taken throughout the pre-breakup, breakup and post-breakup (Appendix D) periods to document changes at the lakes.

Generally, WSE at these study lakes increased during recharge and then decreased from outflow. HWMs were not evident at all lakes. The WSE data and hydrographs are presented in Table 4.7 through Table 4.11.

Table 4.7: WSE Data for Lake B8530

Date and Time	WSE (feet)	Observations
5/13/13 11:05 AM	95.24	**Pre-breakup** survey to WSE - no local melt
6/29/13 10:09 AM	95.63	**Post Breakup -** No inflow or outflow

A HWM was not captured. As a result, the WSE observations suggest only partial lake recharge; however, observed Nigliq Channel overbank flow from the northwest via Lake M9606 indicates bankfull recharge was achieved and exceeded.

Notes:

1. Elevations are assumed based on TBM B8530-X at 100.00 feet, installed by Baker in May 2011.

2. Dashed line indicates a substantial time interval between observations and that the change in WSE is not likely direct.

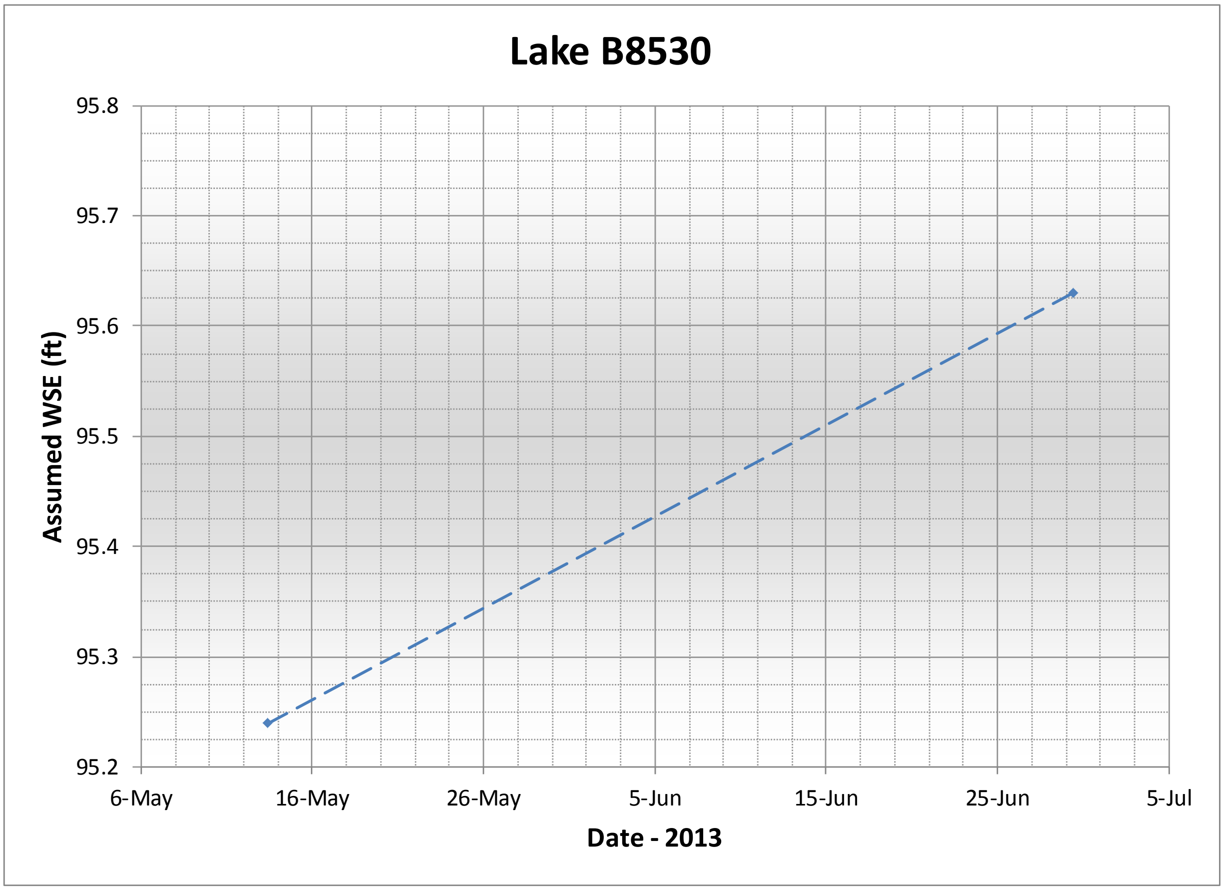


Table 4.8: WSE Data for Lake B8531/L9326

Date and Time	WSE (feet)	Observations
5/13/13 1:00 PM	93.13	**Pre-breakup** survey to WSE (no local melt)
6/29/13 10:53 AM	93.48	**Post Breakup -** No inflow; outflow connected to Toolbox Creek via Lake M9934

A HWM was not captured. As a result, the WSE observations suggest only partial lake recharge; however, outflow was observed intoToolbox Creek via Lake M9934 indicating bankfull recharge was achieved and exceeded.

Notes:

1. Elevations are assumed based on TBM B8531/L9326-X at 100.00 feet, installed by Baker in May 2011.

2. Dashed line indicates a substantial time interval between observations and that the change in WSE is not likely direct.

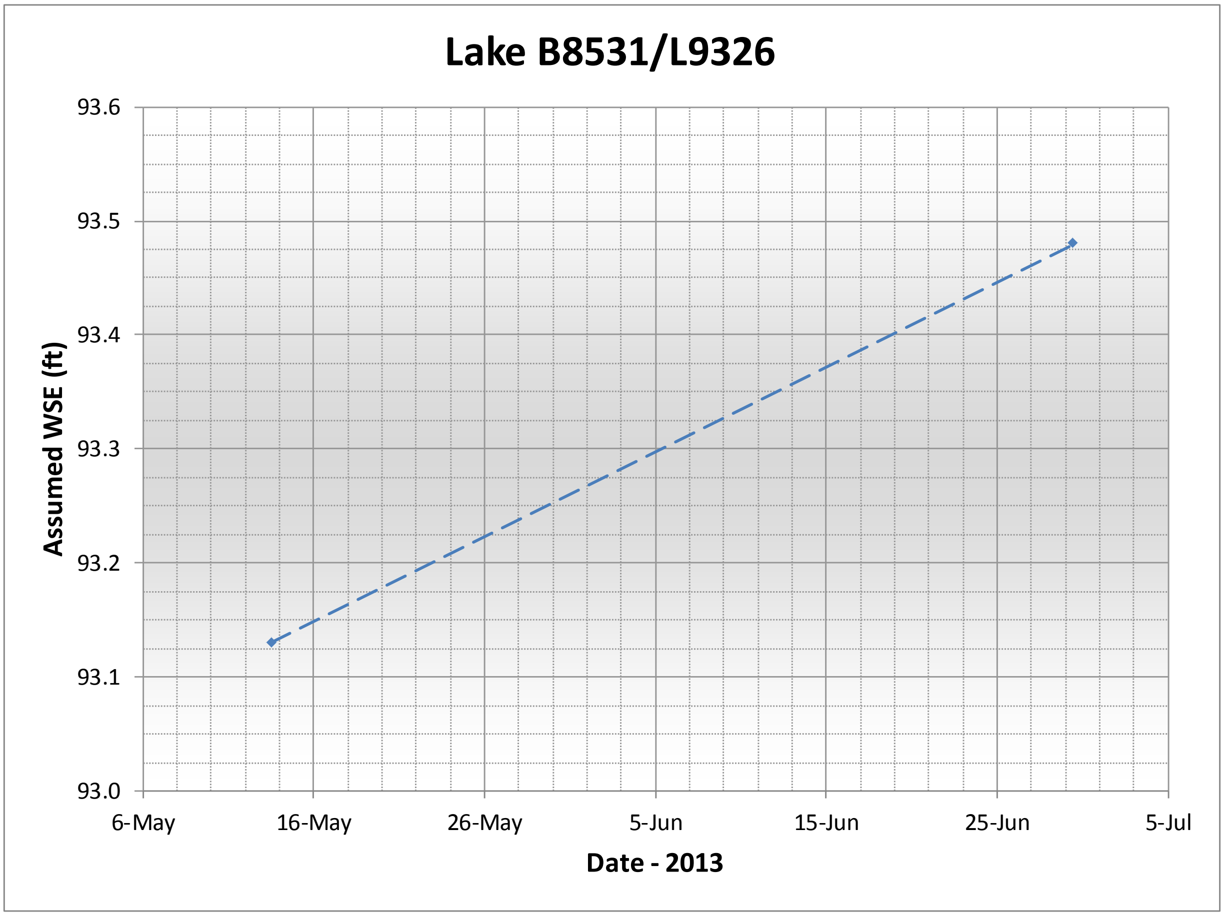


Table 4.9: WSE Data for Lake L9323

Date and Time	WSE (feet BPMSL)	Observations
5/13/13 12:40 PM	8.26	**Pre-breakup** survey to WSE (no local melt)
6/1/13 8:10 AM	-	Gage dry; local melt in the vicinity
6/2/13 7:50 AM	-	Gage dry; local melt in the vicinity
6/3/13 11:25 AM	8.74	
6/3/13 6:20 PM	9.42	Inflow from Lake L9324 via the CD4 culverts
6/4/2013 11:56AM	-	Connected to Nigliq Channel; gage submerged
6/7/13 1:08 PM	9.14	HWM not present because gage was submerged
6/30/13 3:52 PM	8.38	**Post Breakup** - No inflow or outflow

A HWM was not captured. Observations during spring breakup near CD4 facilities indicate peak stage was significantly higher than the highest reported WSE.

Notes:

1. Elevations are based on Monument NANUQ 4 at 12.758 feet BPMSL, surveyed by LCMF in May 2011.
2. Dashed line indicates a substantial time interval between observations and that the change in WSE is not likely direct.

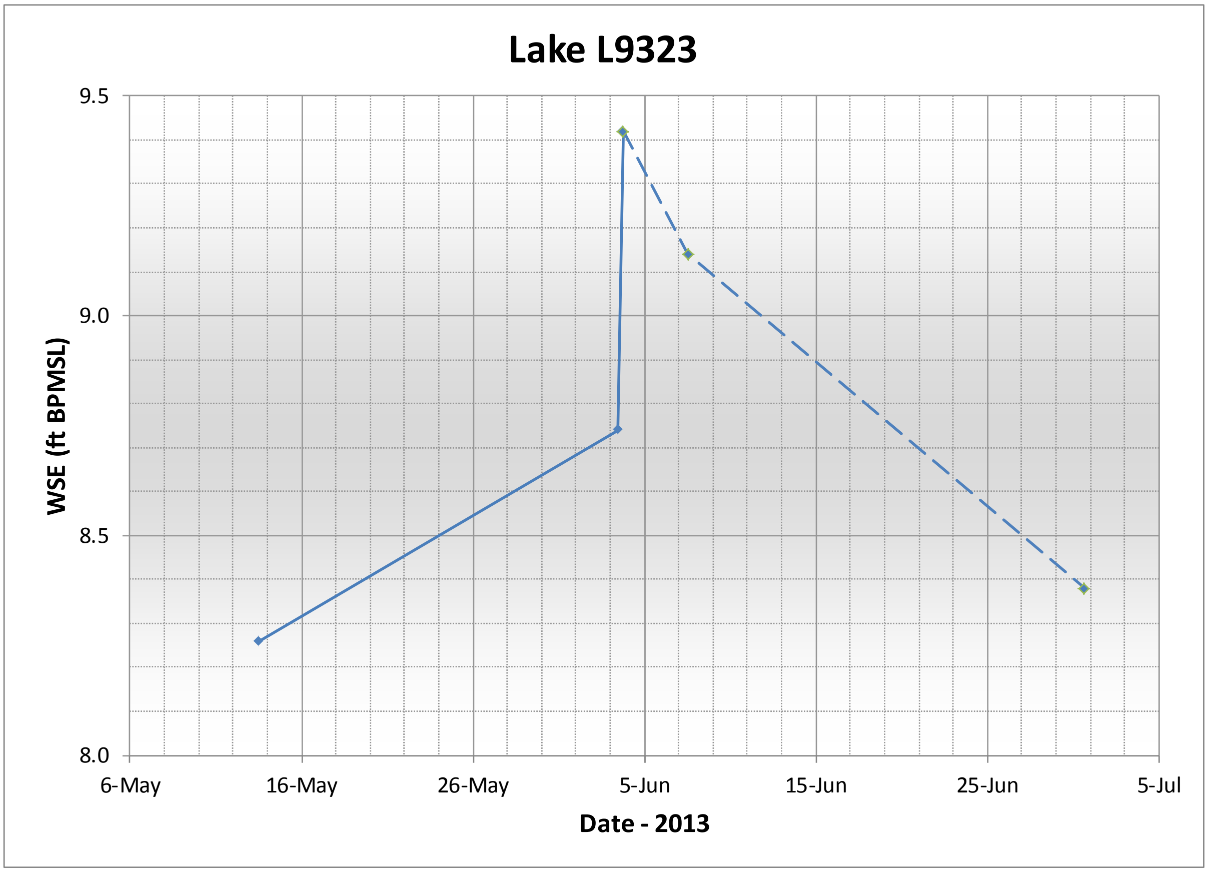


Table 4.10: WSE Data for Lake L9324

Date and Time	WSE (feet BPMSL)	Observations
5/12/13 3:30 PM	6.33	**Pre-breakup** survey to WSE (no local melt)
5/31/13 8:00 AM	6.33	Ponded water- local melt
6/1/13 8:37 AM	8.96	Inflow from Sakoonang via southeast paleolake; connected to the Nigliq Channel and Tapped Lake
6/3/13 6:54 PM	11.89	Outflow to Lake L9323 via the CD4 culverts
6/4/13 5:41 PM	13.51	
6/5/13 12:00 AM	14.39	**Peak Stage** based on HWM, time and date estimated
6/5/13 1:01 PM	13.74	
6/5/13 6:59 PM	13.29	
6/6/13 4:00 PM	11.63	
6/30/13 4:52 PM	6.38	**Post Breakup -** Connected to Sakoonang, no outflow

Notes:

1. Elevations are based Monument NANUQ 5 at 17.461 feet BPMSL, surveyed by LCMF in May 2011.
2. Dashed line indicates a substantial time interval between observations and that the change in WSE is not likely direct.

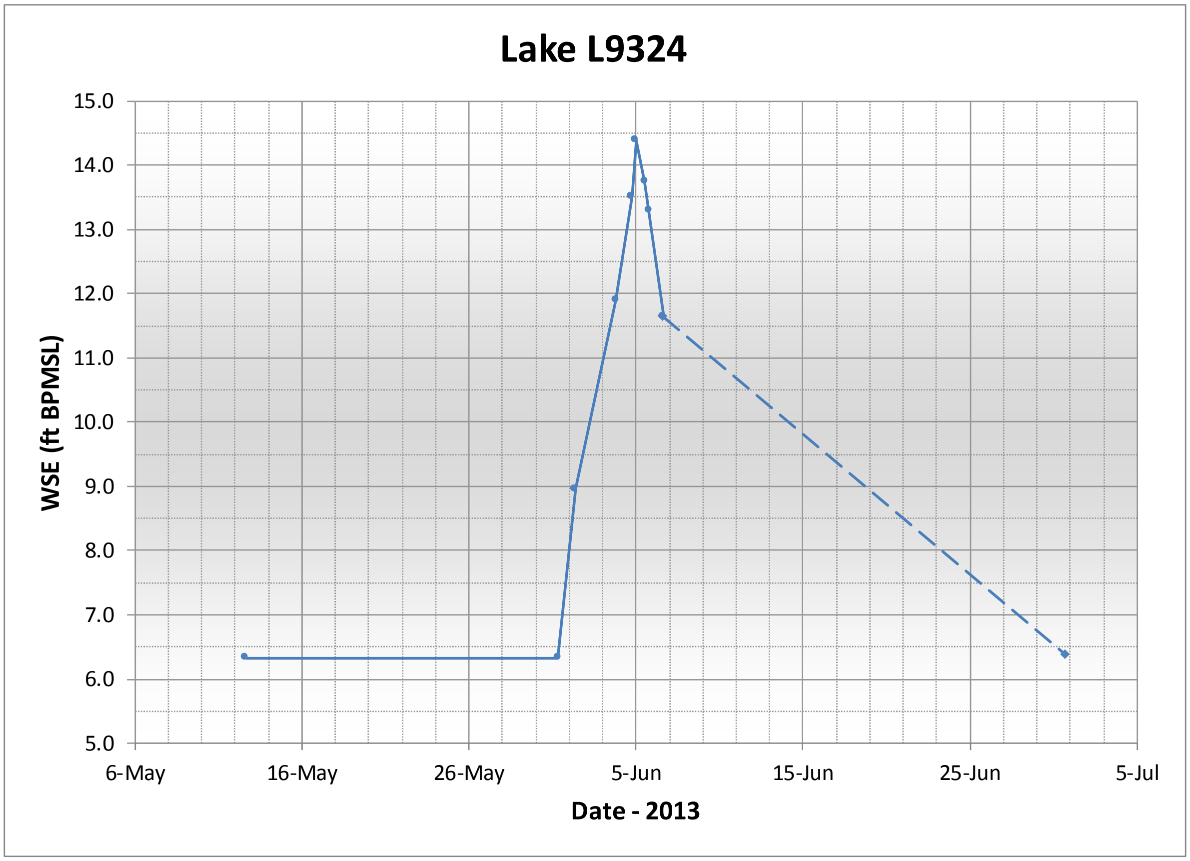
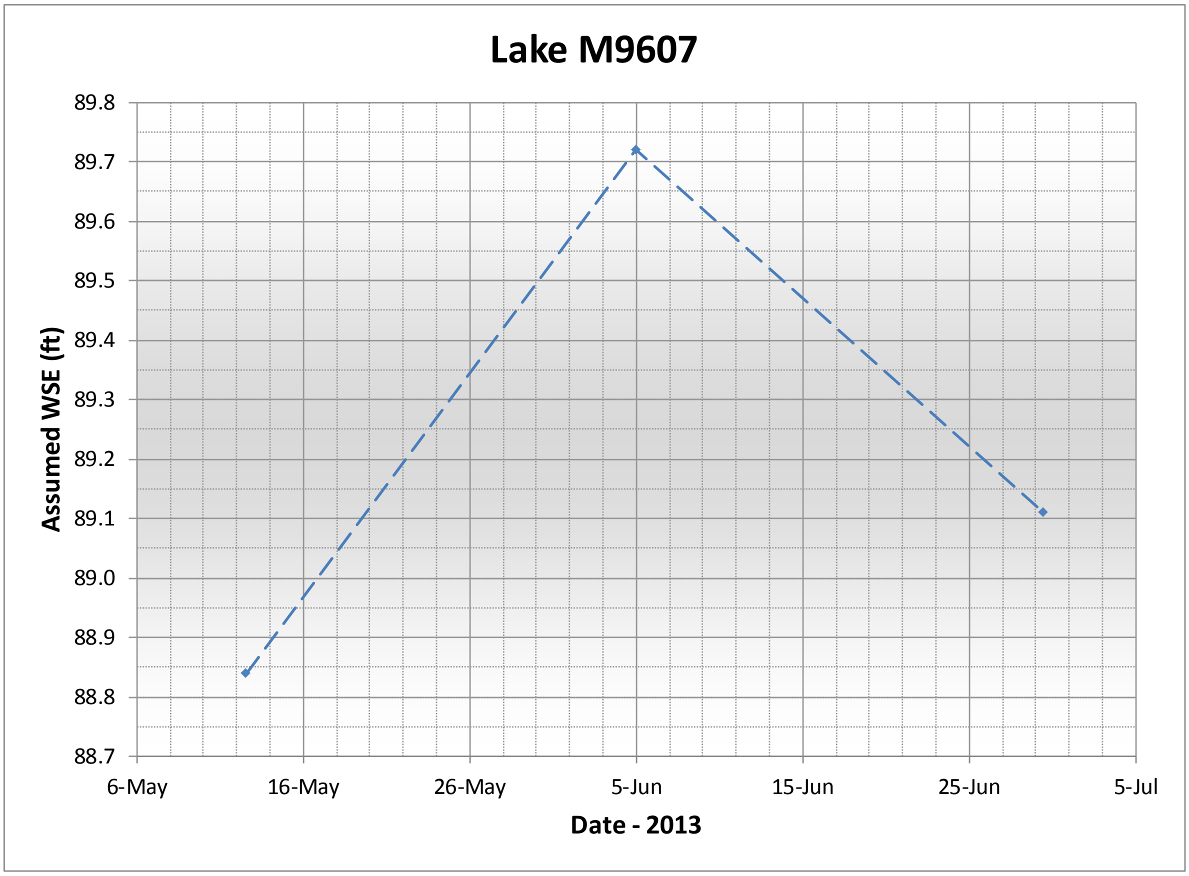


Table 4.11: WSE Data for Lake M9607

Date and Time	WSE (feet)	Observations
5/12/13 2:35 PM	88.84	**Pre-breakup** survey to WSE - no local melt
6/5/13 12:00 AM	89.72	HWM (scum line on gage plate observed on 6/26/13)- date and time estimated[3]
6/29/13 10:53 AM	89.11	**Post Breakup -** No inflow or outflow

Notes:

1. Elevations are assumed based on TBM M9607-X at 100.00 feet, installed by Baker in May 2011.
2. Dashed line indicates a substantial time interval between observations and that the change in WSE is not likely direct.
3. HWM defined by scum line is evidence that water level was at this elevation, however, it is not a clear indicator of peak stage.



4.2.2 Lake Recharge

All General Study Lakes were observed to fully recharge over bankfull during the 2013 monitoring season. This was evident by visual observations and the rise and recession of WSE in the hydrographs.

The CRD experienced significant overbank flooding during the 2013 spring breakup flood event. As a result, all General Study Lakes were hydraulically connected to water bodies. Most of these connections are likely seasonal and limited to an increase in stage conditions during spring breakup. All General Study Lakes, except Lake B8530, should be considered hydraulically isolated during the remainder of the year. Lake B8530 is hydraulically connected to Lake M9608 during the open water season. Potential snowmelt contribution should be determined from their combined catchments when considering lake water recharge as it relates to water withdrawal volumes.

4.3 Summary of Lake Recharge Observations

At the time of the study, all lakes appeared to recharge to or above bankfull elevations via either channelized spring breakup flood flow or local melt. A compilation of hydrologic observations is provided in Table 4.12.

Table 4.12: Summary of 2013 Hydrologic Recharge Observations

Study Lake	Recharge to Bankfull	Primary Recharge Mechanism	Additional Hydraulic Connection[1]	
			Flow In	Flow Out
Detailed Study Lakes				
M9602	√	Local melt	No channelized drainage into lake	Lake M9601 (northeast) via small drainage across ice road
M9603	√	Local Melt	Colville East Channel overbank flow (west)	Channelized flow into Lake L9334/M9506 (north)
M9605	√	Local melt	Small drainages from wetlands (southeast and southwest)	Unnamed lake (north) via small drainage across ice road
General Study Lakes				
B8530[2]	√	Local melt	Nigliq Channel via M9606 (west)	Overland flow into M9607, no channelized drainage out of lake
B8531/L9326	√	Nigliq Channel via Toolbox Creek and Lake M9934 (northeast)	Sakoonang via paleolake (southeast)	Nigliq Channel via Lake M9934 (northeast) into Toolbox Creek
B8533	√	Sakoonang via marshy area (east)	Nigliq Channel overflow (west)	Limited flow into Sakoonang (east) via marshy area
L9323	√	Sakoonang and Lake L9324 via CD 4 culverts (south)	Nigliq Channel and Tapped Lake (south)	Lake M9525 (north) via CD 4 road culverts
L9324	√	Sakoonang via paleolake (southeast)	Nigliq Channel and Tapped Lake (northwest)	Lake L9323 (north) via CD 4 road culverts
M9607	√	Local melt	B8530 (west)	No channelized drainage out of lake

Notes: 1. Observations between May 4 and June 30, 2013. Unless specified, hydraulic connections are likely seasonal only.
2. Additional annual connection with Lake M9608 (west)

5.0 References

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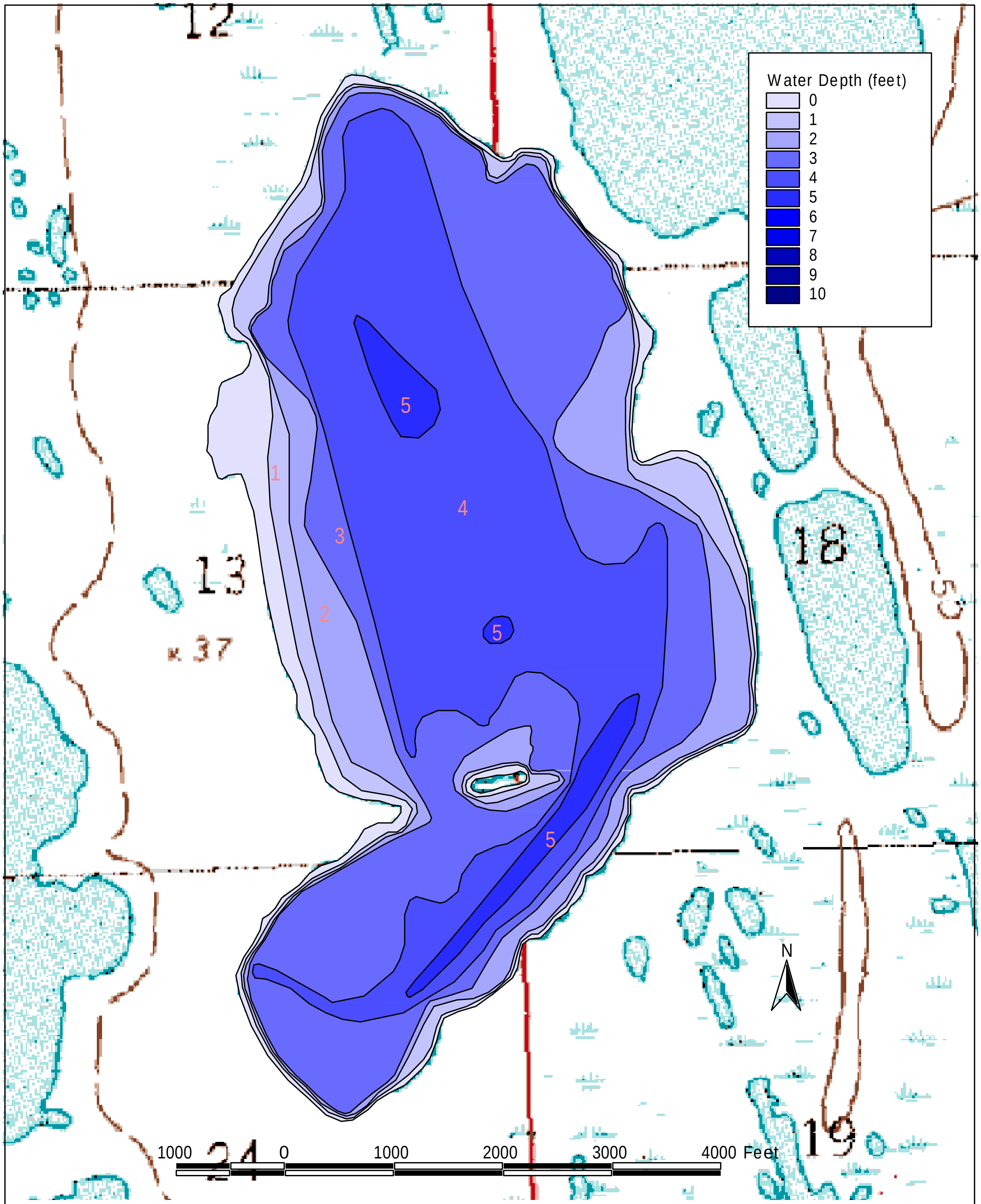
Appendix A Gage and TBM Locations

Monitoring Location	Site Name	Type	Latitude (WGS84)[1]	Longitude (WGS84)[1]
B8530	B8530-A	Gage	N70° 14.622'	W150° 52.911'
	B8530-X	TBM	N70° 14.613'	W150° 52.895'
B8531/L9326	B8531/L9326-A	Gage	N70° 16.360'	W150° 59.684'
	B8531/L9326-X	TBM	N70° 16.355'	W150° 59.686'
B8533	B8533 – Lake Center	Aerial Photos	N70° 21.074'	W151° 01.886'
L9323	L9323-A	Gage	N70° 17.733'	W150° 59.041'
	NANUQ 4	TBM	N70° 17.726'	W150° 58.884'
L9324	L9324-A	Gage	N70° 17.485'	W150° 58.879'
	L9324-B	Gage	N70° 17.486'	W150° 58.882'
	NANUQ 5	TBM	N70° 17.501'	W150° 58.840'
M9602	M9602-A	Gage	N70° 12.963'	W150° 43.365'
	M9602-X	TBM	N70° 12.957'	W150° 43.225'
M9603	M9603-A	Gage	N70° 13.274'	W150° 47.383'
	M9603-X	TBM	N70° 13.278'	W150° 47.376'
M9605	M9605-A	Gage	N70° 13.722'	W150° 30.813'
	M9605-X	TBM	N70° 13.743'	W150° 30.767'
M9607	M9607-A	Gage	N70° 14.639'	W150° 52.100'
	M9607-X	TBM	N70° 14.657'	W150° 51.990'
Note 1: Locations are referenced to World Geodetic System 1984 (WGS84) datum.				

Appendix B Lake Bathymetry: M9602, M9603 and M9605



Depth contours of lake M9602 based on transects surveyed on July 12, 2005.
(depths in 1 foot intervals)

(not to be used for navigation or to direct use of heavy equipment)

Lake M9602

Other Names: AA10.1
Location: 70.22147°N 150.73865°W
USGS Quad Sheet: Harrison Bay A-2: T10N R5/6E, Sec 112/13/24/7/18/19
Habitat: Tundra
Lake Area: 658
acres Maximum Depth:
6.4 feet
Active Outlet: No
Total Lake Volume: 734.9 million gallons (2005 data)
Volume Under 4 ft of ice: 42.9 million
gallons Volume Under 5 ft of ice: 2.6
million gallons Volume Under 7 ft of ice:
0.0 million gallons
Potential Aggregate: 391.5 acres (water depth 4 ft or less)

Maximum Recommended Winter Removal: 0.78 million gallons
(30% of volume under 5 feet of ice)
(does not include volume associated with ice aggregate)

Water Use History:

Year	Water Removed (all sources) (mill. Gals)
1998/1999	3.03
2000/2001	7.96
2001/2002	2.84
2002/2003	13.69
2003/2004	3.65
2004/2005	7.83

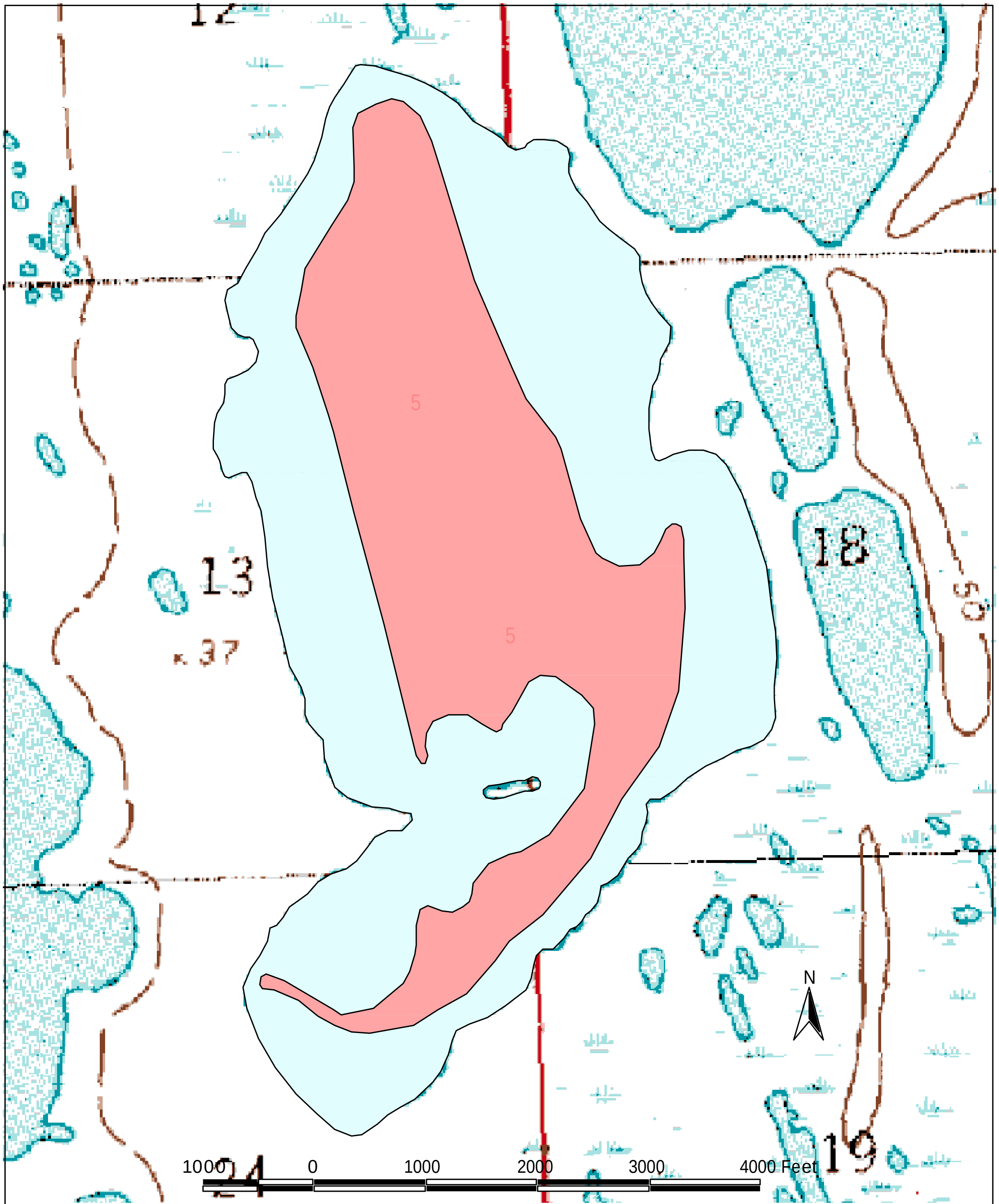
Water Chemistry:

Year of Test	Calcium (mg/l)	Magnesium (mg/l	Chloride (mg/l)	Sodium (mg/l)	Total Hardness [CaCO3] (mg/l)	Specific Conductance (microS/cm)	Turbidity (NTU)	pH	So
1996	15.9	13.5	2.9	31.5	90				J. L
1997								8.04	
2002						209	0.8	8.02	
2005	25.0	2.3	14.8	4.9	72	142	1.5	8.00	

Catch Record:

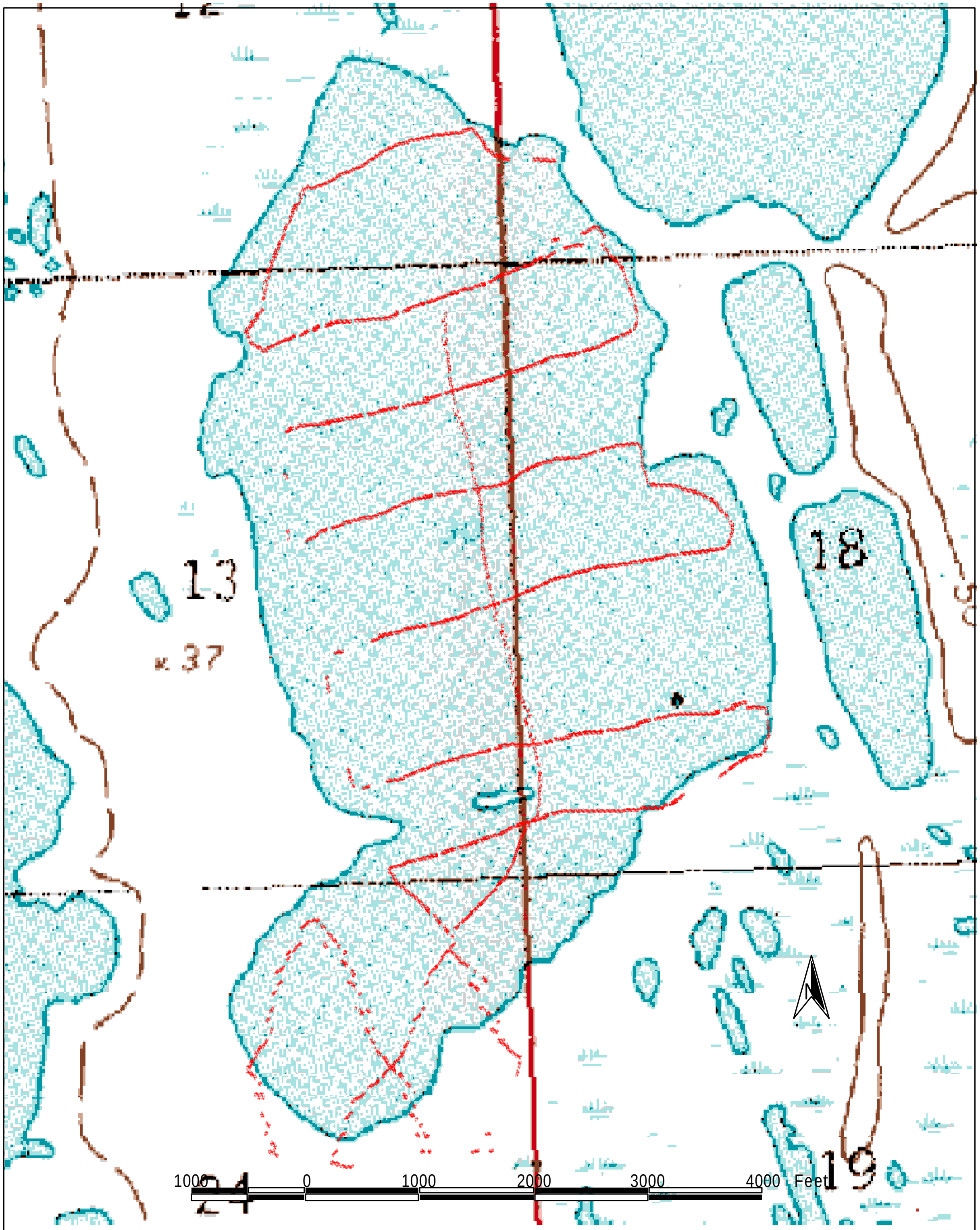
Gear	Date	Effort (hours)	Species	Number Caught
Gill Net	Jul 26 96	10.7	None	0
Observed	Jul 15 02		Ninespine stickleback	many

Last Revised: September 30, 2005

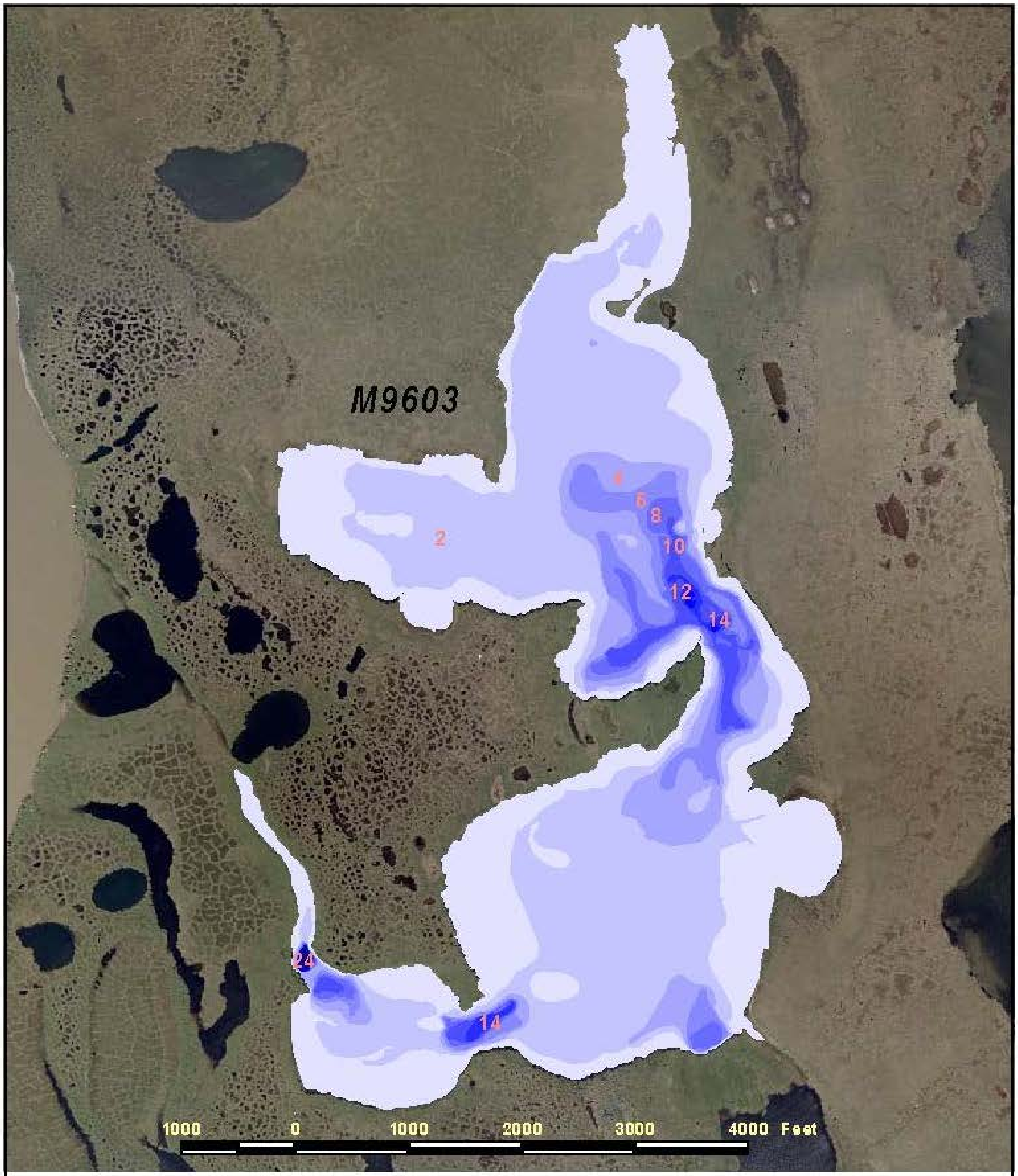


Regions of lake M9602 less than 4 feet deep (light shaded) and likely to be available for ice chips, based on transects surveyed on July 12, 2005.

(not to be used for navigation or to direct use of heavy equipment)



Depth transects measured at lake M9602 on July 12, 2005.



Depth contours of lake M9603 based on transects surveyed on July 19, 2006.
(depths in 2 foot intervals)

(not to be used for navigation or to direct operation of heavy equipment)

Lake M9603

Other Names: BB9.1
Location: 70.21041°N 150.78031°W
USGS Quad Sheet: Harrison Bay A-2: T10N R5E, Sec. 14, 23
Habitat: Drainage Lake
Area: 465.7 acres
Maximum Depth: 27.3 feet
Active Outlet: Yes
Total Lake Volume: 696.2 million gallons (2006 data)
Water Volume Under 4 ft of ice: 200.3 million gallons
Water Volume Under 5 ft of ice: 125.4 million gallons
Water Volume Under 7 ft of ice: 58.1 million gallons

Potential Ice Aggregate: 185.7 acres (water depth 4 ft or less)
14.53 million gallons

Maximum Recommended Winter Removal: **8.72 million gallons**
(15% of volume under 7 feet of ice)
(does not include volume associated with ice aggregate)

Water Use History:

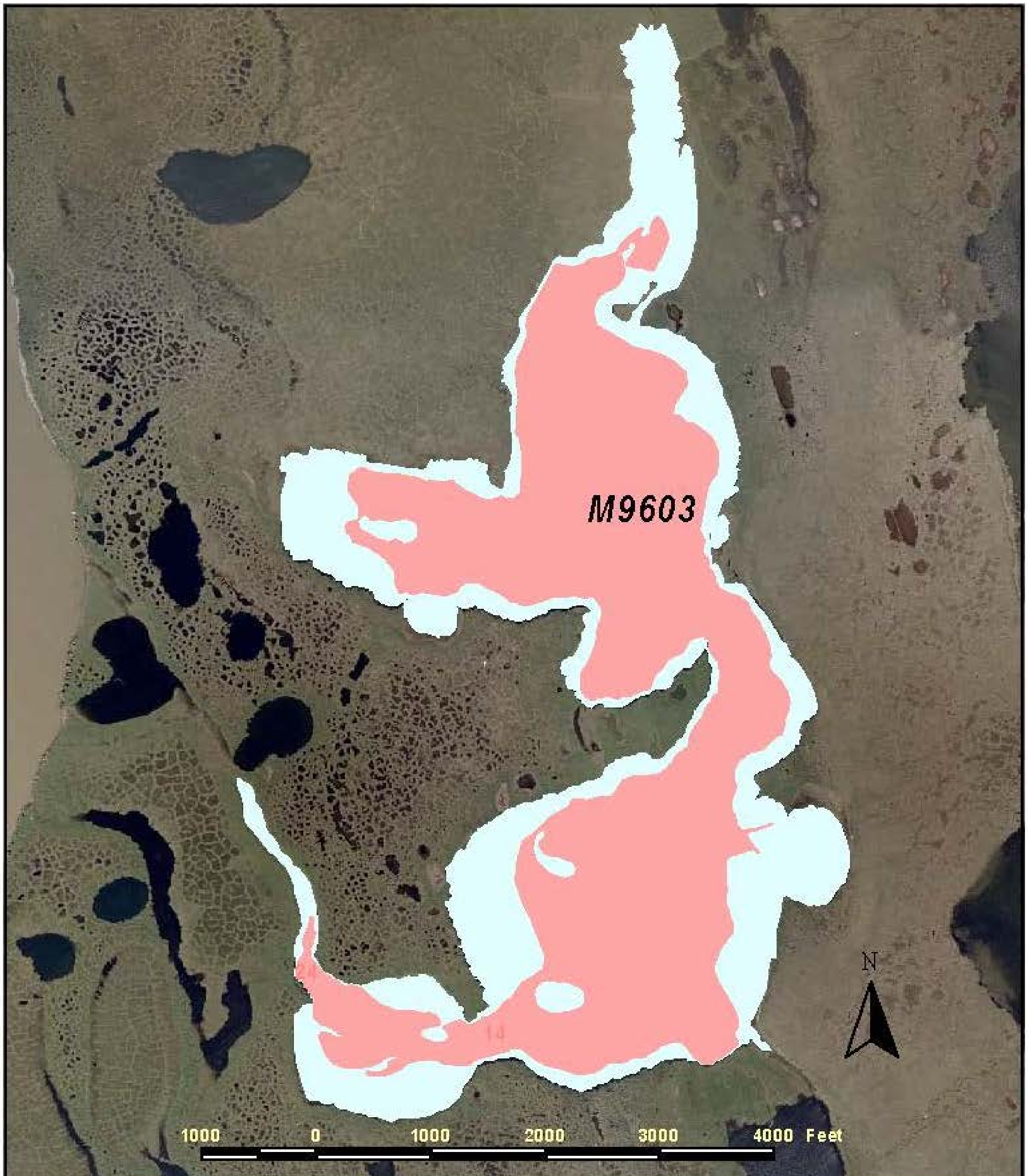
Year	Water Removed (all sources) (mill. Gals)
2005-2006	1.81

Water Chemistry:

Year of Test	Calcium (mg/l	Magnesium (mg/l)	Sodium (mg/l)	Chloride (mg/l)	Total Hardness [CaCO3] (mg/l)	Specific Conductance (microS/cm)	Turbidity (NTU)	pH	Source
1996	25.4	3.3	8.3	11.0	77	165	--	8.29	Moulton 98
2002	--	--	--	--	--	138	1.4	8.01	
2006	14.8	2.2	1.6	2.7	46.2	98	4.5	7.95	this study

Catch Record:

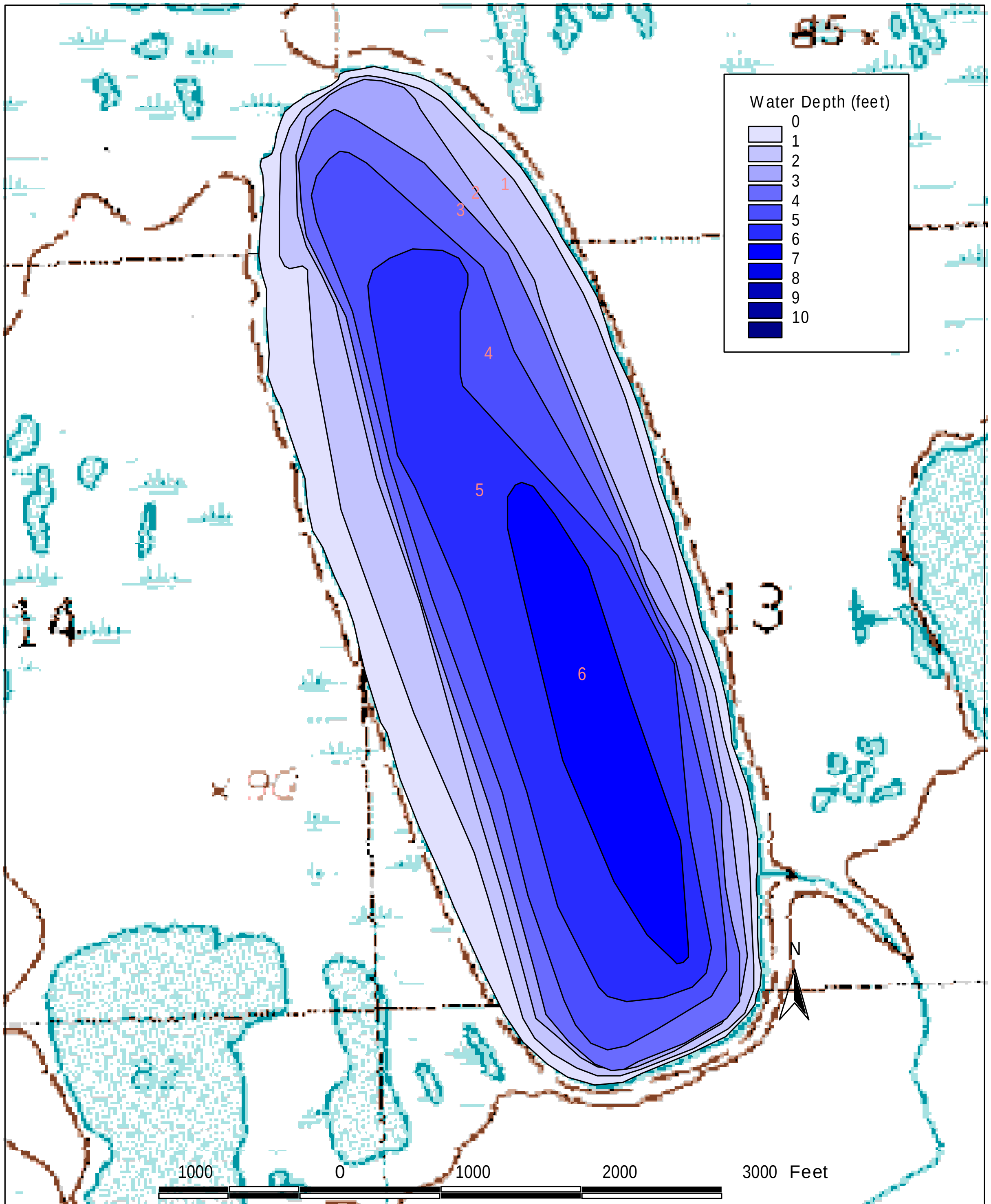
Gear	Date	Effort (hours)	Species	Number Caught	Fork Length (mm)
Gill Net	Jul 17 96	8.1	Least cisco	2	286, 318
Gill Net	Jul 27 96	10.9	Least cisco	9	155-294
			Arctic grayling	1	237



Regions of lake M9521 less than 4 feet deep (light shaded) and likely to be available for ice chips, based transects surveyed on July 19, 2006.

(not to be used for navigation or to direct operation of heavy equipment)

Depth transects measured on lake M9521 on July 19, 2006.



Depth contours of lake M9605 based on transects surveyed on July 20, 2005.

(not to be used for navigation or to direct use of heavy equipment)

Lake M9605

Other Names:	AA14.1
Location:	70.22099°N 150.51572°W
USGS Quad Sheet:	Harrison Bay A-1: T10N R6E, Sec 11/12/13/14/24
Habitat:	Tundra Lake
Area:	350 acres
Maximum Depth:	7.2 feet
Active Outlet:	No
Total Lake Volume:	408.9 million gallons (2005 data)
Volume Under 4 ft of ice:	75.9 million gallons
Volume Under 5 ft of ice:	28.4 million gallons
Volume Under 7 ft of ice:	0.0 million gallons
Potential Aggregate:	174.1 acres (water depth 4 ft or less)

Maximum Recommended Winter Removal: 8.52 million gallons
(30% of volume under 5 feet of ice)
(does not include volume associated with ice aggregate)

Water Use History:

Year	Water Removed (all sources) (mill. Gals)
1998/1999	6.13
2000/2001	18.26
2001/2002	9.22
2002/2003	17.34
2003/2004	5.89
2004/2005	12.82

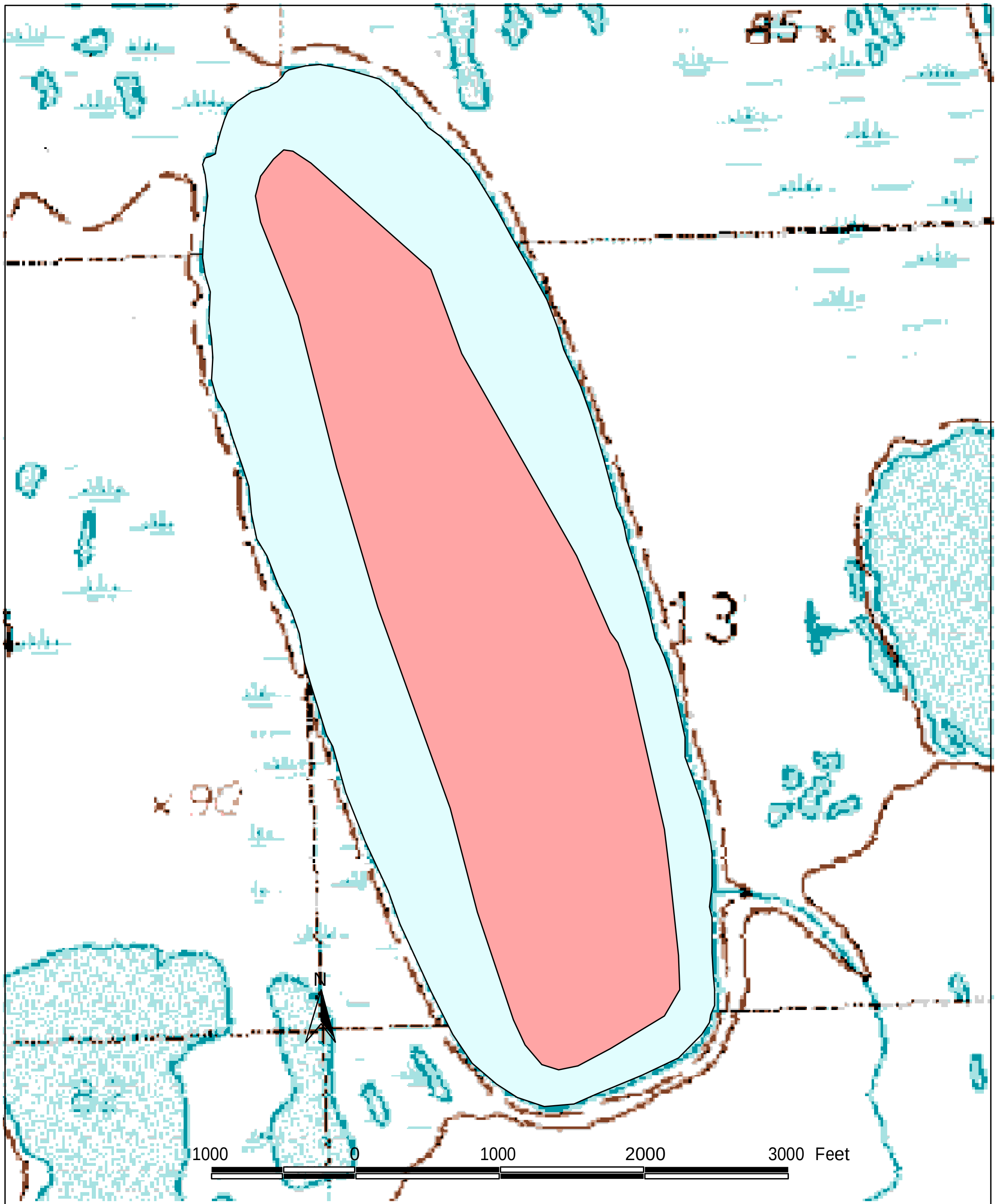
Water Chemistry:

Year of Test	Calcium (mg/l	Magnesium (mg/l)	Chloride (mg/l)	Sodium (mg/l)	Total Hardness [CaCO3] (mg/l)	Specific Conductance (microS/cm)	Turbidity (NTU)	pH	Source
1996	9.8	9.8	2.9	31.2	90				J. Lobdell
2005	21.0	1.7	8.9	3.3	59	137	0.7	8.10	

Catch Record:

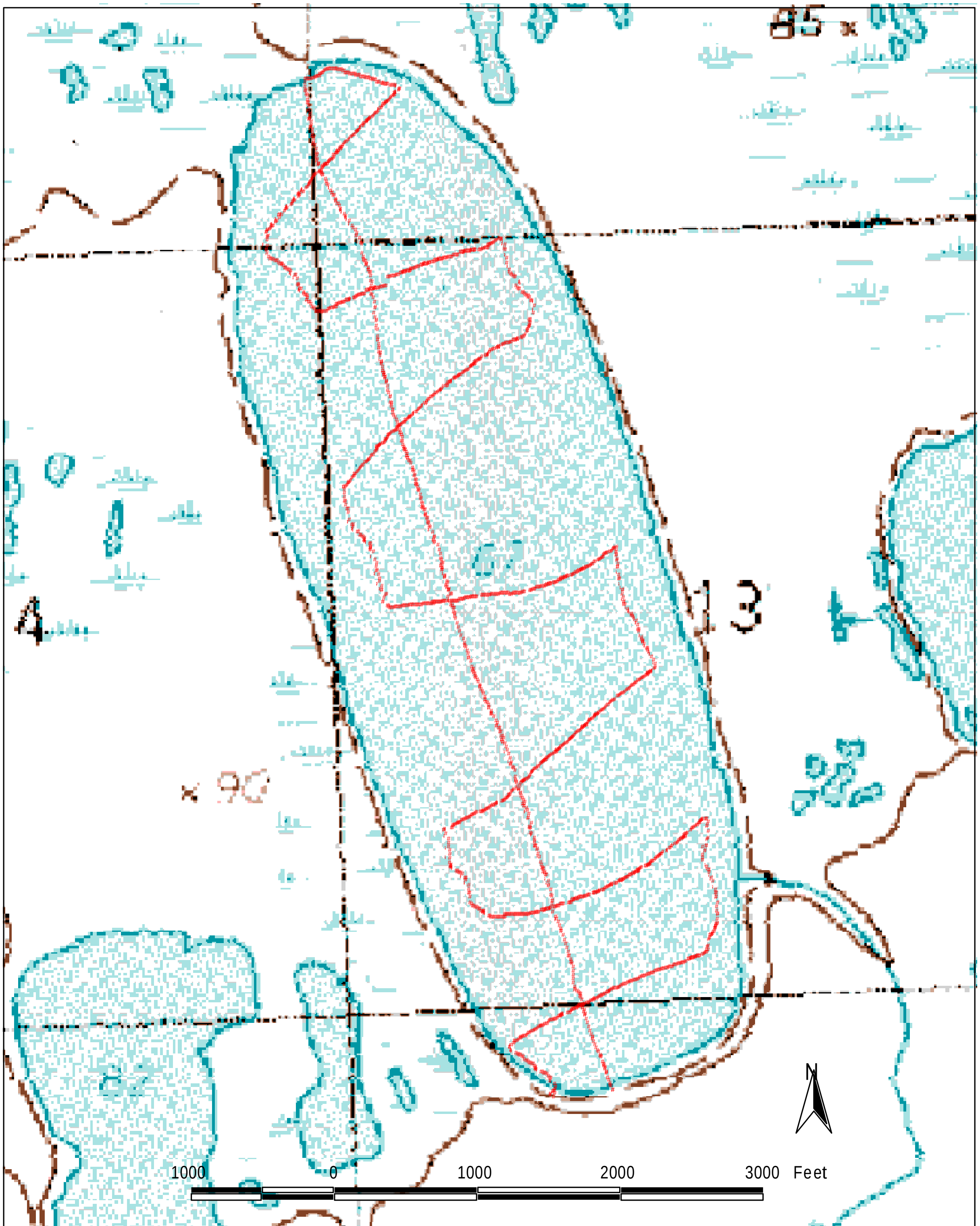
Gear	Date	Effort (hours)	Species	Number Caught
Gill Net	Jul 18 96	4.3	None	0
Gill Net	Jul 20 05	6.7	None	0
Minnow Traps	Jul 20 05	12.2	Ninespine stickleback	1

Last Revised: September 30, 2005



Regions of lake M9605 less than 4 feet deep (light shaded) and likely to be available for ice chips, based on transects surveyed on July 20, 2005.

(not to be used for navigation or to direct use of heavy equipment)



Depth transects measured at lake M9605 on July 20, 2005.

Appendix C Snow Survey Sheets: M9602, M9603 and M9605

Pooled Snow Survey Data Sheet						
Date: 5/5/2013		Start Time: 10:30		End Time: 18:15	Observers: GCY, SMC, WAB	
Catchment Basin: M9602		Driving Wrench Used: Mt. Rose			Tube Section Used: 0-62"	
Snow Sample No.	Pooled Sample #	Terrain Type	Snow Depth (in) w/ Dirt Plug	Snow Depth (in) w/o Dirt Plug	Calculations	
PS023	1	Tundra	6.5	6.5	Bucket & Core Weight (lb) =	1.32
	2		7.0	6.9	Empty Bucket Weight (lb) =	0.82
	3		7.0	6.9	Average Mass (lb) =	0.13
	4		7.0	7.0	Core Area (in^2) =	2.0739
	5				Freshwater Density (lb/in^3) =	0.0361
Latitude	N70° 13.339'		Sum (in) =	27.3	Average Density (lb/in^3) =	0.009
Longitude	W150° 44.333'		Average (in) =	6.8	Average SWE (in) =	1.67
PS024	1	Lake	9.5	9.5	Bucket & Core Weight (lb) =	1.42
	2		9.5	9.5	Empty Bucket Weight (lb) =	0.80
	3		10.0	10.0	Average Mass (lb) =	0.21
	4				Core Area (in^2) =	2.0739
	5				Freshwater Density (lb/in^3) =	0.0361
Latitude	N70° 13.495'		Sum (in) =	29.0	Average Density (lb/in^3) =	0.010
Longitude	W150° 44.183'		Average (in) =	9.7	Average SWE (in) =	2.76
PS025	1	Lake	9.0	8.9	Bucket & Core Weight (lb) =	1.46
	2		8.0	7.8	Empty Bucket Weight (lb) =	0.82
	3		12.0	12.0	Average Mass (lb) =	0.21
	4				Core Area (in^2) =	2.0739
	5				Freshwater Density (lb/in^3) =	0.0361
Latitude	N70° 13.620'		Sum (in) =	28.7	Average Density (lb/in^3) =	0.011
Longitude	W150° 44.063'		Average (in) =	9.6	Average SWE (in) =	2.85
PS026	1	Lake	17.5	17.5	Bucket & Core Weight (lb) =	1.50
	2		15.0	15.0	Empty Bucket Weight (lb) =	0.82
	3				Average Mass (lb) =	0.34
	4				Core Area (in^2) =	2.0739
	5				Freshwater Density (lb/in^3) =	0.0361
Latitude	N70° 13.776'		Sum (in) =	32.5	Average Density (lb/in^3) =	0.010
Longitude	W150° 43.912'		Average (in) =	16.3	Average SWE (in) =	4.54
PS027	1	Tundra	23.5	21.5	Bucket & Core Weight (lb) =	1.14
	2				Empty Bucket Weight (lb) =	0.80
	3				Average Mass (lb) =	0.34
	4				Core Area (in^2) =	2.0739
	5				Freshwater Density (lb/in^3) =	0.0361
Latitude	N70° 13.901'		Sum (in) =	21.5	Average Density (lb/in^3) =	0.008
Longitude	W150° 43.792'		Average (in) =	21.5	Average SWE (in) =	4.54
PS028	1	Lake	6.0	6.0	Bucket & Core Weight (lb) =	1.36
	2		4.0	4.0	Empty Bucket Weight (lb) =	0.80
	3		6.5	6.5	Average Mass (lb) =	0.11
	4		5.5	5.4	Core Area (in^2) =	2.0739
	5		4.5	4.5	Freshwater Density (lb/in^3) =	0.0361
Latitude	N70° 13.366'		Sum (in) =	26.4	Average Density (lb/in^3) =	0.010
Longitude	W150° 44.053'		Average (in) =	5.3	Average SWE (in) =	1.50
Note 1: Locations are referenced to NAD 83 datum.						

Pooled Snow Survey Data Sheet						
Date: 5/5/2013	Start Time: 10:30		End Time: 18:15		Observers: GCY, SMC, WAB	
Catchment Basin: M9602		Driving Wrench Used: Mt. Rose			Tube Section Used: 0-62"	
Snow Sample No.	Pooled Sample #	Terrain Type	Snow Depth (in) w/ Dirt Plug	Snow Depth (in) w/o Dirt Plug	Calculations	
PS029	1	Lake	9.5	9.4	Bucket & Core Weight (lb) =	1.54
	2		11.0	11.0	Empty Bucket Weight (lb) =	0.82
	3		10.5	10.5	Average Mass (lb) =	0.24
	4				Core Area (in^2) =	2.0739
	5				Freshwater Density (lb/in^3) =	0.0361
Latitude	N70° 13.403'	Sum (in) =		**30.9**	Average Density (lb/in^3) =	**0.011**
Longitude	W150° 43.680'	Average (in) =		**10.3**	Average SWE (in) =	**3.20**
PS030	1	Tundra	14.0	13.0	Bucket & Core Weight (lb) =	1.36
	2		19.5	18.0	Empty Bucket Weight (lb) =	0.80
	3				Average Mass (lb) =	0.28
	4				Core Area (in^2) =	2.0739
	5				Freshwater Density (lb/in^3) =	0.0361
Latitude	N70° 13.440'	Sum (in) =		**31.0**	Average Density (lb/in^3) =	**0.009**
Longitude	W150° 43.307'	Average (in) =		**15.5**	Average SWE (in) =	**3.74**
PS031	1	Lake	8.0	8.0	Bucket & Core Weight (lb) =	1.32
	2		8.0	7.9	Empty Bucket Weight (lb) =	0.84
	3		7.0	7.0	Average Mass (lb) =	0.12
	4		7.0	7.0	Core Area (in^2) =	2.0739
	5				Freshwater Density (lb/in^3) =	0.0361
Latitude	N70° 13.262'	Sum (in) =		**29.9**	Average Density (lb/in^3) =	**0.008**
Longitude	W150° 44.019'	Average (in) =		**7.5**	Average SWE (in) =	**1.60**
PS032	1	Lake	9.5	9.5	Bucket & Core Weight (lb) =	1.40
	2		9.0	9.0	Empty Bucket Weight (lb) =	0.84
	3		9.5	9.5	Average Mass (lb) =	0.19
	4				Core Area (in^2) =	2.0739
	5				Freshwater Density (lb/in^3) =	0.0361
Latitude	N70° 13.185'	Sum (in) =		**28.0**	Average Density (lb/in^3) =	**0.010**
Longitude	W150° 43.704'	Average (in) =		**9.3**	Average SWE (in) =	**2.49**
PS033	1	Lake	7.0	7.0	Bucket & Core Weight (lb) =	1.50
	2		6.5	6.4	Empty Bucket Weight (lb) =	0.82
	3		6.0	5.9	Average Mass (lb) =	0.14
	4		6.5	6.5	Core Area (in^2) =	2.0739
	5		8.0	8.0	Freshwater Density (lb/in^3) =	0.0361
Latitude	N70° 13.108'	Sum (in) =		**33.8**	Average Density (lb/in^3) =	**0.010**
Longitude	W150°43.389'	Average (in) =		**6.8**	Average SWE (in) =	**1.82**
PS034	1	Tundra	17.0	17.0	Bucket & Core Weight (lb) =	1.28
	2		16.0	14.0	Empty Bucket Weight (lb) =	0.82
	3				Average Mass (lb) =	0.23
	4				Core Area (in^2) =	2.0739
	5				Freshwater Density (lb/in^3) =	0.0361
Latitude	N70° 13.011'	Sum (in) =		**31.0**	Average Density (lb/in^3) =	**0.007**
Longitude	W150° 42.995'	Average (in) =		**15.5**	Average SWE (in) =	**3.07**
Note 1: Locations are referenced to NAD 83 datum.						

Pooled Snow Survey Data Sheet						
Date: 5/5/2013	Start Time: 10:30		End Time: 18:15		Observers: GCY, SMC, WAB	
Catchment Basin: M9602		Driving Wrench Used: Mt. Rose			Tube Section Used: 0-62"	
Snow Sample No.	Pooled Sample #	Terrain Type	Snow Depth (in) w/ Dirt Plug	Snow Depth (in) w/o Dirt Plug	Calculations	
PS035	1	Lake	12.5	12.5	Bucket & Core Weight (lb) =	1.70
	2		14.0	14.0	Empty Bucket Weight (lb) =	0.80
	3		13.0	13.0	Average Mass (lb) =	0.30
	4				Core Area (in^2) =	2.0739
	5				Freshwater Density (lb/in^3) =	0.0361
Latitude	N70° 13.276'	Sum (in) =		**39.5**	Average Density (lb/in^3) =	**0.011**
Longitude	W150° 44.391'	Average (in) =		**13.2**	Average SWE (in) =	**4.01**
PS036	1	Lake	12.5	12.5	Bucket & Core Weight (lb) =	1.76
	2		14.5	14.5	Empty Bucket Weight (lb) =	0.82
	3		15.0	15.0	Average Mass (lb) =	0.31
	4				Core Area (in^2) =	2.0739
	5				Freshwater Density (lb/in^3) =	0.0361
Latitude	N70° 13.150'	Sum (in) =		**42.0**	Average Density (lb/in^3) =	**0.011**
Longitude	W150° 44.508'	Average (in) =		**14.0**	Average SWE (in) =	**4.18**
PS037	1	Lake	6.5	6.3	Bucket & Core Weight (lb) =	1.20
	2		6.5	6.5	Empty Bucket Weight (lb) =	0.78
	3		6.5	6.3	Average Mass (lb) =	0.11
	4		6.5	6.3	Core Area (in^2) =	2.0739
	5				Freshwater Density (lb/in^3) =	0.0361
Latitude	N70° 13.025'	Sum (in) =		**25.4**	Average Density (lb/in^3) =	**0.008**
Longitude	W150° 44.624'	Average (in) =		**6.4**	Average SWE (in) =	**1.40**
PS038	1	Tundra	26.5	22.0	Bucket & Core Weight (lb) =	1.88
	2		24.0	22.0	Empty Bucket Weight (lb) =	0.82
	3				Average Mass (lb) =	0.53
	4				Core Area (in^2) =	2.0739
	5				Freshwater Density (lb/in^3) =	0.0361
Latitude	N70° 12.900'	Sum (in) =		**44.0**	Average Density (lb/in^3) =	**0.012**
Longitude	W150° 44.740'	Average (in) =		**22.0**	Average SWE (in) =	**7.08**
PS039	1	Lake	13.0	13.0	Bucket & Core Weight (lb) =	1.30
	2		13.0	12.9	Empty Bucket Weight (lb) =	0.82
	3				Average Mass (lb) =	0.24
	4				Core Area (in^2) =	2.0739
	5				Freshwater Density (lb/in^3) =	0.0361
Latitude	N70° 12.805'	Sum (in) =		**25.9**	Average Density (lb/in^3) =	**0.009**
Longitude	W150° 44.827'	Average (in) =		**13.0**	Average SWE (in) =	**3.20**
PS040	1	Lake	10.5	10.5	Bucket & Core Weight (lb) =	1.40
	2		10.0	9.8	Empty Bucket Weight (lb) =	0.82
	3		10.0	9.8	Average Mass (lb) =	0.19
	4				Core Area (in^2) =	2.0739
	5				Freshwater Density (lb/in^3) =	0.0361
Latitude	N70° 12.680'	Sum (in) =		**30.1**	Average Density (lb/in^3) =	**0.009**
Longitude	W150° 44.942'	Average (in) =		**10.0**	Average SWE (in) =	**2.58**
Note 1: Locations are referenced to NAD 83 datum.						

Pooled Snow Survey Data Sheet						
Date: 5/5/2013		Start Time: 10:30	End Time: 18:15		Observers: GCY, SMC, WAB	
Catchment Basin: M9602		Driving Wrench Used: Mt. Rose			Tube Section Used: 0-62"	
Snow Sample No.	Pooled Sample #	Terrain Type	Snow Depth (in) w/ Dirt Plug	Snow Depth (in) w/o Dirt Plug	Calculations	
PS041	1	Lake	10.0	9.8	Bucket & Core Weight (lb) =	1.40
	2		9.5	9.5	Empty Bucket Weight (lb) =	0.82
	3		9.0	9.0	Average Mass (lb) =	0.19
	4				Core Area (in^2) =	2.0739
	5				Freshwater Density (lb/in^3) =	0.0361
Latitude	N70° 12.586'		Sum (in) =	**28.3**	Average Density (lb/in^3) =	**0.010**
Longitude	W150° 45.030'		Average (in) =	**9.4**	Average SWE (in) =	**2.58**
PS042	1	Lake	22.0	22.0	Bucket & Core Weight (lb) =	1.92
	2		22.0	22.0	Empty Bucket Weight (lb) =	0.82
	3				Average Mass (lb) =	0.55
	4				Core Area (in^2) =	2.0739
	5				Freshwater Density (lb/in^3) =	0.0361
Latitude	N70° 12.492'		Sum (in) =	**44.0**	Average Density (lb/in^3) =	**0.012**
Longitude	W150° 45.117'		Average (in) =	**22.0**	Average SWE (in) =	**7.34**
PS043	1	Tundra	23.5	23.0	Bucket & Core Weight (lb) =	1.28
	2				Empty Bucket Weight (lb) =	0.82
	3				Average Mass (lb) =	0.46
	4				Core Area (in^2) =	2.0739
	5				Freshwater Density (lb/in^3) =	0.0361
Latitude	N70° 12.366'		Sum (in) =	**23.0**	Average Density (lb/in^3) =	**0.010**
Longitude	W150° 45.234'		Average (in) =	**23.0**	Average SWE (in) =	**6.14**
PS044	1	Lake	9.5	9.5	Bucket & Core Weight (lb) =	1.18
	2		10.0	10.0	Empty Bucket Weight (lb) =	0.84
	3		10.0	9.8	Average Mass (lb) =	0.11
	4				Core Area (in^2) =	2.0739
	5				Freshwater Density (lb/in^3) =	0.0361
Latitude	N70° 13.291'		Sum (in) =	**29.3**	Average Density (lb/in^3) =	**0.006**
Longitude	W150° 44.799'		Average (in) =	**9.8**	Average SWE (in) =	**1.51**
PS045	1	Lake	10.0	9.8	Bucket & Core Weight (lb) =	1.44
	2		10.0	10.0	Empty Bucket Weight (lb) =	0.82
	3		10.0	10.0	Average Mass (lb) =	0.21
	4				Core Area (in^2) =	2.0739
	5				Freshwater Density (lb/in^3) =	0.0361
Latitude	N70° 13.263'		Sum (in) =	**29.8**	Average Density (lb/in^3) =	**0.010**
Longitude	W150° 45.078'		Average (in) =	**9.9**	Average SWE (in) =	**2.76**
PS046	1	Lake	17.5	17.5	Bucket & Core Weight (lb) =	1.68
	2		18.5	18.5	Empty Bucket Weight (lb) =	0.78
	3		19.5	19.5	Average Mass (lb) =	0.30
	4				Core Area (in^2) =	2.0739
	5				Freshwater Density (lb/in^3) =	0.0361
Latitude	N70° 13.235'		Sum (in) =	**55.5**	Average Density (lb/in^3) =	**0.008**
Longitude	W150° 45.357'		Average (in) =	**18.5**	Average SWE (in) =	**4.01**
Note 1: Locations are referenced to NAD 83 datum.						

Pooled Snow Survey Data Sheet						
Date: 5/5/2013	Start Time: 10:30		End Time: 18:15		Observers: GCY, SMC, WAB	
Catchment Basin: M9602		Driving Wrench Used: Mt. Rose			Tube Section Used: 0-62"	
Snow Sample No.	Pooled Sample #	Terrain Type	Snow Depth (in) w/ Dirt Plug	Snow Depth (in) w/o Dirt Plug	Calculations	
PS047	1	Tundra	12.5	12.3	Bucket & Core Weight (lb) =	1.24
	2		13.0	12.8	Empty Bucket Weight (lb) =	0.82
	3				Average Mass (lb) =	0.21
	4				Core Area (in^2) =	2.0739
	5				Freshwater Density (lb/in^3) =	0.0361
Latitude	N70° 13.207'		Sum (in) =	**25.1**	Average Density (lb/in^3) =	**0.008**
Longitude	W150° 45.637'		Average (in) =	**12.6**	Average SWE (in) =	**2.80**
PS048	1	Lake	5.0	5.0	Bucket & Core Weight (lb) =	1.26
	2		6.0	5.7	Empty Bucket Weight (lb) =	0.82
	3		5.5	5.4	Average Mass (lb) =	0.09
	4		6.5	6.5	Core Area (in^2) =	2.0739
	5		6.5	6.5	Freshwater Density (lb/in^3) =	0.0361
Latitude	N70° 13.397'		Sum (in) =	**29.1**	Average Density (lb/in^3) =	**0.007**
Longitude	W150° 44.569'		Average (in) =	**5.8**	Average SWE (in) =	**1.18**
PS049	1	Lake	6.5	6.2	Bucket & Core Weight (lb) =	1.36
	2		9.5	9.3	Empty Bucket Weight (lb) =	0.82
	3		5.5	5.5	Average Mass (lb) =	0.11
	4		6.0	6.0	Core Area (in^2) =	2.0739
	5		6.5	6.5	Freshwater Density (lb/in^3) =	0.0361
Latitude	N70° 13.493'		Sum (in) =	**33.5**	Average Density (lb/in^3) =	**0.008**
Longitude	W150° 44.962'		Average (in) =	**6.7**	Average SWE (in) =	**1.44**
PS050	1	Tundra	22.5	22.5	Bucket & Core Weight (lb) =	1.10
	2				Empty Bucket Weight (lb) =	0.82
	3				Average Mass (lb) =	0.28
	4				Core Area (in^2) =	2.0739
	5				Freshwater Density (lb/in^3) =	0.0361
Latitude	N70° 13.570'		Sum (in) =	**22.5**	Average Density (lb/in^3) =	**0.006**
Longitude	W150° 45.276'		Average (in) =	**22.5**	Average SWE (in) =	**3.74**
PS051	1	Tundra	17.0	16.0	Bucket & Core Weight (lb) =	1.40
	2		19.0	17.5	Empty Bucket Weight (lb) =	0.82
	3				Average Mass (lb) =	0.29
	4				Core Area (in^2) =	2.0739
	5				Freshwater Density (lb/in^3) =	0.0361
Latitude	N70° 13.629'		Sum (in) =	**33.5**	Average Density (lb/in^3) =	**0.008**
Longitude	W150° 45.511'		Average (in) =	**16.8**	Average SWE (in) =	**3.87**
PS052	1	Tundra	14.5	13.5	Bucket & Core Weight (lb) =	1.12
	2		11.0	11.0	Empty Bucket Weight (lb) =	0.84
	3				Average Mass (lb) =	0.14
	4				Core Area (in^2) =	2.0739
	5				Freshwater Density (lb/in^3) =	0.0361
Latitude	N70° 13.686'		Sum (in) =	**24.5**	Average Density (lb/in^3) =	**0.006**
Longitude	W150° 45.748'		Average (in) =	**12.3**	Average SWE (in) =	**1.87**
Note 1: Locations are referenced to NAD 83 datum.						

Pooled Snow Survey Data Sheet						
Date: 5/5/2013	Start Time: 10:30		End Time: 18:15		Observers: GCY, SMC, WAB	
Catchment Basin: M9602		Driving Wrench Used: Mt. Rose			Tube Section Used: 0-62"	
Snow Sample No.	Pooled Sample #	Terrain Type	Snow Depth (in) w/ Dirt Plug	Snow Depth (in) w/o Dirt Plug	Calculations	
PS053	1	Lake	5.0	5.0	**Bucket & Core Weight (lb) =**	1.30
	2		3.5	3.5	**Empty Bucket Weight (lb) =**	0.82
	3		5.0	5.0	**Average Mass (lb) =**	0.10
	4		6.0	6.0	**Core Area (in^2) =**	2.0739
	5		6.0	6.0	**Freshwater Density (lb/in^3) =**	0.0361
Latitude	N70° 13.564'		**Sum (in) =**	**25.5**	**Average Density (lb/in^3) =**	**0.009**
Longitude	W150° 44.471'		**Average (in) =**	**5.1**	**Average SWE (in) =**	**1.28**
PS054	1	Lake	5.0	5.0	**Bucket & Core Weight (lb) =**	1.40
	2		5.0	5.0	**Empty Bucket Weight (lb) =**	0.84
	3		5.0	5.0	**Average Mass (lb) =**	0.11
	4		5.0	5.0	**Core Area (in^2) =**	2.0739
	5		5.5	5.5	**Freshwater Density (lb/in^3) =**	0.0361
Latitude	N70° 13.821'		**Sum (in) =**	**25.5**	**Average Density (lb/in^3) =**	**0.011**
Longitude	W150° 44.629'		**Average (in) =**	**5.1**	**Average SWE (in) =**	**1.50**
PS055	1	Tundra	6.0	5.0	**Bucket & Core Weight (lb) =**	1.24
	2		11.0	9.5	**Empty Bucket Weight (lb) =**	0.82
	3		10.0	10.0	**Average Mass (lb) =**	0.11
	4		10.0	10.0	**Core Area (in^2) =**	2.0739
	5				**Freshwater Density (lb/in^3) =**	0.0361
Latitude	N70° 14.013'		**Sum (in) =**	**34.5**	**Average Density (lb/in^3) =**	**0.006**
Longitude	W150° 44.748'		**Average (in) =**	**8.6**	**Average SWE (in) =**	**1.40**
PS056	1	Lake	9.5	9.2	**Bucket & Core Weight (lb) =**	1.38
	2		9.5	9.3	**Empty Bucket Weight (lb) =**	0.82
	3		10.0	9.8	**Average Mass (lb) =**	0.19
	4				**Core Area (in^2) =**	2.0739
	5				**Freshwater Density (lb/in^3) =**	0.0361
Latitude	N70° 13.114'		**Sum (in) =**	**28.3**	**Average Density (lb/in^3) =**	**0.010**
Longitude	W150° 44.184'		**Average (in) =**	**9.4**	**Average SWE (in) =**	**2.49**
PS057	1	Lake	4.5	4.4	**Bucket & Core Weight (lb) =**	1.14
	2		5.0	5.0	**Empty Bucket Weight (lb) =**	0.80
	3		5.5	5.4	**Average Mass (lb) =**	0.07
	4		5.0	4.8	**Core Area (in^2) =**	2.0739
	5		5.5	5.3	**Freshwater Density (lb/in^3) =**	0.0361
Latitude	N70° 12.889'		**Sum (in) =**	**24.9**	**Average Density (lb/in^3) =**	**0.007**
Longitude	W150° 44.036'		**Average (in) =**	**5.0**	**Average SWE (in) =**	**0.91**
PS058	1	Tundra	27.5	26.5	**Bucket & Core Weight (lb) =**	1.36
	2				**Empty Bucket Weight (lb) =**	0.78
	3				**Average Mass (lb) =**	0.58
	4				**Core Area (in^2) =**	2.0739
	5				**Freshwater Density (lb/in^3) =**	0.0361
Latitude	N70° 12.697'		**Sum (in) =**	**26.5**	**Average Density (lb/in^3) =**	**0.011**
Longitude	W150° 43.910'		**Average (in) =**	**26.5**	**Average SWE (in) =**	**7.74**
Note 1: Locations are referenced to NAD 83 datum.						

Pooled Snow Survey Data Sheet						
Date: 5/5/2013		Start Time: 10:30		End Time: 18:15	Observers: GCY, SMC, WAB	
Catchment Basin: M9602			Driving Wrench Used: Mt. Rose		Tube Section Used: 0-62"	
Snow Sample No.	Pooled Sample #	Terrain Type	Snow Depth (in) w/ Dirt Plug	Snow Depth (in) w/o Dirt Plug	Calculations	
BKR04 WPT 021	1	Berm	53.0	53.0	Bucket & Core Weight (lb) =	2.46
	2				Empty Bucket Weight (lb) =	0.82
	3				Average Mass (lb) =	1.64
	4				Core Area (in^2) =	2.0739
	5				Freshwater Density (lb/in^3) =	0.0361
Latitude	N70° 13.925'		Sum (in) =	**53.0**	Average Density (lb/in^3) =	**0.015**
Longitude	W150° 44.351'		Average (in) =	**53.0**	Average SWE (in) =	**21.90**
BKR04 WPT 024	1	Berm	54.0	54.0	Bucket & Core Weight (lb) =	2.30
	2				Empty Bucket Weight (lb) =	0.82
	3				Average Mass (lb) =	1.48
	4				Core Area (in^2) =	2.0739
	5				Freshwater Density (lb/in^3) =	0.0361
Latitude	N70° 13.883'		Sum (in) =	**54.0**	Average Density (lb/in^3) =	**0.013**
Longitude	W150° 44.226'		Average (in) =	**54.0**	Average SWE (in) =	**19.76**
Note 1: Locations are referenced to NAD 83 datum.						

Snow Depth Survey Data Sheet				
Date: 5/5/2013		Start Time: 10:25 AM		Observers: GCY, SMC, WAB
Catchment Basin: M9602		End Time: 6:15 PM		
Snow Sample No.	Terrain Type	Snow Depth (in)	Location	
			Latitude	Longitude
SS085	Lake	7.5	N70° 13.370'	W150° 44.303'
SS086	Lake	7.1	N70° 13.401'	W150° 44.273'
SS087	Lake	12.6	N70° 13.433'	W150° 44.243'
SS088	Lake	7.9	N70° 13.464'	W150° 44.213'
SS089	Lake	7.5	N70° 13.526'	W150° 44.153'
SS090	Lake	5.9	N70° 13.557'	W150° 44.123'
SS091	Lake	8.7	N70° 13.588'	W150° 44.093'
SS092	Lake	7.9	N70° 13.651'	W150° 44.033'
SS093	Lake	4.7	N70° 13.682'	W150° 44.003'
SS094	Lake	6.3	N70° 13.713'	W150° 43.973'
SS095	Lake	10.6	N70° 13.745'	W150° 43.942'
SS096	Tundra	32.7	N70° 13.807'	W150° 43.882'
SS097	Tundra	22.8	N70° 13.839'	W150° 43.852'
SS098	Tundra	13.4	N70° 13.870'	W150° 43.822'
SS099	Lake	7.9	N70° 13.348'	W150° 44.240'
SS100	Lake	8.7	N70° 13.357'	W150° 44.146'
SS101	Lake	7.5	N70° 13.376'	W150° 43.960'
SS102	Lake	9.8	N70° 13.385'	W150° 43.867'
SS103	Lake	5.9	N70° 13.394'	W150° 43.773'
SS104	Lake	9.4	N70° 13.412'	W150° 43.587'
SS105	Tundra	9.8	N70° 13.422'	W150° 43.494'
SS106	Tundra	20.9	N70° 13.431'	W150° 43.401'
SS107	Tundra	11.8	N70° 13.449'	W150° 43.214'
SS108	Lake	21.7	N70° 13.319'	W150° 44.255'
SS109	Lake	3.9	N70° 13.300'	W150° 44.176'
SS110	Lake	3.5	N70° 13.281'	W150° 44.097'
SS111	Lake	7.1	N70° 13.242'	W150° 43.940'
SS112	Lake	8.7	N70° 13.223'	W150° 43.861'
SS113	Lake	14.6	N70° 13.204'	W150° 43.783'
SS114	Lake	9.1	N70° 13.165'	W150° 43.625'
SS115	Lake	11.8	N70° 13.146'	W150° 43.547'
SS116	Lake	5.5	N70° 13.127'	W150° 43.468'
SS117	Lake	8.7	N70° 13.088'	W150° 43.310'
SS118	Lake	7.5	N70° 13.069'	W150° 43.232'
SS119	Lake	15.7	N70° 13.050'	W150° 43.153'
SS120	Lake	26.8	N70° 13.031'	W150° 43.074'
SS121	Tundra	22.0	N70° 12.992'	W150° 42.918'
SS122	Lake	10.2	N70° 13.307'	W150° 44.362'
SS123	Lake	7.5	N70° 13.245'	W150° 44.420'
SS124	Lake	10.6	N70° 13.213'	W150° 44.449'
SS125	Lake	7.5	N70° 13.182'	W150° 44.479'

Snow Depth Survey Data Sheet				
Date: 5/5/2013		Start Time: 10:25 AM		Observers: GCY, SMC, WAB
Catchment Basin: M9602		End Time: 6:15 PM		
Snow Sample No.	Terrain Type	Snow Depth (in)	Location	
			Latitude	Longitude
SS126	Lake	8.7	N70° 13.119'	W150° 44.537'
SS127	Lake	5.9	N70° 13.088'	W150° 44.566'
SS128	Lake	9.4	N70° 13.056'	W150° 44.595'
SS129	Lake	19.7	N70° 12.993'	W150° 44.653'
SS130	Lake	11.8	N70° 12.962'	W150° 44.682'
SS131	Lake	8.3	N70° 12.930'	W150° 44.712'
SS132	Lake	13.8	N70° 12.868'	W150° 44.769'
SS133	Lake	13.0	N70° 12.837'	W150° 44.798'
SS134	Lake	8.3	N70° 12.774'	W150° 44.857'
SS135	Lake	4.3	N70° 12.743'	W150° 44.885'
SS136	Lake	7.9	N70° 12.711'	W150° 44.914'
SS137	Lake	10.6	N70° 12.648'	W150° 44.972'
SS138	Lake	10.2	N70° 12.617'	W150° 45.002'
SS139	Lake	7.5	N70° 12.555'	W150° 45.060'
SS140	Lake	10.6	N70° 12.523'	W150° 45.089'
SS141	Tundra	29.5	N70° 12.460'	W150° 45.147'
SS142	Tundra	15.0	N70° 12.429'	W150° 45.176'
SS143	Tundra	17.7	N70° 12.398'	W150° 45.205'
SS144	Lake	13.0	N70° 13.329'	W150° 44.426'
SS145	Lake	4.3	N70° 13.320'	W150° 44.519'
SS146	Lake	11.0	N70° 13.310'	W150° 44.612'
SS147	Lake	9.1	N70° 13.301'	W150° 44.706'
SS148	Lake	7.9	N70° 13.282'	W150° 44.892'
SS149	Lake	11.0	N70° 13.273'	W150° 44.985'
SS150	Lake	36.2	N70° 13.254'	W150° 45.171'
SS151	Tundra	16.5	N70° 13.244'	W150° 45.264'
SS152	Tundra	19.3	N70° 13.226'	W150° 45.450'
SS153	Lake	27.6	N70° 13.216'	W150° 45.543'
SS154	Lake	7.5	N70° 13.358'	W150° 44.412'
SS155	Lake	8.7	N70° 13.377'	W150° 44.490'
SS156	Lake	13.8	N70° 13.416'	W150° 44.648'
SS157	Lake	8.7	N70° 13.435'	W150° 44.726'
SS158	Lake	9.8	N70° 13.455'	W150° 44.805'
SS159	Lake	13.0	N70° 13.474'	W150° 44.883'
SS160	Lake	7.9	N70° 13.512'	W150° 45.040'
SS161	Lake	9.1	N70° 13.532'	W150° 45.119'
SS162	Lake	11.8	N70° 13.551'	W150° 45.197'
SS163	Lake	29.5	N70° 13.590'	W150° 45.354'
SS164	Tundra	14.6	N70° 13.609'	W150° 45.433'
SS165	Tundra	19.3	N70° 13.648'	W150° 45.591'
SS166	Tundra	23.2	N70° 13.667'	W150° 45.669'

Snow Depth Survey Data Sheet				
Date: 5/5/2013		Start Time: 10:25 AM		Observers: GCY, SMC, WAB
Catchment Basin: M9602		End Time: 6:15 PM		
Snow Sample No.	Terrain Type	Snow Depth (in)	Location	
			Latitude	Longitude
SS167	Lake	9.4	N70° 13.371'	W150° 44.353'
SS168	Lake	12.2	N70° 13.403'	W150° 44.373'
SS169	Lake	11.8	N70° 13.435'	W150° 44.392'
SS170	Lake	11.8	N70° 13.467'	W150° 44.412'
SS171	Lake	7.1	N70° 13.499'	W150° 44.432'
SS172	Lake	8.3	N70° 13.531'	W150° 44.452'
SS173	Lake	5.9	N70° 13.596'	W150° 44.491'
SS174	Lake	3.9	N70° 13.627'	W150° 44.510'
SS175	Lake	5.9	N70° 13.660'	W150° 44.530'
SS176	Lake	5.9	N70° 13.692'	W150° 44.550'
SS177	Lake	6.3	N70° 13.724'	W150° 44.570'
SS178	Lake	10.6	N70° 13.756'	W150° 44.589'
SS179	Lake	9.1	N70° 13.788'	W150° 44.609'
SS180	Lake	5.9	N70° 13.853'	W150° 44.649'
SS181	Lake	7.1	N70° 13.885'	W150° 44.669'
SS182	Lake	7.1	N70° 13.917'	W150° 44.688'
SS183	Lake	8.7	N70° 13.949'	W150° 44.708'
SS184	Tundra	11.8	N70° 13.981'	W150° 44.728'
SS185	Tundra	22.4	N70° 14.046'	W150° 44.767'
SS186	Tundra	24.8	N70° 14.078'	W150° 44.787'
SS187	Tundra	32.3	N70° 14.110'	W150° 44.807'
SS188	Lake	8.3	N70° 13.307'	W150° 44.310'
SS189	Lake	8.3	N70° 13.275'	W150° 44.288'
SS190	Lake	9.8	N70° 13.242'	W150° 44.267'
SS191	Lake	12.2	N70° 13.210'	W150° 44.247'
SS192	Lake	11.8	N70° 13.178'	W150° 44.226'
SS193	Lake	12.6	N70° 13.146'	W150° 44.204'
SS194	Lake	7.1	N70° 13.083'	W150° 44.163'
SS195	Lake	13.8	N70° 13.050'	W150° 44.142'
SS196	Lake	19.7	N70° 13.018'	W150° 44.120'
SS197	Lake	9.1	N70° 12.986'	W150° 44.099'
SS198	Lake	17.7	N70° 12.954'	W150° 44.078'
SS199	Lake	20.5	N70° 12.922'	W150° 44.057'
SS200	Lake	9.8	N70° 12.857'	W150° 44.015'
SS201	Lake	9.4	N70° 12.825'	W150° 43.994'
SS202	Lake	9.8	N70° 12.793'	W150° 43.973'
SS203	Lake	13.4	N70° 12.761'	W150° 43.952'
SS204	Tundra	13.8	N70° 12.729'	W150° 43.931'
SS205	Tundra	20.1	N70° 12.664'	W150° 43.888'

Pooled Snow Survey Data Sheet						
Date: 5/14/2013	Start Time: 11:50		End Time: 17:00		Observers: GCY, SMC, WAB, SAC	
Catchment Basin: M9603		Driving Wrench Used: Mt. Rose			Tube Section Used: 0-62"	
Snow Sample No.	Pooled Sample #	Terrain Type	Snow Depth (in) w/ Dirt Plug	Snow Depth (in) w/o Dirt Plug	Calculations	
PS059	1	Lake	11.5	11.4	Bucket & Core Weight (lb) =	1.40
	2		9.5	9.5	Empty Bucket Weight (lb) =	0.84
	3		10.0	10.0	Average Mass (lb) =	0.14
	4		10.0	10.0	Core Area (in^2) =	2.0739
	5				Freshwater Density (lb/in^3) =	0.0361
Latitude	N70° 13.240'		Sum (in) =	**40.9**	Average Density (lb/in^3) =	**0.007**
Longitude	W150° 46.974'		Average (in) =	**10.2**	Average SWE (in) =	**1.87**
PS060	1	Lake	6.5	6.1	Bucket & Core Weight (lb) =	1.28
	2		7.5	7.5	Empty Bucket Weight (lb) =	0.84
	3		7.0	7.0	Average Mass (lb) =	0.09
	4		8.0	8.0	Core Area (in^2) =	2.0739
	5		6.0	6.0	Freshwater Density (lb/in^3) =	0.0361
Latitude	N70° 13.398'		Sum (in) =	**34.6**	Average Density (lb/in^3) =	**0.006**
Longitude	W150° 46.842'		Average (in) =	**6.9**	Average SWE (in) =	**1.18**
PS061	1	Tundra	7.5	6.0	Bucket & Core Weight (lb) =	1.48
	2		10.5	9.5	Empty Bucket Weight (lb) =	0.84
	3		11.5	11.5	Average Mass (lb) =	0.13
	4		16.0	14.5	Core Area (in^2) =	2.0739
	5		15.5	13.5	Freshwater Density (lb/in^3) =	0.0361
Latitude	N70° 13.526'		Sum (in) =	**55.0**	Average Density (lb/in^3) =	**0.006**
Longitude	W150° 46.734'		Average (in) =	**11.0**	Average SWE (in) =	**1.71**
PS062	1	Lake	18.0	18.0	Bucket & Core Weight (lb) =	1.72
	2		18.0	18.0	Empty Bucket Weight (lb) =	0.84
	3				Average Mass (lb) =	0.44
	4				Core Area (in^2) =	2.0739
	5				Freshwater Density (lb/in^3) =	0.0361
Latitude	N70° 13.683'		Sum (in) =	**36.0**	Average Density (lb/in^3) =	**0.012**
Longitude	W150° 46.602'		Average (in) =	**18.0**	Average SWE (in) =	**5.88**
PS063	1	Tundra	31.0	29.0	Bucket & Core Weight (lb) =	1.32
	2				Empty Bucket Weight (lb) =	0.84
	3				Average Mass (lb) =	0.48
	4				Core Area (in^2) =	2.0739
	5				Freshwater Density (lb/in^3) =	0.0361
Latitude	N70° 13.810'		Sum (in) =	**29.0**	Average Density (lb/in^3) =	**0.008**
Longitude	W150° 46.494'		Average (in) =	**29.0**	Average SWE (in) =	**6.41**
PS064	1	Lake	7.5	7.4	Bucket & Core Weight (lb) =	1.40
	2		6.5	6.2	Empty Bucket Weight (lb) =	0.84
	3		6.5	6.5	Average Mass (lb) =	0.11
	4		9.0	9.0	Core Area (in^2) =	2.0739
	5		7.5	7.3	Freshwater Density (lb/in^3) =	0.0361
Latitude	N70° 13.395'		Sum (in) =	**36.4**	Average Density (lb/in^3) =	**0.007**
Longitude	W150° 47.138'		Average (in) =	**7.3**	Average SWE (in) =	**1.50**
Note 1: Locations are referenced to NAD 83 datum.						

Pooled Snow Survey Data Sheet						
Date: 5/14/2013	Start Time: 11:50		End Time: 17:00		Observers: GCY, SMC, WAB, SAC	
Catchment Basin: M9603		Driving Wrench Used: Mt. Rose			Tube Section Used: 0-62"	
Snow Sample No.	Pooled Sample #	Terrain Type	Snow Depth (in)		Calculations	
			w/ Dirt Plug	w/o Dirt Plug		
PS065	1	Tundra	19.5	15.0	**Bucket & Core Weight (lb) =**	1.40
	2		18.0	17.0	**Empty Bucket Weight (lb) =**	0.84
	3				**Average Mass (lb) =**	0.28
	4				**Core Area (in^2) =**	2.0739
	5				**Freshwater Density (lb/in^3) =**	0.0361
Latitude	N70° 13.550'		**Sum (in) =**	**32.0**	**Average Density (lb/in^3) =**	**0.008**
Longitude	W150° 47.302'		**Average (in) =**	**16.0**	**Average SWE (in) =**	**3.74**
PS066	1	Tundra	16.0	15.5	**Bucket & Core Weight (lb) =**	1.40
	2		19.0	18.0	**Empty Bucket Weight (lb) =**	0.84
	3				**Average Mass (lb) =**	0.28
	4				**Core Area (in^2) =**	2.0739
	5				**Freshwater Density (lb/in^3) =**	0.0361
Latitude	N70° 13.703'		**Sum (in) =**	**33.5**	**Average Density (lb/in^3) =**	**0.008**
Longitude	W150° 47.464'		**Average (in) =**	**16.8**	**Average SWE (in) =**	**3.74**
PS067	1	Lake	14.5	14.5	**Bucket & Core Weight (lb) =**	1.92
	2		13.5	13.5	**Empty Bucket Weight (lb) =**	0.84
	3		14.5	14.5	**Average Mass (lb) =**	0.27
	4		13.0	12.8	**Core Area (in^2) =**	2.0739
	5				**Freshwater Density (lb/in^3) =**	0.0361
Latitude	N70° 13.240'		**Sum (in) =**	**55.3**	**Average Density (lb/in^3) =**	**0.009**
Longitude	W150° 47.453'		**Average (in) =**	**13.8**	**Average SWE (in) =**	**3.61**
PS068	1	Lake	3.0	2.9	**Bucket & Core Weight (lb) =**	1.10
	2		5.5	5.4	**Empty Bucket Weight (lb) =**	0.84
	3		3.0	3.0	**Average Mass (lb) =**	0.05
	4		3.0	2.7	**Core Area (in^2) =**	2.0739
	5		4.0	3.8	**Freshwater Density (lb/in^3) =**	0.0361
Latitude	N70° 13.241'		**Sum (in) =**	**17.8**	**Average Density (lb/in^3) =**	**0.007**
Longitude	W150° 47.934'		**Average (in) =**	**3.6**	**Average SWE (in) =**	**0.69**
PS069	1	Tundra	29.0	26.0	**Bucket & Core Weight (lb) =**	1.38
	2				**Empty Bucket Weight (lb) =**	0.84
	3				**Average Mass (lb) =**	0.54
	4				**Core Area (in^2) =**	2.0739
	5				**Freshwater Density (lb/in^3) =**	0.0361
Latitude	N70° 13.242'		**Sum (in) =**	**26.0**	**Average Density (lb/in^3) =**	**0.010**
Longitude	W150° 48.325'		**Average (in) =**	**26.0**	**Average SWE (in) =**	**7.21**
PS070	1	Lake	6.5	6.5	**Bucket & Core Weight (lb) =**	1.48
	2		8.0	8.0	**Empty Bucket Weight (lb) =**	0.84
	3		8.5	8.5	**Average Mass (lb) =**	0.13
	4		8.0	8.0	**Core Area (in^2) =**	2.0739
	5		8.0	8.0	**Freshwater Density (lb/in^3) =**	0.0361
Latitude	N70° 13.147'		**Sum (in) =**	**39.0**	**Average Density (lb/in^3) =**	**0.008**
Longitude	W150° 47.054'		**Average (in) =**	**7.8**	**Average SWE (in) =**	**1.71**
Note 1: Locations are referenced to NAD 83 datum.						

Pooled Snow Survey Data Sheet						
Date: 5/14/2013	Start Time: 11:50		End Time: 17:00		Observers: GCY, SMC, WAB, SAC	
Catchment Basin: M9603		Driving Wrench Used: Mt. Rose			Tube Section Used: 0-62"	
Snow Sample No.	Pooled Sample #	Terrain Type	Snow Depth (in) w/ Dirt Plug	Snow Depth (in) w/o Dirt Plug	Calculations	
PS071	1	Tundra	26.5	23.0	**Bucket & Core Weight (lb) =**	1.66
	2		27.0	27.0	**Empty Bucket Weight (lb) =**	0.84
	3				**Average Mass (lb) =**	0.41
	4				**Core Area (in^2) =**	2.0739
	5				**Freshwater Density (lb/in^3) =**	0.0361
Latitude	N70° 13.053'		**Sum (in) =**	**50.0**	**Average Density (lb/in^3) =**	**0.008**
Longitude	W150° 47.133'		**Average (in) =**	**25.0**	**Average SWE (in) =**	**5.47**
PS072	1	Lake	9.5	9.5	**Bucket & Core Weight (lb) =**	1.82
	2		10.0	9.9	**Empty Bucket Weight (lb) =**	0.84
	3		8.0	8.0	**Average Mass (lb) =**	0.20
	4		9.0	9.0	**Core Area (in^2) =**	2.0739
	5		10.0	10.0	**Freshwater Density (lb/in^3) =**	0.0361
Latitude	N70° 13.239'		**Sum (in) =**	**46.4**	**Average Density (lb/in^3) =**	**0.010**
Longitude	W150° 46.683'		**Average (in) =**	**9.3**	**Average SWE (in) =**	**2.62**
PS073	1	Tundra	31.0	31.0	**Bucket & Core Weight (lb) =**	1.44
	2				**Empty Bucket Weight (lb) =**	0.84
	3				**Average Mass (lb) =**	0.60
	4				**Core Area (in^2) =**	2.0739
	5				**Freshwater Density (lb/in^3) =**	0.0361
Latitude	N70° 13.238'		**Sum (in) =**	**31.0**	**Average Density (lb/in^3) =**	**0.009**
Longitude	W150° 46.296'		**Average (in) =**	**31.0**	**Average SWE (in) =**	**8.01**
PS074	1	Lake	14.0	13.8	**Bucket & Core Weight (lb) =**	1.62
	2		12.5	12.3	**Empty Bucket Weight (lb) =**	0.84
	3		11.5	11.3	**Average Mass (lb) =**	0.20
	4		12.0	11.7	**Core Area (in^2) =**	2.0739
	5				**Freshwater Density (lb/in^3) =**	0.0361
Latitude	N70° 13.118'		**Sum (in) =**	**49.1**	**Average Density (lb/in^3) =**	**0.008**
Longitude	W150° 46.844'		**Average (in) =**	**12.3**	**Average SWE (in) =**	**2.60**
PS075	1	Lake	11.0	11.0	**Bucket & Core Weight (lb) =**	1.58
	2		11.5	11.5	**Empty Bucket Weight (lb) =**	0.84
	3		6.5	6.3	**Average Mass (lb) =**	0.15
	4		8.0	8.0	**Core Area (in^2) =**	2.0739
	5		9.5	9.5	**Freshwater Density (lb/in^3) =**	0.0361
Latitude	N70° 13.025'		**Sum (in) =**	**46.3**	**Average Density (lb/in^3) =**	**0.008**
Longitude	W150° 46.745'		**Average (in) =**	**9.3**	**Average SWE (in) =**	**1.98**
PS076	1	Tundra	11.0	10.0	**Bucket & Core Weight (lb) =**	1.44
	2		12.5	12.0	**Empty Bucket Weight (lb) =**	0.84
	3		10.5	8.5	**Average Mass (lb) =**	0.15
	4		12.0	11.0	**Core Area (in^2) =**	2.0739
	5				**Freshwater Density (lb/in^3) =**	0.0361
Latitude	N70° 12.932'		**Sum (in) =**	**41.5**	**Average Density (lb/in^3) =**	**0.007**
Longitude	W150° 46.649'		**Average (in) =**	**10.4**	**Average SWE (in) =**	**2.00**
Note 1: Locations are referenced to NAD 83 datum.						

Pooled Snow Survey Data Sheet						
Date: 5/14/2013	Start Time: 11:50		End Time: 17:00		Observers: GCY, SMC, WAB, SAC	
Catchment Basin: M9603		Driving Wrench Used: Mt. Rose			Tube Section Used: 0-62"	
Snow Sample No.	Pooled Sample #	Terrain Type	Snow Depth (in) w/ Dirt Plug	Snow Depth (in) w/o Dirt Plug	Calculations	
PS077	1	Lake	13.5	13.5	Bucket & Core Weight (lb) =	1.82
	2		13.0	12.8	Empty Bucket Weight (lb) =	0.84
	3		15.5	15.5	Average Mass (lb) =	0.33
	4				Core Area (in^2) =	2.0739
	5				Freshwater Density (lb/in^3) =	0.0361
Latitude	N70° 12.684'		Sum (in) =	**41.8**	Average Density (lb/in^3) =	**0.011**
Longitude	W150° 46.826'		Average (in) =	**13.9**	Average SWE (in) =	**4.36**
PS078	1	Lake	13.5	13.5	Bucket & Core Weight (lb) =	1.16
	2		14.0	14.0	Empty Bucket Weight (lb) =	0.84
	3				Average Mass (lb) =	0.16
	4				Core Area (in^2) =	2.0739
	5				Freshwater Density (lb/in^3) =	0.0361
Latitude	N70° 12.781'		Sum (in) =	**27.5**	Average Density (lb/in^3) =	**0.006**
Longitude	W150° 46.759'		Average (in) =	**13.8**	Average SWE (in) =	**2.14**
PS080	1	Lake	7.5	7.5	Bucket & Core Weight (lb) =	1.42
	2		7.5	7.0	Empty Bucket Weight (lb) =	0.84
	3		8.0	8.0	Average Mass (lb) =	0.12
	4		7.5	7.5	Core Area (in^2) =	2.0739
	5		8.0	8.0	Freshwater Density (lb/in^3) =	0.0361
Latitude	N70° 12.759'		Sum (in) =	**38.0**	Average Density (lb/in^3) =	**0.007**
Longitude	W150° 47.015'		Average (in) =	**7.6**	Average SWE (in) =	**1.55**
PS081	1	Tundra	29.5	29.2	Bucket & Core Weight (lb) =	1.50
	2		29.5	29.5	Empty Bucket Weight (lb) =	0.84
	3				Average Mass (lb) =	0.33
	4				Core Area (in^2) =	2.0739
	5				Freshwater Density (lb/in^3) =	0.0361
Latitude	N70° 12.860'		Sum (in) =	**58.7**	Average Density (lb/in^3) =	**0.005**
Longitude	W150° 47.269'		Average (in) =	**29.4**	Average SWE (in) =	**4.41**
PS082	1	Lake	15.0	15.0	Bucket & Core Weight (lb) =	1.32
	2		12.0	12.0	Empty Bucket Weight (lb) =	0.84
	3		13.0	13.0	Average Mass (lb) =	0.16
	4				Core Area (in^2) =	2.0739
	5				Freshwater Density (lb/in^3) =	0.0361
Latitude	N70° 12.605'		Sum (in) =	**40.0**	Average Density (lb/in^3) =	**0.006**
Longitude	W150° 47.134'		Average (in) =	**13.3**	Average SWE (in) =	**2.14**
PS083	1	Tundra	10.5	10.5	Bucket & Core Weight (lb) =	1.54
	2		9.5	9.5	Empty Bucket Weight (lb) =	0.84
	3		9.0	8.5	Average Mass (lb) =	0.14
	4		9.5	9.5	Core Area (in^2) =	2.0739
	5		7.0	6.5	Freshwater Density (lb/in^3) =	0.0361
Latitude	N70° 12.527'		Sum (in) =	**44.5**	Average Density (lb/in^3) =	**0.008**
Longitude	W150° 47.444'		Average (in) =	**8.9**	Average SWE (in) =	**1.87**
Note 1: Locations are referenced to NAD 83 datum.						

Pooled Snow Survey Data Sheet						
Date: 5/14/2013	Start Time: 11:50		End Time: 17:00		Observers: GCY, SMC, WAB, SAC	
Catchment Basin: M9603		Driving Wrench Used: Mt. Rose			Tube Section Used: 0-62"	
Snow Sample No.	Pooled Sample #	Terrain Type	Snow Depth (in) w/ Dirt Plug	Snow Depth (in) w/o Dirt Plug	Calculations	
PS084	1	Lake	8.5	8.5	Bucket & Core Weight (lb) =	1.68
	2		8.5	8.2	Empty Bucket Weight (lb) =	0.84
	3		8.5	8.5	Average Mass (lb) =	0.17
	4		8.5	8.1	Core Area (in^2) =	2.0739
	5		9.0	9.0	Freshwater Density (lb/in^3) =	0.0361
Latitude	N70° 12.450'		Sum (in) =	**42.3**	**Average Density (lb/in^3) =**	**0.010**
Longitude	W150° 47.751'		Average (in) =	**8.5**	**Average SWE (in) =**	**2.24**
PS085	1	Lake	5.0	5.0	Bucket & Core Weight (lb) =	1.32
	2		5.0	4.7	Empty Bucket Weight (lb) =	0.84
	3		6.0	5.9	Average Mass (lb) =	0.10
	4		5.5	5.5	Core Area (in^2) =	2.0739
	5		5.5	5.3	Freshwater Density (lb/in^3) =	0.0361
Latitude	N70° 12.392'		Sum (in) =	**26.4**	**Average Density (lb/in^3) =**	**0.009**
Longitude	W150° 47.981'		Average (in) =	**5.3**	**Average SWE (in) =**	**1.28**
PS087	1	Lake	7.5	7.5	Bucket & Core Weight (lb) =	1.22
	2		7.0	7.0	Empty Bucket Weight (lb) =	0.84
	3		7.0	7.0	Average Mass (lb) =	0.08
	4		7.0	7.0	Core Area (in^2) =	2.0739
	5		7.0	7.0	Freshwater Density (lb/in^3) =	0.0361
Latitude	N70° 12.762'		Sum (in) =	**35.5**	**Average Density (lb/in^3) =**	**0.005**
Longitude	W150° 46.510'		Average (in) =	**7.1**	**Average SWE (in) =**	**1.01**
PS088	1	Tundra	11.0	11.0	Bucket & Core Weight (lb) =	1.42
	2		9.5	8.0	Empty Bucket Weight (lb) =	0.84
	3		9.0	7.0	Average Mass (lb) =	0.12
	4		12.5	12.5	Core Area (in^2) =	2.0739
	5		8.5	6.0	Freshwater Density (lb/in^3) =	0.0361
Latitude	N70° 12.842'		Sum (in) =	**44.5**	**Average Density (lb/in^3) =**	**0.006**
Longitude	W150° 46.192'		Average (in) =	**8.9**	**Average SWE (in) =**	**1.55**
PS089	1	Tundra	26.0	24.0	Bucket & Core Weight (lb) =	1.34
	2				Empty Bucket Weight (lb) =	0.84
	3				Average Mass (lb) =	0.50
	4				Core Area (in^2) =	2.0739
	5				Freshwater Density (lb/in^3) =	0.0361
Latitude	N70° 12.922'		Sum (in) =	**24.0**	**Average Density (lb/in^3) =**	**0.010**
Longitude	W150° 45.875'		Average (in) =	**24.0**	**Average SWE (in) =**	**6.68**
PS090	1	Lake	10.5	10.5	Bucket & Core Weight (lb) =	1.30
	2		9.0	9.0	Empty Bucket Weight (lb) =	0.84
	3		11.0	11.0	Average Mass (lb) =	0.15
	4				Core Area (in^2) =	2.0739
	5				Freshwater Density (lb/in^3) =	0.0361
Latitude	N70° 12.560'		Sum (in) =	**30.5**	**Average Density (lb/in^3) =**	**0.007**
Longitude	W150° 46.511'		Average (in) =	**10.2**	**Average SWE (in) =**	**2.05**
Note 1: Locations are referenced to NAD 83 datum.						

Pooled Snow Survey Data Sheet						
Date: 5/14/2013	Start Time: 11:50		End Time: 17:00		Observers: GCY, SMC, WAB, SAC	
Catchment Basin: M9603		Driving Wrench Used: Mt. Rose			Tube Section Used: 0-62"	
Snow Sample No.	Pooled Sample #	Terrain Type	Snow Depth (in) w/ Dirt Plug	Snow Depth (in) w/o Dirt Plug	Calculations	
PS091	1	Tundra	48.0	47.0	**Bucket & Core Weight (lb) =**	2.12
	2				**Empty Bucket Weight (lb) =**	0.84
	3				**Average Mass (lb) =**	1.28
	4				**Core Area (in^2) =**	2.0739
	5				**Freshwater Density (lb/in^3) =**	0.0361
Latitude	N70° 12.416'		**Sum (in) =**	**47.0**	**Average Density (lb/in^3) =**	**0.013**
Longitude	W150° 46.146'		**Average (in) =**	**47.0**	**Average SWE (in) =**	**17.09**
PS092	1	Lake	6.0	6.0	**Bucket & Core Weight (lb) =**	1.28
	2		6.0	6.0	**Empty Bucket Weight (lb) =**	0.84
	3		5.5	5.5	**Average Mass (lb) =**	0.09
	4		5.0	5.0	**Core Area (in^2) =**	2.0739
	5		6.5	6.5	**Freshwater Density (lb/in^3) =**	0.0361
Latitude	N70° 12.590'		**Sum (in) =**	**29.0**	**Average Density (lb/in^3) =**	**0.007**
Longitude	W150° 46.898'		**Average (in) =**	**5.8**	**Average SWE (in) =**	**1.18**
PS093	1	Lake	15.0	15.0	**Bucket & Core Weight (lb) =**	1.46
	2		15.0	14.7	**Empty Bucket Weight (lb) =**	0.84
	3				**Average Mass (lb) =**	0.31
	4				**Core Area (in^2) =**	2.0739
	5				**Freshwater Density (lb/in^3) =**	0.0361
Latitude	N70° 12.464'		**Sum (in) =**	**29.7**	**Average Density (lb/in^3) =**	**0.010**
Longitude	W150° 46.990'		**Average (in) =**	**14.9**	**Average SWE (in) =**	**4.14**
PS094	1	Tundra	17.5	16.5	**Bucket & Core Weight (lb) =**	1.50
	2		16.0	14.5	**Empty Bucket Weight (lb) =**	0.84
	3		17.0	15.0	**Average Mass (lb) =**	0.22
	4				**Core Area (in^2) =**	2.0739
	5				**Freshwater Density (lb/in^3) =**	0.0361
Latitude	N70° 12.339'		**Sum (in) =**	**46.0**	**Average Density (lb/in^3) =**	**0.007**
Longitude	W150° 47.081'		**Average (in) =**	**15.3**	**Average SWE (in) =**	**2.94**
PS095	1	Tundra	16.5	15.5	**Bucket & Core Weight (lb) =**	1.46
	2		16.5	16.5	**Empty Bucket Weight (lb) =**	0.82
	3		18.5	13.5	**Average Mass (lb) =**	0.21
	4				**Core Area (in^2) =**	2.0739
	5				**Freshwater Density (lb/in^3) =**	0.0361
Latitude	N70° 13.857'		**Sum (in) =**	**45.5**	**Average Density (lb/in^3) =**	**0.007**
Longitude	W150° 47.625'		**Average (in) =**	**15.2**	**Average SWE (in) =**	**2.85**
PS096	1	Tundra	21.5	21.5	**Bucket & Core Weight (lb) =**	1.20
	2				**Empty Bucket Weight (lb) =**	0.84
	3				**Average Mass (lb) =**	0.36
	4				**Core Area (in^2) =**	2.0739
	5				**Freshwater Density (lb/in^3) =**	0.0361
Latitude	N70° 12.213'		**Sum (in) =**	**21.5**	**Average Density (lb/in^3) =**	**0.008**
Longitude	W150° 47.175'		**Average (in) =**	**21.5**	**Average SWE (in) =**	**4.81**
Note 1: Locations are referenced to NAD 83 datum.						

Pooled Snow Survey Data Sheet						
Date: 5/14/2013	Start Time: 11:50		End Time: 17:00		Observers: GCY, SMC, WAB, SAC	
Catchment Basin: M9603		Driving Wrench Used: Mt. Rose			Tube Section Used: 0-62"	
Snow Sample No.	Pooled Sample #	Terrain Type	Snow Depth (in) w/ Dirt Plug	Snow Depth (in) w/o Dirt Plug	Calculations	
PS097	1	Lake	11.5	11.5	**Bucket & Core Weight (lb) =**	2.34
	2		11.5	11.5	**Empty Bucket Weight (lb) =**	0.82
	3		11.5	11.3	**Average Mass (lb) =**	0.30
	4		11.5	11.5	**Core Area (in^2) =**	2.0739
	5		12.0	12.0	**Freshwater Density (lb/in^3) =**	0.0361
Latitude	N70° 12.550'		**Sum (in) =**	**57.8**	**Average Density (lb/in^3) =**	**0.013**
Longitude	W150° 48.140'		**Average (in) =**	**11.6**	**Average SWE (in) =**	**4.06**
PS098	1	Tundra	15.5	15.0	**Bucket & Core Weight (lb) =**	1.52
	2		16.0	14.5	**Empty Bucket Weight (lb) =**	0.82
	3		16.0	16.0	**Average Mass (lb) =**	0.14
	4		16.0	15.0	**Core Area (in^2) =**	2.0739
	5		16.5	15.5	**Freshwater Density (lb/in^3) =**	0.0361
Latitude	N70° 12.675'		**Sum (in) =**	**76.0**	**Average Density (lb/in^3) =**	**0.004**
Longitude	W150° 48.270'		**Average (in) =**	**15.2**	**Average SWE (in) =**	**1.87**
PS099*	1	Lake	84.0	84.0	**Bucket & Core Weight (lb) =**	3.18
	2				**Empty Bucket Weight (lb) =**	0.82
	3				**Average Mass (lb) =**	2.36
	4				**Core Area (in^2) =**	2.0739
	5				**Freshwater Density (lb/in^3) =**	0.0361
Latitude	N70° 12.769'		**Sum (in) =**	**84.0**	**Average Density (lb/in^3) =**	**0.014**
Longitude	W150° 48.366'		**Average (in) =**	**84.0**	**Average SWE (in) =**	**31.51**
PS100*	1	Lake	87.0	87.0	**Bucket & Core Weight (lb) =**	3.22
	2				**Empty Bucket Weight (lb) =**	0.82
	3				**Average Mass (lb) =**	2.40
	4				**Core Area (in^2) =**	2.0739
	5				**Freshwater Density (lb/in^3) =**	0.0361
Latitude	N70° 12.834'		**Sum (in) =**	**87.0**	**Average Density (lb/in^3) =**	**0.013**
Longitude	W150° 48.433'		**Average (in) =**	**87.0**	**Average SWE (in) =**	**32.05**
PS101	1	Tundra	20.5	18.5	**Bucket & Core Weight (lb) =**	1.20
	2				**Empty Bucket Weight (lb) =**	0.84
	3				**Average Mass (lb) =**	0.36
	4				**Core Area (in^2) =**	2.0739
	5				**Freshwater Density (lb/in^3) =**	0.0361
Latitude	N70° 12.353'		**Sum (in) =**	**18.5**	**Average Density (lb/in^3) =**	**0.009**
Longitude	W150° 48.135'		**Average (in) =**	**18.5**	**Average SWE (in) =**	**4.81**
PS102	1	Tundra	21.0	21.0	**Bucket & Core Weight (lb) =**	1.22
	2				**Empty Bucket Weight (lb) =**	0.84
	3				**Average Mass (lb) =**	0.38
	4				**Core Area (in^2) =**	2.0739
	5				**Freshwater Density (lb/in^3) =**	0.0361
Latitude	N70° 13.238'		**Sum (in) =**	**21.0**	**Average Density (lb/in^3) =**	**0.009**
Longitude	W150° 45.909'		**Average (in) =**	**21.0**	**Average SWE (in) =**	**5.07**

Note 1: Locations are referenced to NAD 83 datum.
* Corn snow could not be contained in sampler.

Snow Depth Survey Data Sheet				
Date: 5/14/2013		Start Time: 11:30 AM		Observers: GCY, SMC, WAB, SAC, BTG
Catchment Basin: M9602		End Time: 5:30 PM		
Snow Sample No.	Terrain Type	Snow Depth (in)	Location	
			Latitude	Longitude
SS206	Lake	11.8	N70° 13.272'	W150° 46.949'
SS207	Lake	13.4	N70° 13.303'	W150° 46.922'
SS208	Lake	2.4	N70° 13.334'	W150° 46.896'
SS209	Lake	6.3	N70° 13.365'	W150° 46.870'
SS210	Lake	7.1	N70° 13.431'	W150° 46.814'
SS210.5	Lake	11.0	N70° 13.463'	W150° 46.787'
SS211	Lake	15.7	N70° 13.494'	W150° 46.761'
SS212	Lake	29.9	N70° 13.557'	W150° 46.708'
SS213	Lake	16.5	N70° 13.588'	W150° 46.681'
SS214	Lake	14.2	N70° 13.620'	W150° 46.655'
SS215	Lake	10.2	N70° 13.651'	W150° 46.629'
SS216	Lake	23.6	N70° 13.714'	W150° 46.575'
SS217	Lake	40.9	N70° 13.747'	W150° 46.548'
SS218	Tundra	12.6	N70° 13.778'	W150° 46.521'
SS219	Lake	11.0	N70° 13.271'	W150° 47.007'
SS220	Lake	15.0	N70° 13.303'	W150° 47.040'
SS221	Lake	11.8	N70° 13.333'	W150° 47.073'
SS222	Lake	9.4	N70° 13.365'	W150° 47.106'
SS223	Lake	11.8	N70° 13.427'	W150° 47.171'
SS224	Lake	5.9	N70° 13.457'	W150° 47.203'
SS225	Lake	5.9	N70° 13.488'	W150° 47.236'
SS226	Lake	33.1	N70° 13.519'	W150° 47.269'
SS227	Lake	22.0	N70° 13.581'	W150° 47.334'
SS228	Lake	22.4	N70° 13.611'	W150° 47.367'
SS229	Lake	15.7	N70° 13.642'	W150° 47.399'
SS230	Lake	22.8	N70° 13.673'	W150° 47.432'
SS231	Lake	19.7	N70° 13.734'	W150° 47.496'
SS232	Lake	20.9	N70° 13.765'	W150° 47.529'
SS233	Lake	19.7	N70° 13.796'	W150° 47.562'
SS234	Lake	7.1	N70° 13.240'	W150° 47.070'
SS235	Lake	11.4	N70° 13.240'	W150° 47.165'
SS236	Lake	10.2	N70° 13.240'	W150° 47.261'
SS237	Lake	17.7	N70° 13.240'	W150° 47.357'
SS238	Lake	9.8	N70° 13.240'	W150° 47.550'
SS239	Lake	9.8	N70° 13.241'	W150° 47.646'
SS240	Lake	9.4	N70° 13.241'	W150° 47.743'
SS241	Lake	8.3	N70° 13.241'	W150° 47.839'
SS242	Lake	8.7	N70° 13.241'	W150° 48.030'
SS245	Lake	7.9	N70° 13.241'	W150° 48.130'
SS246	Lake	10.2	N70° 13.242'	W150° 48.228'
SS247	Lake	9.1	N70° 13.239'	W150° 46.877'

Snow Depth Survey Data Sheet				
Date: 5/14/2013		Start Time: 11:30 AM		Observers: GCY, SMC, WAB, SAC, BTG
Catchment Basin: M9602		End Time: 5:30 PM		
Snow Sample No.	Terrain Type	Snow Depth (in)	Location	
			Latitude	Longitude
SS248	Lake	10.6	N70° 13.239'	W150° 46.781'
SS249	Lake	3.9	N70° 13.239'	W150° 46.586'
SS250	Lake	18.9	N70° 13.238'	W150° 46.489'
SS251	Tundra	21.7	N70° 13.238'	W150° 46.392'
SS252	Tundra	17.3	N70° 13.238'	W150° 46.199'
SS253	Tundra	20.1	N70° 13.238'	W150° 46.102'
SS254	Tundra	29.1	N70° 13.238'	W150° 46.006'
SS255	Lake	11.8	N70° 13.209'	W150° 47.001'
SS256	Lake	13.0	N70° 13.178'	W150° 47.028'
SS257	Lake	6.3	N70° 13.115'	W150° 47.081'
SS258	Tundra	24.0	N70° 13.084'	W150° 47.107'
SS259	Tundra	17.7	N70° 13.022'	W150° 47.159'
SS260	Lake	7.5	N70° 13.210'	W150° 46.941'
SS261	Lake	7.9	N70° 13.179'	W150° 46.909'
SS262	Lake	13.4	N70° 13.148'	W150° 46.876'
SS263	Lake	8.3	N70° 13.087'	W150° 46.811'
SS264	Lake	10.2	N70° 13.056'	W150° 46.778'
SS265	Lake	12.6	N70° 12.994'	W150° 46.712'
SS266	Tundra	20.1	N70° 12.963'	W150° 46.680'
SS267	Lake	12.6	N70° 12.717'	W150° 46.806'
SS268	Lake	5.9	N70° 12.749'	W150° 46.782'
SS269	Lake	6.3	N70° 12.814'	W150° 46.735'
SS270	Lake	9.1	N70° 12.847'	W150° 46.711'
SS271	Tundra	15.7	N70° 12.879'	W150° 46.688'
SS272	Lake	5.9	N70° 12.709'	W150° 46.889'
SS273	Lake	7.1	N70° 12.734'	W150° 46.952'
SS274	Lake	7.9	N70° 12.784'	W150° 47.079'
SS275	Lake	61.4	N70° 12.810'	W150° 47.143'
SS276	Lake	10.2	N70° 12.835'	W150° 47.206'
SS277	Tundra	20.9	N70° 12.885'	W150° 47.333'
SS278	Lake	8.7	N70° 12.663'	W150° 46.902'
SS279	Lake	10.6	N70° 12.644'	W150° 46.980'
SS280	Lake	10.2	N70° 12.625'	W150° 47.057'
SS281	Lake	4.7	N70° 12.586'	W150° 47.212'
SS282	Lake	5.9	N70° 12.566'	W150° 47.289'
SS283	Lake	11.0	N70° 12.547'	W150° 47.367'
SS284	Tundra	52.0	N70° 12.508'	W150° 47.520'
SS285	Lake	20.5	N70° 12.489'	W150° 47.597'
SS286	Lake	5.9	N70° 12.469'	W150° 47.673'
SS287	Lake	6.7	N70° 12.431'	W150° 47.826'
SS288	Lake	5.9	N70° 12.411'	W150° 47.904'

Snow Depth Survey Data Sheet				
Date: 5/14/2013		Start Time: 11:30 AM		Observers: GCY, SMC, WAB, SAC, BTG
Catchment Basin: M9602		End Time: 5:30 PM		
Snow Sample No.	Terrain Type	Snow Depth (in)	Location	
			Latitude	Longitude
SS289	Lake	1.6	N70° 12.373'	W150° 48.058'
SS292	Lake	9.1	N70° 12.654'	W150° 46.852'
SS293	Lake	8.7	N70° 12.621'	W150° 46.875'
SS294	Lake	8.3	N70° 12.558'	W150° 46.921'
SS295	Lake	8.7	N70° 12.528'	W150° 46.943'
SS296	Lake	13.8	N70° 12.496'	W150° 46.966'
SS297	Lake	8.7	N70° 12.433'	W150° 47.012'
SS298	Lake	5.1	N70° 12.402'	W150° 47.035'
SS299	Tundra	14.2	N70° 12.371'	W150° 47.058'
SS300	Tundra	28.0	N70° 12.308'	W150° 47.104'
SS301	Tundra	20.1	N70° 12.277'	W150° 47.127'
SS302	Lake	7.9	N70° 12.660'	W150° 46.763'
SS303	Lake	5.5	N70° 12.634'	W150° 46.699'
SS304	Lake	9.8	N70° 12.610'	W150° 46.636'
SS305	Lake	12.6	N70° 12.585'	W150° 46.574'
SS306	Lake	6.3	N70° 12.535'	W150° 46.448'
SS307	Lake	9.4	N70° 12.511'	W150° 46.386'
SS308	Lake	31.9	N70° 12.485'	W150° 46.322'
SS309	Lake	92.1	N70° 12.460'	W150° 46.259'
SS310	Lake	70.9	N70° 12.436'	W150° 46.196'
SS311	Lake	9.8	N70° 12.703'	W150° 46.745'
SS312	Lake	10.2	N70° 12.722'	W150° 46.668'
SS313	Lake	10.2	N70° 12.742'	W150° 46.590'
SS314	Lake	10.6	N70° 12.782'	W150° 46.433'
SS315	Lake	5.5	N70° 12.802'	W150° 46.353'
SS316	Tundra	20.9	N70° 12.822'	W150° 46.273'
SS317	Tundra	12.2	N70° 12.862'	W150° 46.113'
SS318	Tundra	37.8	N70° 12.882'	W150° 46.035'
SS319	Tundra	40.2	N70° 12.902'	W150° 45.955'
SS320	Lake	21.3	N70° 13.826'	W150° 47.593'
SS321	Lake	14.2	N70° 13.889'	W150° 47.658'
SS322	Lake	18.9	N70° 13.920'	W150° 47.692'
SS323	Lake	25.2	N70° 13.951'	W150° 47.724'
SS325	Tundra	19.7	N70° 12.911'	W150° 46.664'
SS326	Tundra	15.0	N70° 12.245'	W150° 47.152'
SS327	Tundra	13.8	N70° 13.842'	W150° 46.466'
SS328	Tundra	20.5	N70° 13.873'	W150° 46.440'
SS329	Tundra	15.7	N70° 13.905'	W150° 46.413'
SS331	Tundra	20.5	N70° 13.238'	W150° 45.813'
SS332	Tundra	16.1	N70° 12.941'	W150° 45.793'
SS333	Tundra	18.5	N70° 12.961'	W150° 45.713'

Snow Depth Survey Data Sheet				
Date: 5/14/2013		Start Time: 11:30 AM		Observers: GCY, SMC, WAB, SAC, BTG
Catchment Basin: M9602		End Time: 5:30 PM		
Snow Sample No.	Terrain Type	Snow Depth (in)	Location	
			Latitude	Longitude
SS334	Tundra	18.5	N70° 12.980'	W150° 45.634'
SS335	Lake	6.7	N70° 12.425'	W150° 48.012'
SS336	Lake	4.7	N70° 12.455'	W150° 48.043'
SS337	Lake	2.4	N70° 12.487'	W150° 48.076'
SS338	Lake	49.2	N70° 12.518'	W150° 48.108'
SS339	Lake	39.8	N70° 12.580'	W150° 48.172'
SS340	Tundra	24.0	N70° 12.612'	W150° 48.204'
SS341	Tundra	29.9	N70° 12.643'	W150° 48.237'
SS342	Tundra	19.3	N70° 12.707'	W150° 48.302'
SS343	Tundra	83.1	N70° 12.738'	W150° 48.334'
SS344	Tundra	86.6	N70° 12.800'	W150° 48.398'
SS345	Tundra	19.7	N70° 13.243'	W150° 48.421'
SS346	Tundra	17.7	N70° 13.244'	W150° 48.517'
SS347	Tundra	21.7	N70° 12.988'	W150° 47.177'
SS348	Tundra	28.3	N70° 12.957'	W150° 47.199'
SS349	Tundra	16.1	N70° 12.928'	W150° 47.221'
SS350	Tundra	22.8	N70° 12.896'	W150° 47.244'

Pooled Snow Survey Data Sheet						
Date: 5/4/2013	Start Time: 10:00		End Time: 17:00		Observers: GCY, SMC, WAB	
Catchment Basin: M9605		Driving Wrench Used: Mt. Rose			Tube Section Used: 0-62"	
Snow Sample No.	Pooled Sample #	Terrain Type	Snow Depth (in) w/ Dirt Plug	Snow Depth (in) w/o Dirt Plug	Calculations	
PS001	1	Lake	3.5	3.4	**Bucket & Core Weight (lb) =**	1.12
	2		3.5	3.4	**Empty Bucket Weight (lb) =**	0.86
	3		3.5	3.5	**Average Mass (lb) =**	0.07
	4		3.5	3.3	**Core Area (in^2) =**	2.0739
	5				**Freshwater Density (lb/in^3) =**	0.0361
Latitude	N70° 13.267'		**Sum (in) =**	**13.6**	**Average Density (lb/in^3) =**	**0.009**
Longitude	W150° 30.943'		**Average (in) =**	**3.4**	**Average SWE (in) =**	**0.87**
PS002	1	Lake	4.5	4.5	**Bucket & Core Weight (lb) =**	1.18
	2		4.5	4.5	**Empty Bucket Weight (lb) =**	0.82
	3		5.0	5.0	**Average Mass (lb) =**	0.07
	4		4.5	4.5	**Core Area (in^2) =**	2.0739
	5		5.0	5.0	**Freshwater Density (lb/in^3) =**	0.0361
Latitude	N70° 13.455'		**Sum (in) =**	**23.5**	**Average Density (lb/in^3) =**	**0.007**
Longitude	W150° 31.131'		**Average (in) =**	**4.7**	**Average SWE (in) =**	**0.96**
PS003	1	Lake	12.0	12.0	**Bucket & Core Weight (lb) =**	1.40
	2		9.5	9.5	**Empty Bucket Weight (lb) =**	0.84
	3		10.0	10.0	**Average Mass (lb) =**	0.19
	4				**Core Area (in^2) =**	2.0739
	5				**Freshwater Density (lb/in^3) =**	0.0361
Latitude	N70° 13.609'		**Sum (in) =**	**31.5**	**Average Density (lb/in^3) =**	**0.009**
Longitude	W150° 31.284'		**Average (in) =**	**10.5**	**Average SWE (in) =**	**2.49**
PS004	1	Lake	5.0	5.0	**Bucket & Core Weight (lb) =**	1.34
	2		5.5	5.5	**Empty Bucket Weight (lb) =**	0.84
	3		4.5	4.5	**Average Mass (lb) =**	0.10
	4		7.0	7.0	**Core Area (in^2) =**	2.0739
	5		5.0	5.0	**Freshwater Density (lb/in^3) =**	0.0361
Latitude	N70° 13.765'		**Sum (in) =**	**27.0**	**Average Density (lb/in^3) =**	**0.009**
Longitude	W150° 31.440'		**Average (in) =**	**5.4**	**Average SWE (in) =**	**1.34**
PS00X	1	Tundra	6.5	6.0	**Bucket & Core Weight (lb) =**	1.12
	2		8.5	8.0	**Empty Bucket Weight (lb) =**	0.82
	3		5.5	5.5	**Average Mass (lb) =**	0.06
	4		8.0	6.0	**Core Area (in^2) =**	2.0739
	5		6.0	6.0	**Freshwater Density (lb/in^3) =**	0.0361
Latitude	N70° 13.853'		**Sum (in) =**	**31.5**	**Average Density (lb/in^3) =**	**0.005**
Longitude	W150° 31.523'		**Average (in) =**	**6.3**	**Average SWE (in) =**	**0.80**
PS005	1	Lake	7.0	7.0	**Bucket & Core Weight (lb) =**	1.62
	2		8.5	8.5	**Empty Bucket Weight (lb) =**	0.82
	3		5.5	5.5	**Average Mass (lb) =**	0.16
	4		8.0	8.0	**Core Area (in^2) =**	2.0739
	5		6.0	6.0	**Freshwater Density (lb/in^3) =**	0.0361
Latitude	N70° 13.405'		**Sum (in) =**	**35.0**	**Average Density (lb/in^3) =**	**0.011**
Longitude	W150° 30.679'		**Average (in) =**	**7.0**	**Average SWE (in) =**	**2.14**
Note 1: Locations are referenced to NAD 83 datum.						

Pooled Snow Survey Data Sheet						
Date: 5/4/2013	Start Time: 10:00		End Time: 17:00		Observers: GCY, SMC, WAB	
Catchment Basin: M9605		Driving Wrench Used: Mt. Rose			Tube Section Used: 0-62"	
Snow Sample No.	Pooled Sample #	Terrain Type	Snow Depth (in) w/ Dirt Plug	Snow Depth (in) w/o Dirt Plug	Calculations	
PS006	1	Tundra	11.0	11.0	**Bucket & Core Weight (lb) =**	1.20
	2		12.5	10.5	**Empty Bucket Weight (lb) =**	0.84
	3		11.5	10.5	**Average Mass (lb) =**	0.12
	4				**Core Area (in^2) =**	2.0739
	5				**Freshwater Density (lb/in^3) =**	0.0361
Latitude	N70° 13.543'		**Sum (in) =**	**32.0**	**Average Density (lb/in^3) =**	**0.005**
Longitude	W150° 30.415'		**Average (in) =**	**10.7**	**Average SWE (in) =**	**1.60**
PS007	1	Lake	7.5	7.5	**Bucket & Core Weight (lb) =**	1.18
	2		7.0	7.0	**Empty Bucket Weight (lb) =**	0.82
	3		7.5	7.5	**Average Mass (lb) =**	0.12
	4				**Core Area (in^2) =**	2.0739
	5				**Freshwater Density (lb/in^3) =**	0.0361
Latitude	N70° 13.200'		**Sum (in) =**	**22.0**	**Average Density (lb/in^3) =**	**0.008**
Longitude	W150° 30.609'		**Average (in) =**	**7.3**	**Average SWE (in) =**	**1.60**
PS008	1	Tundra	10.0	8.0	**Bucket & Core Weight (lb) =**	1.16
	2		10.0	8.5	**Empty Bucket Weight (lb) =**	0.82
	3		10.0	10.0	**Average Mass (lb) =**	0.11
	4				**Core Area (in^2) =**	2.0739
	5				**Freshwater Density (lb/in^3) =**	0.0361
Latitude	N70° 13.100'		**Sum (in) =**	**26.5**	**Average Density (lb/in^3) =**	**0.006**
Longitude	W150° 30.106'		**Average (in) =**	**8.8**	**Average SWE (in) =**	**1.51**
PS009	1	Tundra	23.0	23.0	**Bucket & Core Weight (lb) =**	1.36
	2				**Empty Bucket Weight (lb) =**	0.82
	3				**Average Mass (lb) =**	0.54
	4				**Core Area (in^2) =**	2.0739
	5				**Freshwater Density (lb/in^3) =**	0.0361
Latitude	N70° 13.033'		**Sum (in) =**	**23.0**	**Average Density (lb/in^3) =**	**0.011**
Longitude	W150° 29.771'		**Average (in) =**	**23.0**	**Average SWE (in) =**	**7.21**
PS010	1	Lake	3.5	3.5	**Bucket & Core Weight (lb) =**	1.16
	2		3.5	3.5	**Empty Bucket Weight (lb) =**	0.76
	3		4.0	4.0	**Average Mass (lb) =**	0.08
	4		3.5	3.5	**Core Area (in^2) =**	2.0739
	5		3.5	3.5	**Freshwater Density (lb/in^3) =**	0.0361
Latitude	N70° 13.113'		**Sum (in) =**	**18.0**	**Average Density (lb/in^3) =**	**0.011**
Longitude	W150° 30.769'		**Average (in) =**	**3.6**	**Average SWE (in) =**	**1.07**
PS011	1	Lake	3.5	3.5	**Bucket & Core Weight (lb) =**	1.12
	2		3.5	3.5	**Empty Bucket Weight (lb) =**	0.82
	3		4.0	4.0	**Average Mass (lb) =**	0.06
	4		4.0	3.9	**Core Area (in^2) =**	2.0739
	5		4.0	4.0	**Freshwater Density (lb/in^3) =**	0.0361
Latitude	N70° 12.991'		**Sum (in) =**	**18.9**	**Average Density (lb/in^3) =**	**0.008**
Longitude	W150° 30.630'		**Average (in) =**	**3.8**	**Average SWE (in) =**	**0.80**
Note 1: Locations are referenced to NAD 83 datum.						

Pooled Snow Survey Data Sheet						
Date: 5/4/2013	Start Time: 10:00		End Time: 17:00		Observers: GCY, SMC, WAB	
Catchment Basin: M9605		Driving Wrench Used: Mt. Rose			Tube Section Used: 0-62"	
Snow Sample No.	Pooled Sample #	Terrain Type	Snow Depth (in) w/ Dirt Plug	Snow Depth (in) w/o Dirt Plug	Calculations	
PS012	1	Lake	7.0	7.0	Bucket & Core Weight (lb) =	1.32
	2		7.5	7.5	Empty Bucket Weight (lb) =	0.82
	3		7.5	7.5	Average Mass (lb) =	0.17
	4				Core Area (in^2) =	2.0739
	5				Freshwater Density (lb/in^3) =	0.0361
Latitude	N70° 12.837'		Sum (in) =	**22.0**	Average Density (lb/in^3) =	**0.011**
Longitude	W150° 30.456'		Average (in) =	**7.3**	Average SWE (in) =	**2.23**
PS013	1	Tundra	11.5	10.0	Bucket & Core Weight (lb) =	1.10
	2		10.5	9.5	Empty Bucket Weight (lb) =	0.82
	3				Average Mass (lb) =	0.14
	4				Core Area (in^2) =	2.0739
	5				Freshwater Density (lb/in^3) =	0.0361
Latitude	N70° 12.653'		Sum (in) =	**19.5**	Average Density (lb/in^3) =	**0.007**
Longitude	W150° 30.248'		Average (in) =	**9.8**	Average SWE (in) =	**1.87**
PS014	1	Tundra	22.5	21.0	Bucket & Core Weight (lb) =	1.52
	2		21.5	19.5	Empty Bucket Weight (lb) =	0.82
	3				Average Mass (lb) =	0.35
	4				Core Area (in^2) =	2.0739
	5				Freshwater Density (lb/in^3) =	0.0361
Latitude	N70° 12.563'		Sum (in) =	**40.5**	Average Density (lb/in^3) =	**0.008**
Longitude	W150° 30.142'		Average (in) =	**20.3**	Average SWE (in) =	**4.67**
PS015	1	Tundra	10.0	9.0	Bucket & Core Weight (lb) =	1.18
	2		10.0	9.0	Empty Bucket Weight (lb) =	0.82
	3		9.0	8.0	Average Mass (lb) =	0.12
	4				Core Area (in^2) =	2.0739
	5				Freshwater Density (lb/in^3) =	0.0361
Latitude	N70° 12.495'		Sum (in) =	**26.0**	Average Density (lb/in^3) =	**0.007**
Longitude	W150° 30.583'		Average (in) =	**8.7**	Average SWE (in) =	**1.60**
PS016	1	Tundra	18.0	18.0	Bucket & Core Weight (lb) =	1.24
	2				Empty Bucket Weight (lb) =	0.82
	3				Average Mass (lb) =	0.42
	4				Core Area (in^2) =	2.0739
	5				Freshwater Density (lb/in^3) =	0.0361
Latitude	N70° 12.633'		Sum (in) =	**18.0**	Average Density (lb/in^3) =	**0.011**
Longitude	W150° 29.702'		Average (in) =	**18.0**	Average SWE (in) =	**5.61**
PS017	1	Lake	5.0	5.0	Bucket & Core Weight (lb) =	1.22
	2		5.5	5.5	Empty Bucket Weight (lb) =	0.80
	3		4.5	4.5	Average Mass (lb) =	0.08
	4		4.5	4.5	Core Area (in^2) =	2.0739
	5		4.5	4.5	Freshwater Density (lb/in^3) =	0.0361
Latitude	N70° 13.174'		Sum (in) =	**24.0**	Average Density (lb/in^3) =	**0.008**
Longitude	W150° 31.042'		Average (in) =	**4.8**	Average SWE (in) =	**1.12**
Note 1: Locations are referenced to NAD 83 datum.						

Pooled Snow Survey Data Sheet						
Date: 5/4/2013	Start Time: 10:00		End Time: 17:00		Observers: GCY, SMC, WAB	
Catchment Basin: M9605		Driving Wrench Used: Mt. Rose			Tube Section Used: 0-62"	
Snow Sample No.	Pooled Sample #	Terrain Type	Snow Depth (in) w/ Dirt Plug	Snow Depth (in) w/o Dirt Plug	Calculations	
PS018	1	Lake	6.0	6.0	Bucket & Core Weight (lb) =	1.26
	2		6.0	6.0	Empty Bucket Weight (lb) =	0.80
	3		7.5	7.5	Average Mass (lb) =	0.12
	4		8.5	8.5	Core Area (in^2) =	2.0739
	5				Freshwater Density (lb/in^3) =	0.0361
Latitude	N70° 13.082'		Sum (in) =	**28.0**	Average Density (lb/in^3) =	**0.008**
Longitude	W150° 31.142'		Average (in) =	**7.0**	Average SWE (in) =	**1.54**
PS019	1	Tundra	10.0	9.5	Bucket & Core Weight (lb) =	1.04
	2		10.0	10.0	Empty Bucket Weight (lb) =	0.80
	3		11.0	11.0	Average Mass (lb) =	0.08
	4				Core Area (in^2) =	2.0739
	5				Freshwater Density (lb/in^3) =	0.0361
Latitude	N70° 12.958'		Sum (in) =	**30.5**	Average Density (lb/in^3) =	**0.004**
Longitude	W150° 31.274'		Average (in) =	**10.2**	Average SWE (in) =	**1.07**
PS020	1	Tundra	11.5	10.0	Bucket & Core Weight (lb) =	1.42
	2		10.0	8.0	Empty Bucket Weight (lb) =	0.82
	3		11.0	9.0	Average Mass (lb) =	0.20
	4				Core Area (in^2) =	2.0739
	5				Freshwater Density (lb/in^3) =	0.0361
Latitude	N70° 12.835'		Sum (in) =	**27.0**	Average Density (lb/in^3) =	**0.011**
Longitude	W150° 31.408'		Average (in) =	**9.0**	Average SWE (in) =	**2.67**
PS021	1	Lake	10.0	10.0	Bucket & Core Weight (lb) =	1.30
	2		12.0	12.0	Empty Bucket Weight (lb) =	0.78
	3				Average Mass (lb) =	0.26
	4				Core Area (in^2) =	2.0739
	5				Freshwater Density (lb/in^3) =	0.0361
Latitude	N70° 13.279'		Sum (in) =	**22.0**	Average Density (lb/in^3) =	**0.011**
Longitude	W150° 31.427'		Average (in) =	**11.0**	Average SWE (in) =	**3.47**
PS022	1	Tundra	18.5	17.5	Bucket & Core Weight (lb) =	1.36
	2		18.0	18.0	Empty Bucket Weight (lb) =	0.82
	3				Average Mass (lb) =	0.27
	4				Core Area (in^2) =	2.0739
	5				Freshwater Density (lb/in^3) =	0.0361
Latitude	N70° 13.289'		Sum (in) =	**35.5**	Average Density (lb/in^3) =	**0.007**
Longitude	W150° 31.814'		Average (in) =	**17.8**	Average SWE (in) =	**3.61**
Note 1: Locations are referenced to NAD 83 datum.						

Pooled Snow Survey Data Sheet						
Date: 5/4/2013	Start Time: 10:00		End Time: 17:00		Observers: GCY, SMC, WAB	
Catchment Basin: M9605		Driving Wrench Used: Mt. Rose			Tube Section Used: 0-62"	
Snow Sample No.	Pooled Sample #	Terrain Type	Snow Depth (in) w/ Dirt Plug	Snow Depth (in) w/o Dirt Plug	Calculations	
BKR04 WPT 004	1	Berm	53.0	53.0	Bucket & Core Weight (lb) =	2.04
	2				Empty Bucket Weight (lb) =	0.82
	3				Average Mass (lb) =	1.22
	4				Core Area (in^2) =	2.0739
	5				Freshwater Density (lb/in^3) =	0.0361
Latitude	N70° 13.245'		Sum (in) =	**53.0**	Average Density (lb/in^3) =	**0.011**
Longitude	W150° 30.290'		Average (in) =	**53.0**	Average SWE (in) =	**16.29**
BKR04 WPT 005	1	Berm	53.0	53.0	Bucket & Core Weight (lb) =	2.30
	2				Empty Bucket Weight (lb) =	0.82
	3				Average Mass (lb) =	1.48
	4				Core Area (in^2) =	2.0739
	5				Freshwater Density (lb/in^3) =	0.0361
Latitude	N70° 13.360'		Sum (in) =	**53.0**	Average Density (lb/in^3) =	**0.013**
Longitude	W150° 30.374'		Average (in) =	**53.0**	Average SWE (in) =	**19.76**
BKR04 WPT 009	1	Berm	54.0	54.0	Bucket & Core Weight (lb) =	2.84
	2				Empty Bucket Weight (lb) =	0.82
	3				Average Mass (lb) =	2.02
	4				Core Area (in^2) =	2.0739
	5				Freshwater Density (lb/in^3) =	0.0361
Latitude	N70° 13.538'		Sum (in) =	**54.0**	Average Density (lb/in^3) =	**0.018**
Longitude	W150° 30.535'		Average (in) =	**54.0**	Average SWE (in) =	**26.97**
BKR04 WPT 012	1	Berm	53.0	53.0	Bucket & Core Weight (lb) =	2.32
	2				Empty Bucket Weight (lb) =	0.82
	3				Average Mass (lb) =	1.50
	4				Core Area (in^2) =	2.0739
	5				Freshwater Density (lb/in^3) =	0.0361
Latitude	N70° 13.376'		Sum (in) =	**53.0**	Average Density (lb/in^3) =	**0.014**
Longitude	W150° 31.507'		Average (in) =	**53.0**	Average SWE (in) =	**20.03**
BKR04 WPT 014	1	Berm	54.0	54.0	Bucket & Core Weight (lb) =	2.12
	2				Empty Bucket Weight (lb) =	0.82
	3				Average Mass (lb) =	1.30
	4				Core Area (in^2) =	2.0739
	5				Freshwater Density (lb/in^3) =	0.0361
Latitude	N70° 13.473'		Sum (in) =	**54.0**	Average Density (lb/in^3) =	**0.012**
Longitude	W150° 31.660'		Average (in) =	**54.0**	Average SWE (in) =	**17.36**
BKR04 WPT 017	1	Berm	53.0	53.0	Bucket & Core Weight (lb) =	2.24
	2				Empty Bucket Weight (lb) =	0.82
	3				Average Mass (lb) =	1.42
	4				Core Area (in^2) =	2.0739
	5				Freshwater Density (lb/in^3) =	0.0361
Latitude	N70° 13.669'		Sum (in) =	**53.0**	Average Density (lb/in^3) =	**0.013**
Longitude	W150° 31.701'		Average (in) =	**53.0**	Average SWE (in) =	**18.96**
Note 1: Locations are referenced to NAD 83 datum.						

Snow Depth Survey Data Sheet				
Date: 5/4/2013		Start Time: 10:30 AM		Observers: GCY, SMC, WAB
Catchment Basin: M9605		End Time: 4:50 PM		
Snow Sample No.	Terrain Type	Snow Depth (in)	Location	
			Latitude	Longitude
SS001	Lake	9.1	N70° 13.298'	W150° 30.974'
SS002	Lake	2.4	N70° 13.329'	W150° 31.005'
SS003	Lake	6.7	N70° 13.36'	W150° 31.036'
SS004	Lake	6.7	N70° 13.391'	W150° 31.067'
SS005	Lake	3.5	N70° 13.423'	W150° 31.098'
SS006	Lake	8.7	N70° 13.485'	W150° 31.16'
SS007	Lake	8.3	N70° 13.516'	W150° 31.191'
SS008	Lake	9.1	N70° 13.547'	W150° 31.222'
SS009	Lake	7.1	N70° 13.578'	W150° 31.253'
SS010	Lake	6.3	N70° 13.64'	W150° 31.315'
SS011	Lake	2.8	N70° 13.672'	W150° 31.348'
SS012	Lake	10.6	N70° 13.703'	W150° 31.378'
SS013	Lake	7.1	N70° 13.734'	W150° 31.409'
SS014	Lake	2.4	N70° 13.796'	W150° 31.473'
SS015	Lake	6.7	N70° 13.827'	W150° 31.502'
SS016	Lake	6.3	N70° 13.294'	W150° 30.889'
SS017	Lake	7.1	N70° 13.322'	W150° 30.837'
SS018	Lake	8.3	N70° 13.35'	W150° 30.784'
SS019	Lake	5.1	N70° 13.377'	W150° 30.732'
SS020	Lake	7.9	N70° 13.432'	W150° 30.626'
SS021	Lake	16.5	N70° 13.46'	W150° 30.573'
SS022	Lake	37.8	N70° 13.487'	W150° 30.521'
SS023	Tundra	11.8	N70° 13.515'	W150° 30.468'
SS024	Tundra	20.1	N70° 13.57'	W150° 30.362'
SS025	Lake	7.1	N70° 13.25'	W150° 30.861'
SS026	Lake	5.9	N70° 13.234'	W150° 30.777'
SS027	Lake	7.1	N70° 13.217'	W150° 30.692'
SS028	Lake	9.4	N70° 13.184'	W150° 30.525'
SS029	Lake	9.1	N70° 13.167'	W150° 30.441'
SS030	Lake	11.0	N70° 13.152'	W150° 30.357'
SS031	Tundra	44.1	N70° 13.134'	W150° 30.274'
SS032	Tundra	63.0	N70° 13.117'	W150° 30.19'
SS033	Tundra	21.3	N70° 13.084'	W150° 30.022'
SS034	Tundra	11.8	N70° 13.067'	W150° 29.938'
SS035	Tundra	17.7	N70° 13.05'	W150° 29.854'
SS036	Lake	7.1	N70° 13.236'	W150° 30.908'
SS037	Lake	5.1	N70° 13.205'	W150° 30.873'
SS038	Lake	7.1	N70° 13.175'	W150° 30.838'
SS039	Lake	5.9	N70° 13.144'	W150° 30.804'
SS040	Lake	3.9	N70° 13.083'	W150° 30.734'
SS041	Lake	9.1	N70° 13.052'	W150° 30.699'
SS042	Lake	7.5	N70° 13.021'	W150° 30.665'

Snow Depth Survey Data Sheet				
Date: 5/4/2013		Start Time: 10:30 AM		Observers: GCY, SMC, WAB
Catchment Basin: M9605		End Time: 4:50 PM		
Snow Sample No.	Terrain Type	Snow Depth (in)	Location	
			Latitude	Longitude
SS043	Lake	3.1	N70° 12.96'	W150° 30.595'
SS044	Lake	7.1	N70° 12.931'	W150° 30.561'
SS045	Lake	8.7	N70° 12.899'	W150° 30.526'
SS046	Lake	5.9	N70° 12.868'	W150° 30.491'
SS047	Lake	10.2	N70° 12.806'	W150° 30.421'
SS048	Lake	7.9	N70° 12.776'	W150° 30.387'
SS049	Lake	54.3	N70° 12.745'	W150° 30.352'
SS050	Tundra	15.4	N70° 12.715'	W150° 30.317'
SS051	Tundra	23.6	N70° 12.684'	W150° 30.283'
SS052	Tundra	16.9	N70° 12.622'	W150° 30.213'
SS053	Tundra	14.6	N70° 12.592'	W150° 30.178'
SS054	Tundra	25.2	N70° 12.549'	W150° 30.23'
SS055	Tundra	30.7	N70° 12.536'	W150° 30.318'
SS056	Tundra	15.4	N70° 12.522'	W150° 30.406'
SS057	Tundra	11.8	N70° 12.508'	W150° 30.495'
SS058	Tundra	19.7	N70° 12.481'	W150° 30.671'
SS059	Tundra	19.3	N70° 12.577'	W150° 30.054'
SS060	Tundra	25.6	N70° 12.591'	W150° 29.966'
SS061	Tundra	18.1	N70° 12.605'	W150° 29.878'
SS062	Tundra	13.0	N70° 12.619'	W150° 29.79'
SS063	Tundra	20.1	N70° 12.647'	W150° 29.613'
SS064	Tundra	18.9	N70° 12.66'	W150° 29.526'
SS065	Lake	1.2	N70° 13.236'	W150° 30.976'
SS066	Lake	7.1	N70° 13.205'	W150° 31.009'
SS067	Lake	7.9	N70° 13.143'	W150° 31.075'
SS068	Lake	4.7	N70° 13.112'	W150° 31.109'
SS069	Lake	3.1	N70° 13.051'	W150° 31.175'
SS070	Lake	9.4	N70° 13.02'	W150° 31.208'
SS071	Tundra	29.5	N70° 12.989'	W150° 31.241'
SS072	Tundra	15.4	N70° 12.927'	W150° 31.308'
SS073	Tundra	13.8	N70° 12.896'	W150° 31.341'
SS074	Tundra	18.1	N70° 12.866'	W150° 31.374'
SS075	Tundra	6.3	N70° 12.804'	W150° 31.44'
SS076	Lake	3.9	N70° 13.269'	W150° 31.039'
SS077	Lake	7.9	N70° 13.272'	W150° 31.136'
SS078	Lake	5.9	N70° 13.274'	W150° 31.233'
SS079	Lake	8.3	N70° 13.277'	W150° 31.33'
SS080	Tundra	78.7	N70° 13.282'	W150° 31.524'
SS081	Tundra	9.1	N70° 13.284'	W150° 31.62'
SS082	Tundra	15.4	N70° 13.287'	W150° 31.717'
SS083	Tundra	13.8	N70° 13.292'	W150° 31.911'
SS084	Tundra	20.5	N70° 13.295'	W150° 32.008'

Appendix D Alpine Area Lake Photos

Photo D. 1: Lake B8530 pre-breakup, looking southeast; May 30, 2013

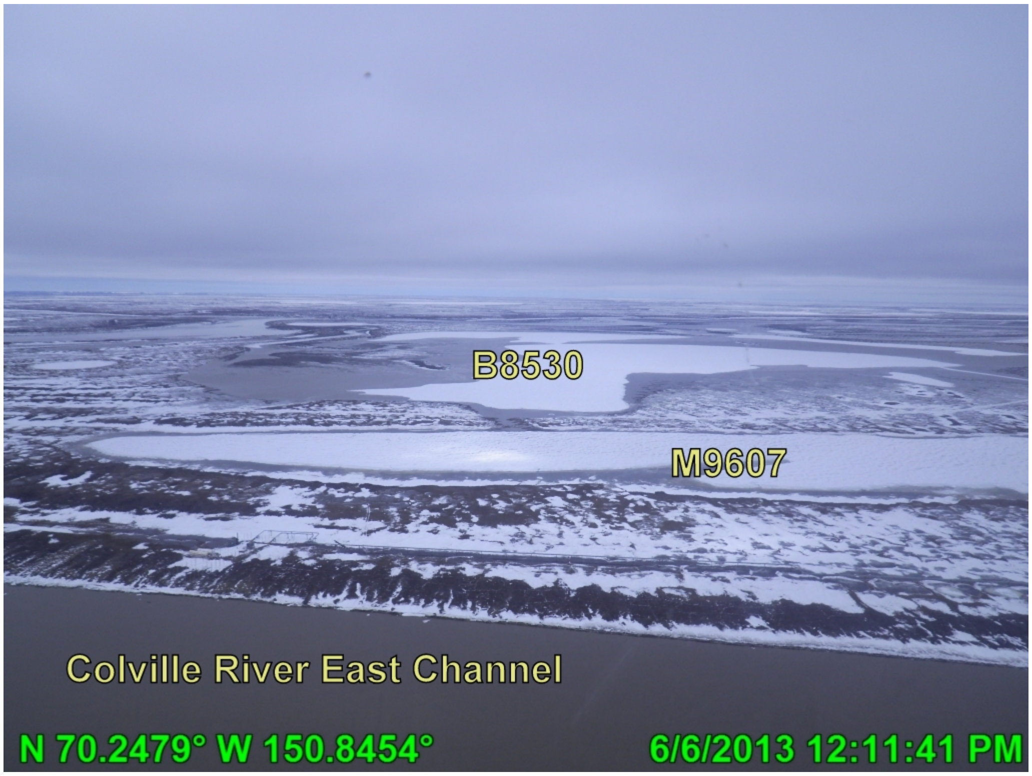


Photo D. 2: Lake B8530 during breakup, looking west; June 6, 2013

Photo D. 3: Lake B8530 post-breakup, looking southwest; June 29, 2013

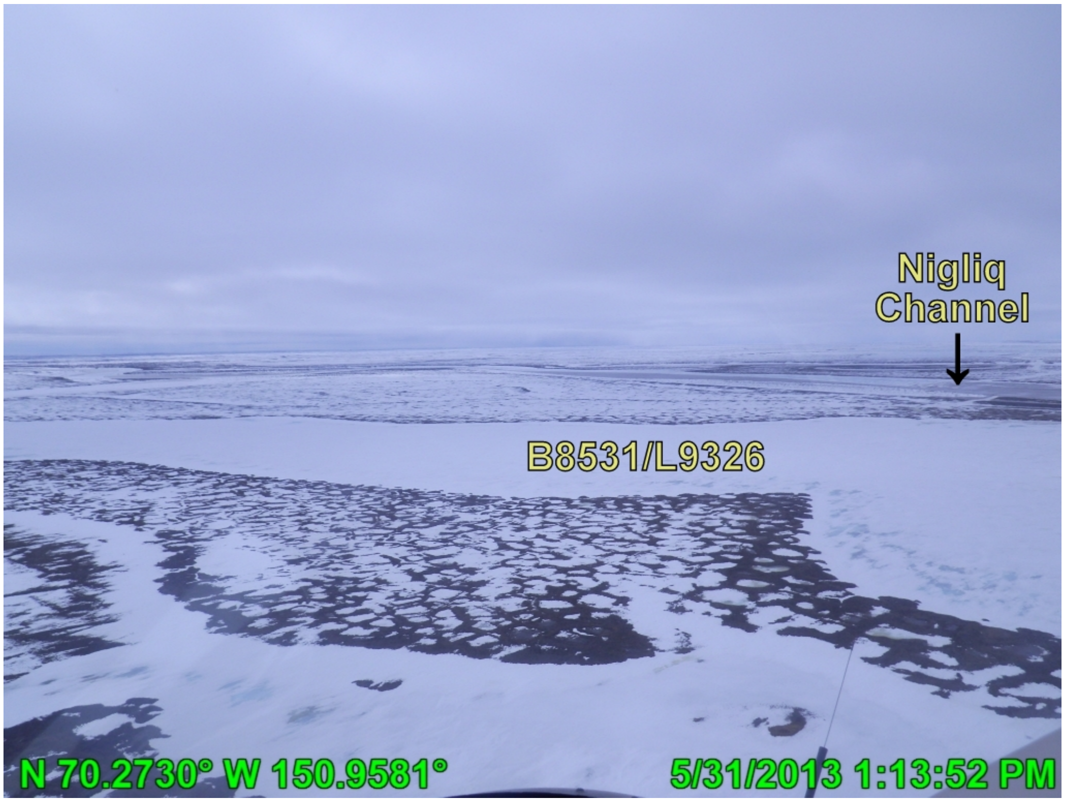


Photo D. 4: Lake B8531/L9326 pre-breakup, looking southwest; May 31, 2013

Photo D. 5: **Lake B8531/L9326 during breakup, looking west; June 2, 2013**

Photo D. 6: **Lake B8531/L9326 post-breakup, looking southeast; June 29, 2013**

Photo D. 7: Lake B8533 pre-breakup, looking southeast; May 30, 2013

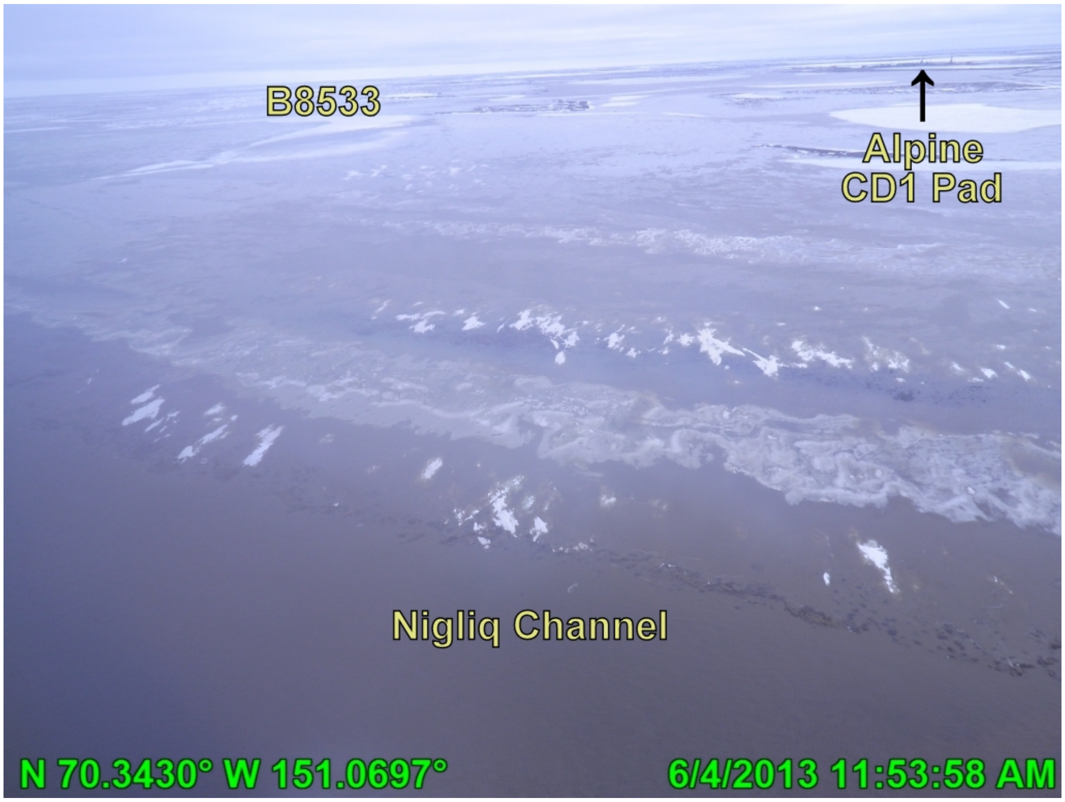


Photo D. 8: Lake B8533 during breakup, looking east; June 4, 2013

Photo D. 9: **Lake B8533 post-breakup, looking northeast; June 29, 2013**

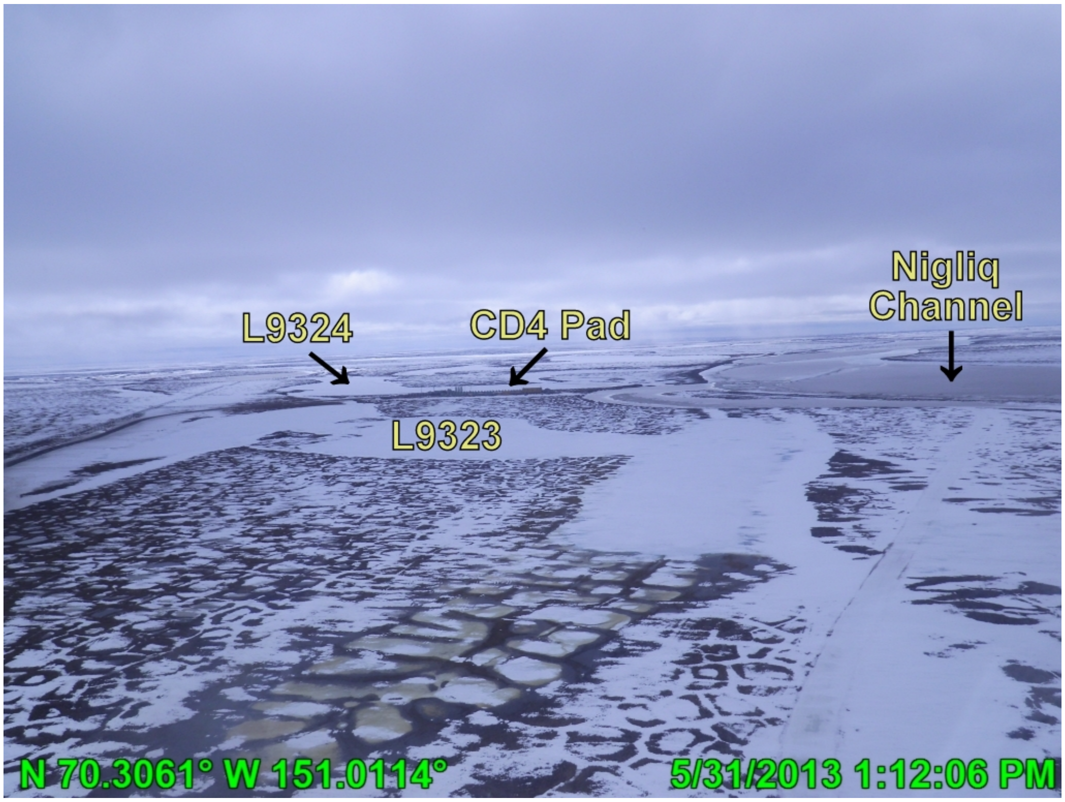


Photo D. 10: **Lake L9323 pre-breakup, looking southeast; May 31, 2013**

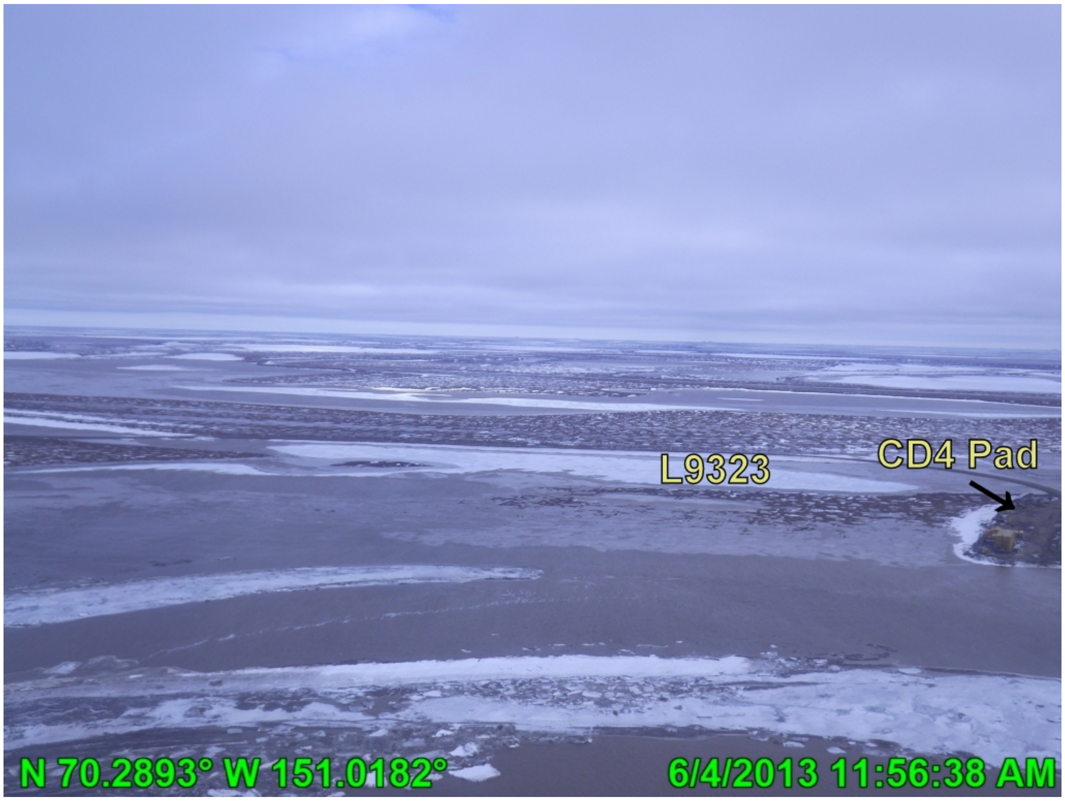


Photo D. 11: **Lake L9323 during breakup, looking northeast; June 4, 2013**

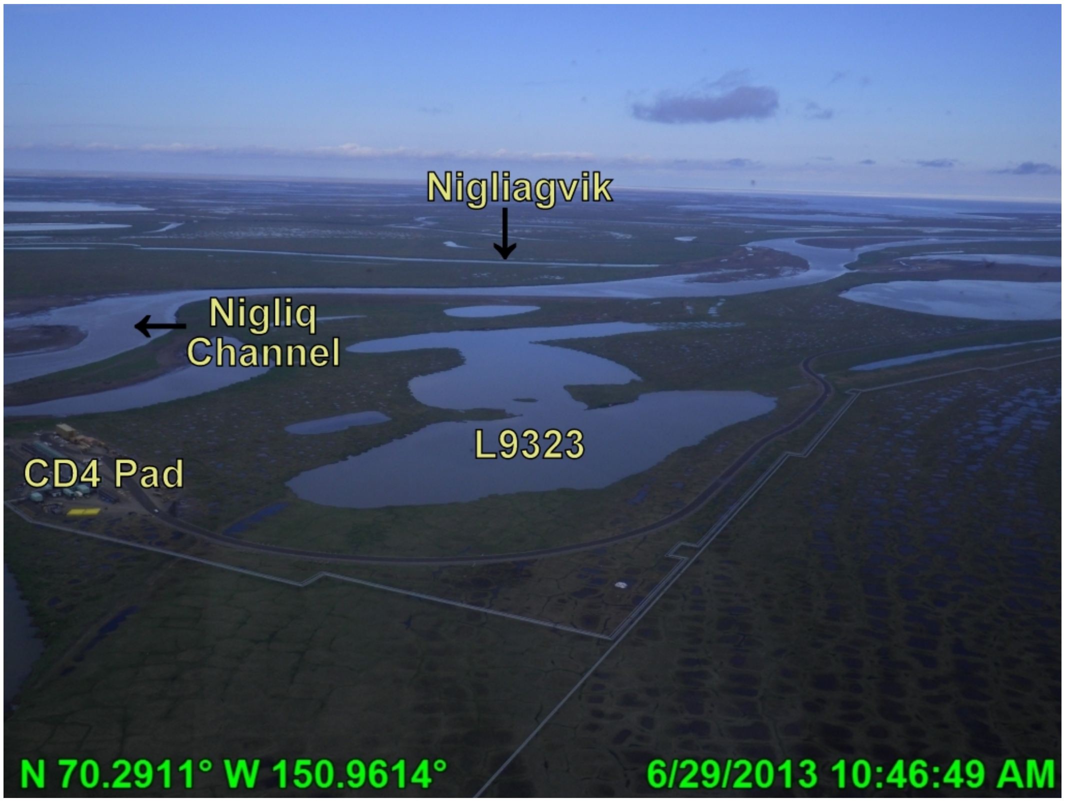


Photo D. 12: **Lake L9323 post-breakup, looking west; June 29, 2013**

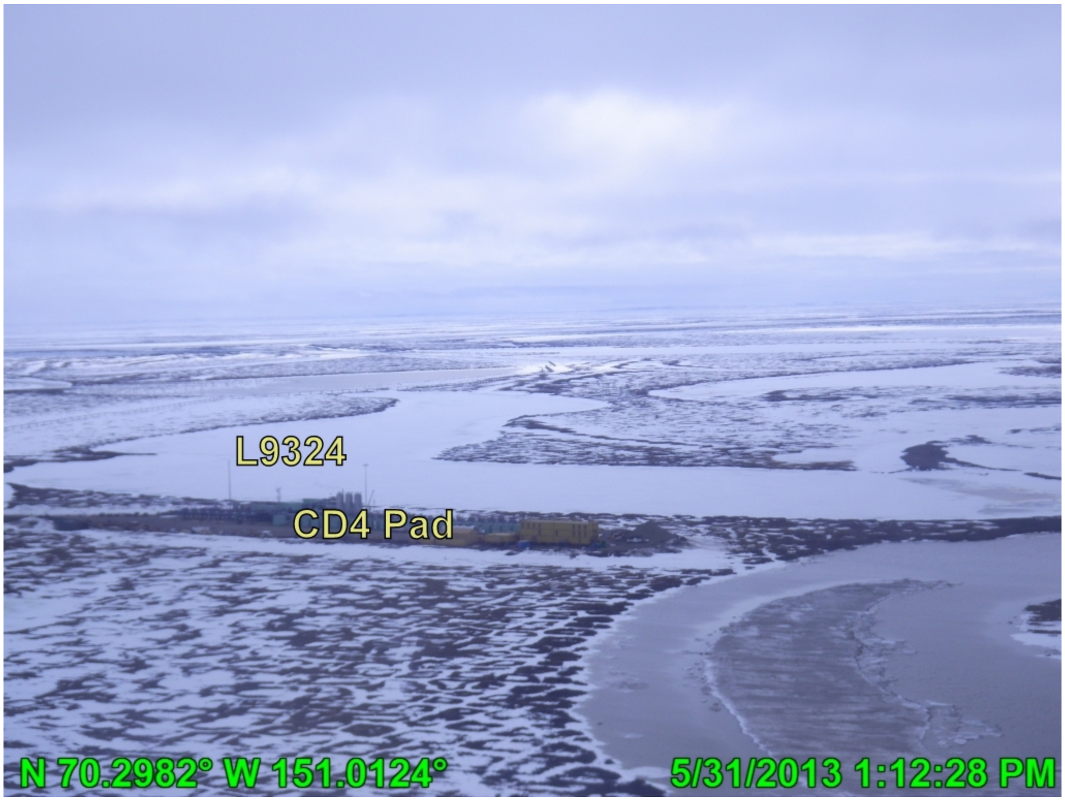


Photo D. 13: **Lake L9324 pre-breakup, looking southeast; May 31, 2013**

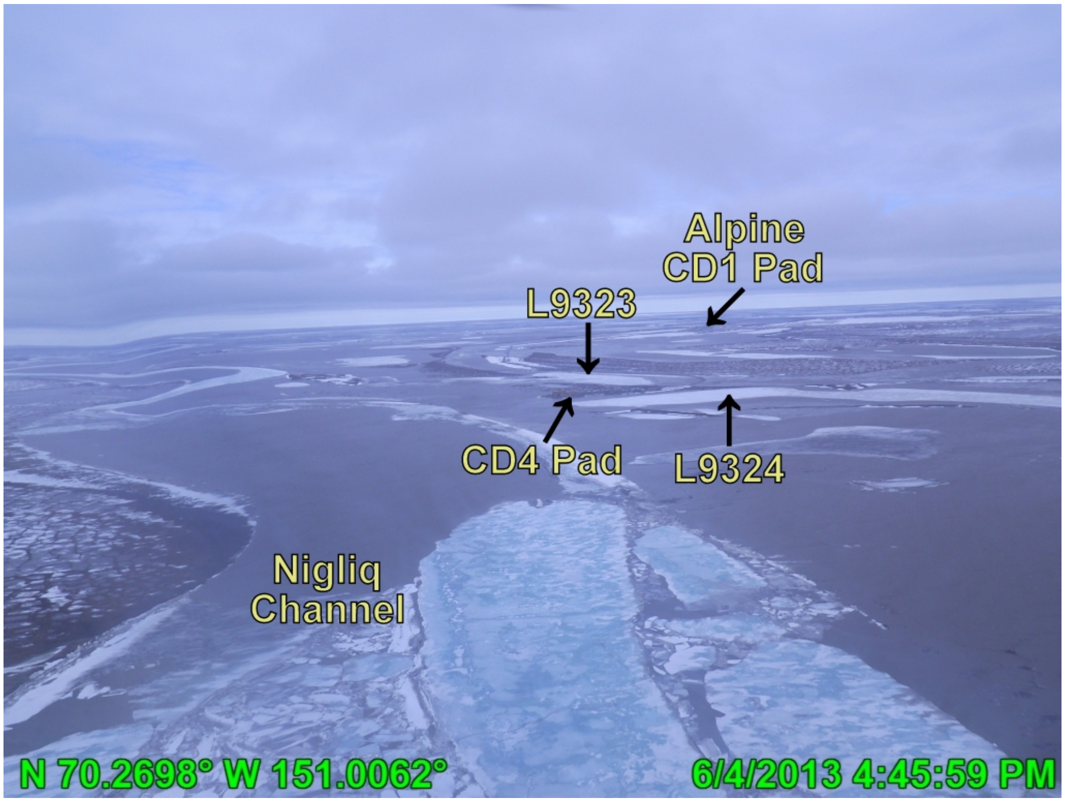


Photo D. 14: **Lake L9324 during breakup, looking north; June 4, 2013**

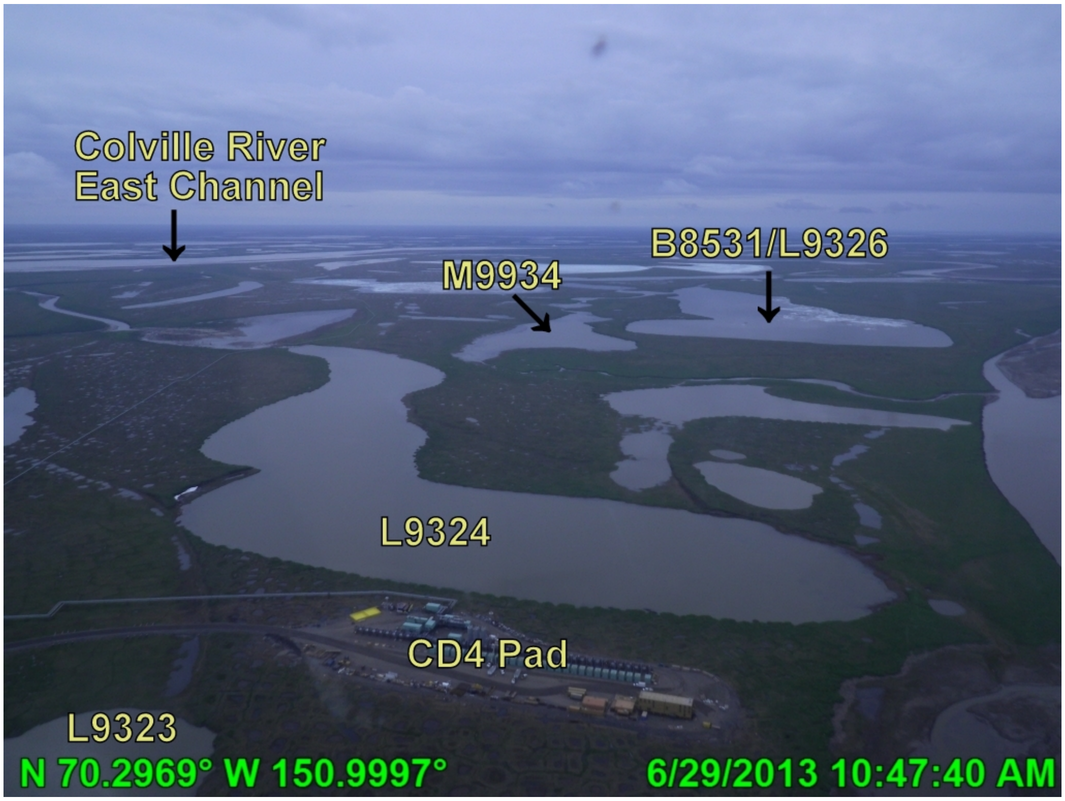


Photo D. 15: Lake L9324 post-breakup, looking south; June 29, 2013

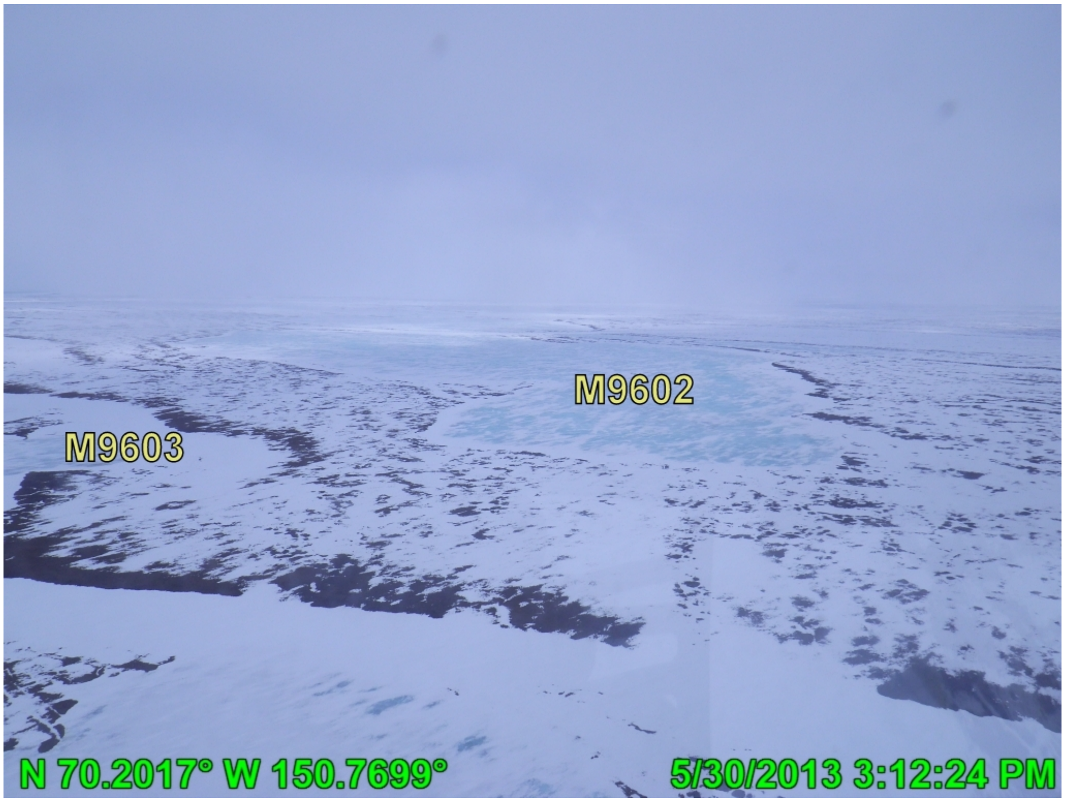


Photo D. 16: Lake M9602 pre-breakup, looking northeast; May 30, 2013

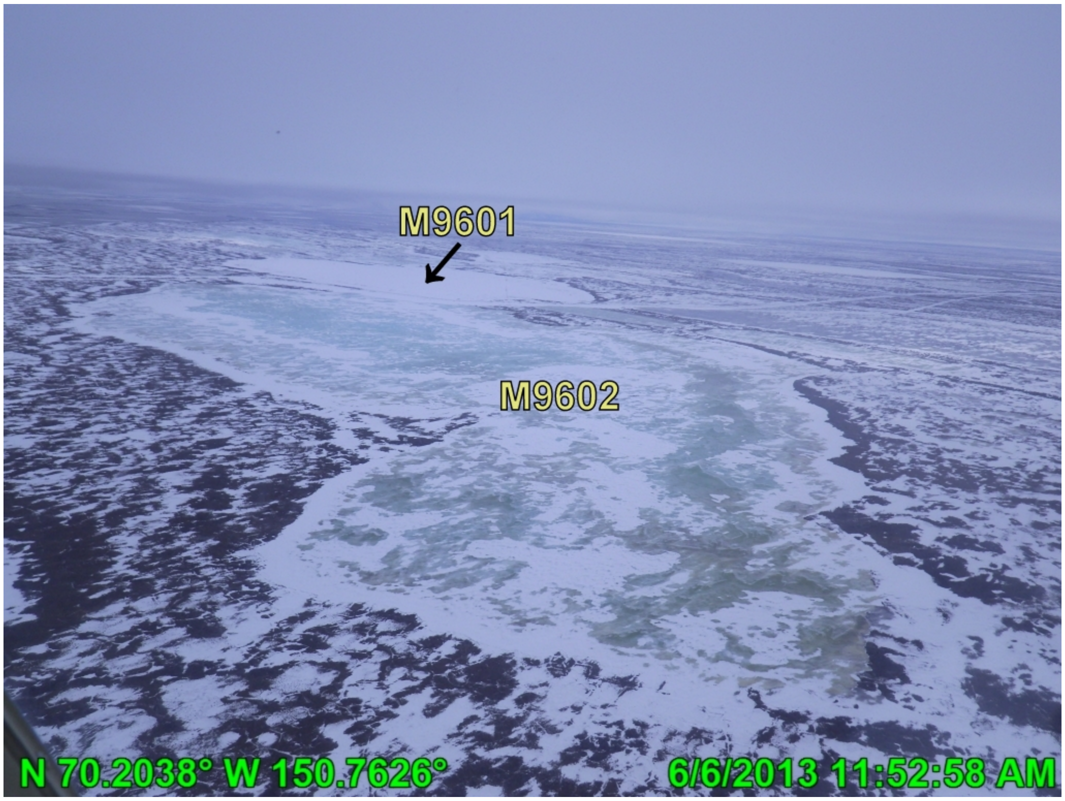


Photo D. 17: **Lake M9602 during breakup, looking northeast; June 6, 2013**

Photo D. 18: **Lake M9602 post-breakup, looking northeast; June 29, 2013**

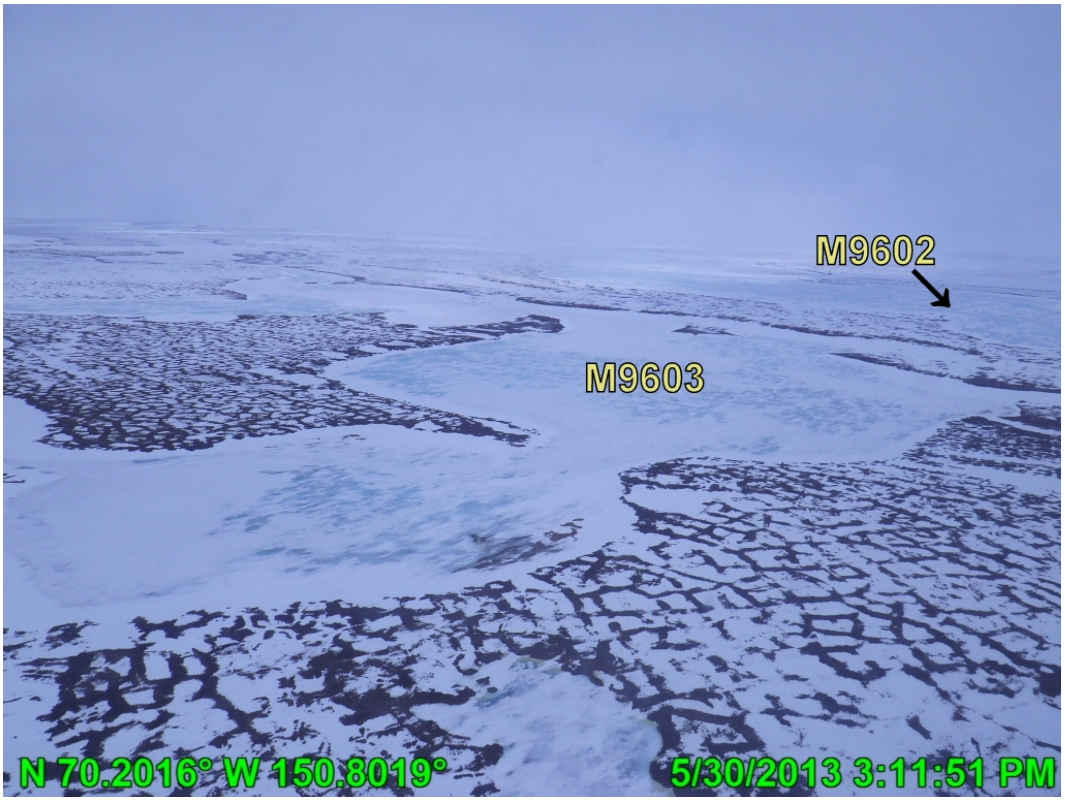


Photo D. 19: **Lake M9603 pre-breakup, looking northeast; May 30, 2013**

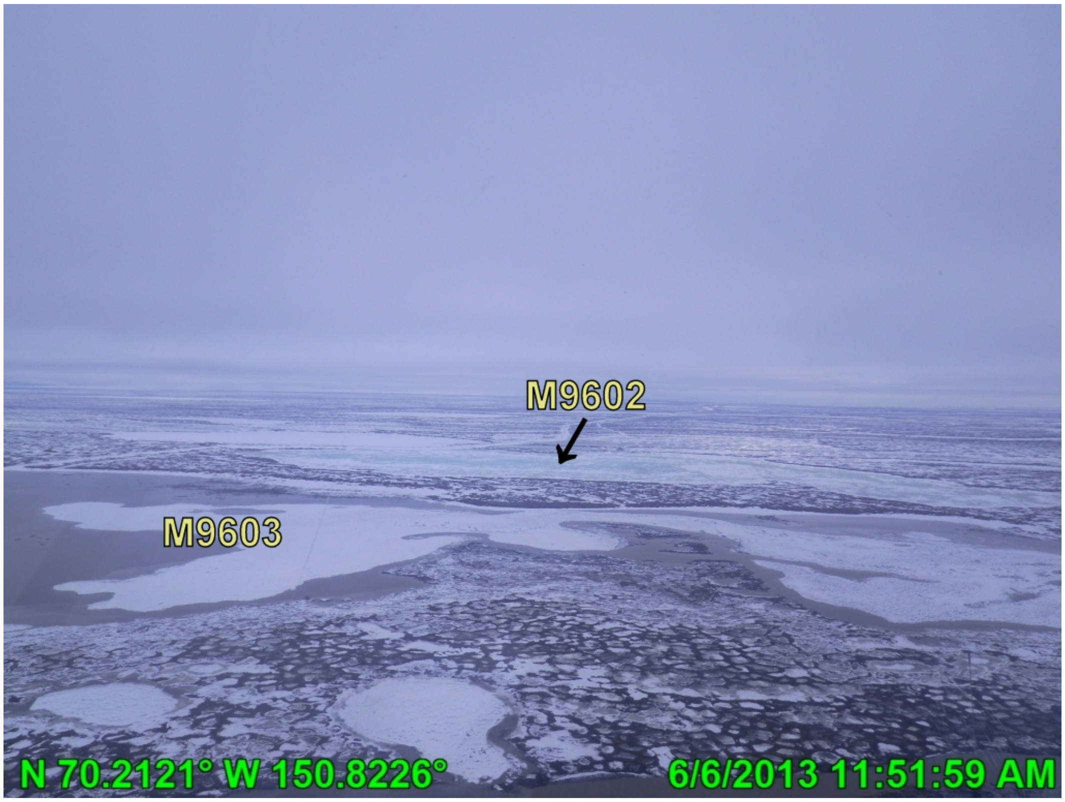


Photo D. 20: **Lake M9603 during breakup, looking east; June 6, 2013**

Photo D. 21: **Lake M9603 post-breakup, looking south; June 29, 2013**

Photo D. 22: **Lake M9605 pre-breakup, looking east; May 31, 2013**

Photo D. 23: **Lake M9605 during breakup, looking north; June 6, 2013**

Photo D. 24: **Lake M9605 post-breakup, looking northeast; June 29, 2013**

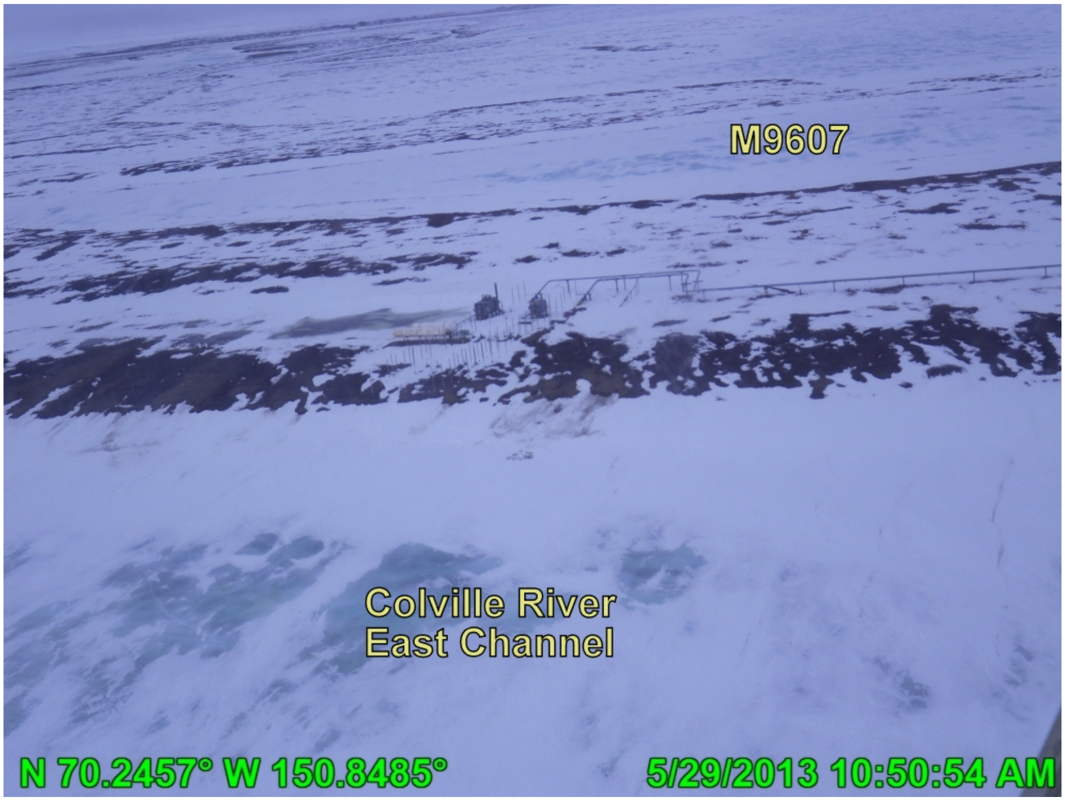


Photo D. 25: **Lake M9607 pre-breakup, looking west; May 29, 2013**

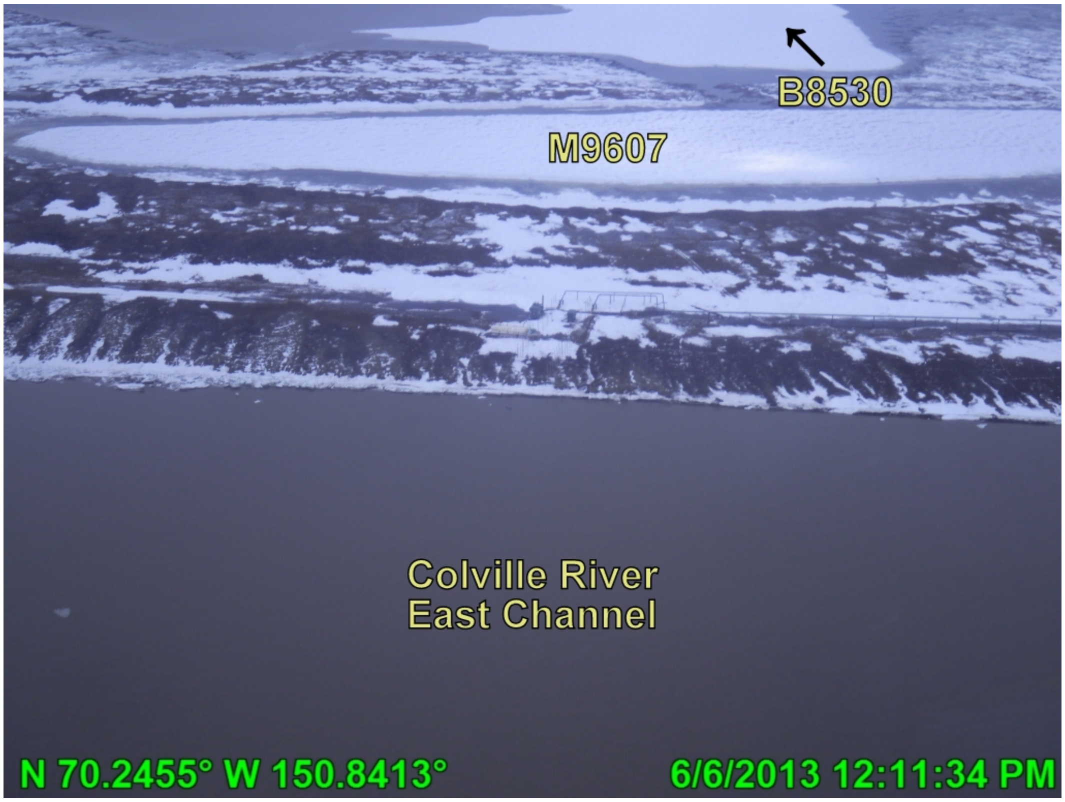


Photo D. 26: **Lake M9607 during breakup, looking northeast; June 6, 2013**

Photo D. 27: **Lake M9607 post-breakup, looking south; June 29, 2013**

2013 Alpine Area Lakes Recharge Studies